Centre

of

SCIENCE AND SOCIETY

{M.Sc. Design and Innovation in Rural Technology (Four Semesters) Programme}
(Syllabus)

UNIVERSITY OF ALLAHABAD

PRAYAGRAJ: 211002

ORDINANCE FOR M.Sc. DESIGN AND INNOVATION IN RURAL TECHNOLOGY BASED ON SEMESTER SYSTEM, IIDS, FACULTY OF SCIENCE UNIVERSITY OF ALLAHABAD

1. The admission to the course of M.Sc. degree in Design and Innovation in Rural Technology open to any candidate who has earned Bachelor degree under 10+2+3 pattern of education with Botany, Agriculture sciences discipline of any Indian University or any accredited institution or any foreign University which the academic council of the University of Allahabad may recognize from time to time for this purpose.
2. The candidates shall be admitted through the entrance test conducted by the University followed by Group discussion and Personal Interview at the Centre in the ratio of 60:40 (60% marks entrance test conducted by University, 30% group discussion and 10% for Personal interview). There shall be separate merit lists for General, SEBC (OBC) and SC/ST candidates.
3. The total number of the candidates admitted to this course will be 15 (Fifteen) and the number may vary from time to time according to the directives of the University.
4. The course shall consist of theory papers and practical based on these papers spread over four semesters.

RULES AND REGULATIONS
EXAMINATION, EVALUATION AND THE MARKING SYSTEM

AS PER CBCS RULE

OBJECTIVE

ORIGIN-To begin with a course dedicated towards overall development of rural technology, the Centre of Science and Society (Rural Technology and Development) {M.Sc. (Four Semesters) Programme} under the Coordinator-ship/ Directorship (Honorarium basis) University of Allahabad, efforts will made to retrieve funds under **CSR** (Corporate- Social Responsibility) from Coal India, NTPC, IFFCO, and Private Industry *viz*., Kirloskar, Mahindra Tractors, Monsanto etc. In addition to this, the Ministry of Rural Technology and Ministry of Small and Medium Scale Industries, Govt. will also render support in establishing an independent Centre of Science and Society (Rural Technology and Development) which will incorporate advancement of technological and social aspect of rural development.

OBJECTIVES AT A GLANCE

- Assessment of rural area and people.
- Rural Entrepreneurships (self-employment through sericulture, lac farming, flower farming, mushroom culture, bee keeping, preparation of natural dyes, bio composting, E-waste management, Biofertilizers etc.).
- Safe and eco-friendly technologies promotion and their compatibility amongst villagers.
- Conservation and promotion of indigenous knowledge.
- Socio-nutritional-economic development of indigenous peoples through appropriate integrated technology and awareness.
- Generating awareness regarding government policies (monitoring and documentation).
- Rural planning and implementation of rural development projects.
- To develop skill in students to for aforementioned tasks.

SUMMARIZED SYLLABUS WITH MARKING SCHEME AND CREDITS

SEMESTER- I

Course no.	Marks	Course title	Credits
DRT- 501	100	Introduction to Design and Innovation in Rural Technology and development	3
DRT- 502	100	Rural Empowerment	3
DRT- 503	100	Innovation, Concept and Models of Rural Development	3
DRT- 504	100	Global approach in Innovative Rural technology	3
DRT- 531	100	Practical of DRT- 501 and DRT- 502 (Training programme/Project work)	4
DRT- 532	100	Practical of DRT- 503 and DRT- 504 (Village Exposure)	4
Total			20

SEMESTER- II

Course no.	Marks	Course title	Credits
DRT- 505	100	Natural resource management practices in India	3
DRT- 506	100	Innovative technologies in Production and Post-harvest management	3
DRT- 507	100	Innovation in productivity and Sustainable management	3
DRT- 508	100	Design and Innovation Commercial Production Technologies	3
DRT- 533	100	Practical of DRT- 505 and DRT- 506	4
DRT- 534	100	Practical of DRT- 507 and DRT- 508	4
Total			20

SEMESTER- III

Course no.	Marks	Course title	Credits
DRT-601	100	Design and Innovation in Rural Entrepreneurship	3
DRT- 602	100	History of Indian traditional Medicine	3
DRT- 603	100	Science, Technology and Society Interaction	3
DRT-604	100	Design and Innovation in Integrated Rural Health Management	3
DRT- 635	100	Practical of DRT- 601 and DRT- 602 (Medical based Field work survey)	4
DRT- 636	100	Practical of DRT- 603 and DRT- 604 (Village Survey for Endemic Diseases)	4
Total			20

SEMESTER- IV

Course no.	Marks	Course title	Credits
DRT- 605	100	Economic status of Rural India	3
DRT- 606	100	IT in Rural Development	3
DRT- 607	100	Dissertation/Thesis/Prototype development	5
DRT 651-DRT-654	100	Elective Papers	3
DRT-638-DRT-641	100	Practical based on Elective Papers	2
DRT- 637	100	Practical of DRT- 513 and DRT- 514	4
Total			20

Elective Papers

Course Code	**Marks**	**Elective***	**Credits**
DRT 651	100	Innovation in Rural Entrepreneurship	3
DRT 652	100	Rural Health Management	3
DRT 653	100	Innovative Commercial Production Technologies	3
DRT 654	100	IT in Rural Development	3
DRT 638	100	Field Work based on Course DRT 651	2
DRT 639	100	Field Work based on Course DRT 652	2
DRT 640	100	Field Work based on Course DRT 653	2
DRT 641	100	Field Work based on Course DRT 654	2
Total			**20**

DETAILED SYLLABUS FOR THE 2- YEAR POST- GRADUATE COURSE DESIGN AND INNOVATION IN RURAL TECHNOLOGY

SEMESTER- I Syllabus

DRT 501- Introduction to Design and Innovation in Rural Technology and development

UNIT- I Indian Rural society – Nature and Characteristics, Factors of Indian Society, Tribal, Rural, Urban-Rural Urban continuum. Sustainable Development, Social Welfare, Social Work

UNIT- II Demography of rural areas, British setup and independent Indian setup, Rural Social structure, Problems of Weaker Sections, Social Problems in India: Population Explosion, Unemployment, Poverty, Gender Discrimination and Inequality, Farmers' suicide, Violation of Human Rights and Women in rural society.

UNIT- III Educational and cultural setup in various parts of the country, administrative setup, link up with district headquarters, Andragogy and Pedagogy.

UNIT- IV Rural Institutional Systems, Religious, Concept, Nature, Function and its Changing Structure, Education, Objectives, Functions and Importance, Cooperation, Concept, Nature, Scope, Role and Significance in Rural Development.

UNIT-V Computer Fundamentals, MS-Office, Data analysis and Interpretation

DRT 502- Rural Empowerment

UNIT- I Great Educators and their methods: Upanishadic Rishis, Booker Education in Rural areas, Education with emphasis on Primary and secondary education. Major Social Reformers and their Work: Raja Ram Mohan Roy, Mahatma Jyotibha Phule

UNIT- II Brief History of Adult Education- influence of Paulo Frere Pre-Independence and Post Independence efforts in India, Adult Education Programme since 1978 and latest Development.

UNIT- III Concept of Rural technology development, Scope of Rural technology, Causes of Rural Backwardness, Need for Rural technology Development and its Constraints.

UNIT- IV Rural Education with emphasis on Primary, Adult and Community Education, Development of Rural Women and Children- Status and Development Strategies

UNIT-V Different education commissions of India and their recommendations.

DRT 503- Innovation, Concept and Models of Rural Development

UNIT-I Innovation, Definition and Basic concepts. Types and Generation of Innovative Models.

UNIT-II System of Innovation, Components and Characteristics, Indian and International Innovation Institutions, Participatory Rural Appraisal (PRA),

UNIT-III Paradigms of Rural Development- Lewis Model of Economic Development, Self Help Group, Concept, Characteristics and Functions, National Rural Livelihood Mission (NRLM), DDU-GKY, Salient features, Nature and Scope.

UNIT-IV Experiments in Rural Development before independence: Sriniketan, Martandam, Sevagram, Baroda, Firka Development, Nilokheri and Etawa Pilot Project.

UNIT-V 'Big Push' theory of Development, Myrdal's thesis of 'Spread and Backwash Effects. Gandhian Model

DRT 504- Global Approach in Innovative Rural technology

UNIT- I Concept of rural technology and growth in general, Distinction between growth and Development, Indicators of Development, Measures of Development.

UNIT- II Poverty and Unemployment Rural Development and Environmental Protection, Participatory rural development.

UNIT-III Rural development Experiences in Asian countries - Need of Rural Development in Asian Countries, Sustainable Rural Development and Globlization.

UNIT-IV Success of Grameen Model in India, approaches to Rural Development in India.

UNIT- III Role of Panchayati Raj Institutions in Rural Development with special reference to Indian constitution. Different Rural Commissions of India, Land Acquition Bill.

DRT 531- Practical of DRT- 501 and DRT- 502

Exposure visit to a village and preparation of report. Exposure visit to a State Agricultural University. A case study on the beneficiaries of any rural development programmes. A compulsory exposure for training programme/project work.

DRT 532- Practical of DRT- 503 and DRT- 504

Exposure visit to any NGOs/Govt. agencies engaged in rural development activities. Conducting socio-economic surveys in the villages to understand the social structure, tribal social system, their values and norms. Survey of a village to find out the major problems**.** Identification of social changes in the villages.

SEMESTER- II Syllabus

DRT- 505- Natural resource management practices in India

UNIT- I Types and classification of natural resource, factors influencing resource availability, ecological, social and economic dimension of resource management

UNIT- II Land resources: Land as a resource. Dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification.

UNIT-III. Forest resources: forest vegetation, status and distribution, major forest types and their characteristics. Uses, over-exploitation, deforestation and case studies. Timber extraction, mining, dams and their effects on forest and tribal people, forest management.

UNIT-IV- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Water ecology and management.

UNIT-V - Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

DRT- 506- Innovative technologies in Production and Post- harvest management

UNIT- I Plant Protection - Plant disease, Plant pests' needs for its control, biological control of pests. Integrated Weed management. Agricultural Development under the Plans, Organizational Aspects of Agriculture: Land Reforms, Agro-forestry

UNIT- II Impact of Information Technology on development, growth and governance, satellite communication and remote sensing, geo-informatics application, geospatial information technologies, Information Technology in Agriculture,

UNIT- III Rural Industrialization- Concept, Importance of Rural Industrialization, Village and Cottage Industries, Livestock production, breeding and maintenance (poultry, goattry and piggery).

UNIT- IV Importance and scope of vegetables in India. Identification of vegetables & their seeds, improved nursery raising, sowing & transplanting of vegetables.

UNIT- V Aquaculture and Fisheries industry in rural setup specially culture and rearing of Carp, Prawn, Poly culture, Pearl culture etc. Different government schemes related to fisheries.

DRT- 507- Innovation in Productivity and Sustainable Management

UNIT- I **Basic Botany-** Classification, Morphology and Anatomy of Plants, Main fruits grown in rural places, Orchard Management practices, Processing and marketing of fruits,

UNIT- II Preparation of Nursery, Importance of cultivation of selected medicinal and aromatic plants. Propagation, planting methods, Bonsai Technology.

UNIT- III **Bee-keeping**: Detailed study of honey bee, its various species and their habits, Rearing techniques of honey bee, Difference between traditional and modern bee keeping. Care and management of bee hive, bee wax and honey; and their utility. Economics of bee keeping.

UNIT- IV **Lac Culture and Sericulture**: Cultivation, species, Importance, management of pests & diseases and Marketing.

UNIT- V Different emerging rural industrial technologies, their applications: Horticulture, Floriculture, Pomology, Olericulture; production and possibilities in global economy etc.

DRT- 508- Design and Innovation in Commercial production technologies

UNIT- I Commercial production technologies-nature, concept, applications and recent technical advancement.

UNIT- II **Mushroom Cultivation**: Morphology and life-cycle, Importance of mushroom as a health food, a cash crop and eco- friendly commodity, Wild and cultivated mushroom, Edible and poisonous types, Tropical and temperate species, Mushroom spawns, media and substrate for different species.

UNIT- III **Biofertilizers**: Bacterial, algal and fugal, Production technology and post-harvest handling of fresh and processed products and their marketing.

UNIT- IV **Vermicomposting**: Principles and functions of Vermicomposting, Biological mechanism of Vermicomposting, large- scale and small- scale production of vermicomposts.

UNIT- V **Biopesticides and Bio-supplements**; herbal soaps, fumigants and hygienic products.

DRT- 533- Practical of DRT- 505 and DRT- 506

Identification of various crops of kharif, rabi and zaid season and seed requirement. Familiarization with various chemicals like- fertilizers, pesticidials, herbicides, insecticides and fungicides. Calculation of fertilizer and pesticides doses. Use of farm implements & equipments. Identification of some important weeds, diseases and pests. Working at organic plots. Analysis of decomposition patterns of animal waste & agro-residuals. Nutrient value of common animal wastes and agro-residues as potential manures.

DRT- 534- Practical of DRT- 507 and DRT- 508

Bee-keeping: Identification and use of commonly used equipments in bee keeping, Identification of queen, drone and worker cells, Occupants of bee colony and the role of individual. Lac Culture, Tasar culture and Sericulture: Identification and description of various host plants of lac, tasar and sericulture, Rearing of lace, tsar and silk worm and cocoon maintenance. Mushroom Cultivation: Pure culture of mushroom---preparation and maintenance of inoculum Dairy**:** Substrate formulations, composting and pasteurization. Vermicomposting: Preparation and demonstration.

SEMESTER- III Syllabus

DRT- 601- Design and Innovation in Rural Entrepreneurship

UNIT- I Entrepreneurship: Concept of Entrepreneurship, origin and Development of Entrepreneurship. Entrepreneurship Movement in India, role of entrepreneurship in economic development.

UNIT- II Small Industries Development corporation (SIDC), Small Scale industries Board (SSIB), State Small Industries Development Corporations (SSIDC), Technical Consultancy Organizations (TCOs).

UNIT- III Rural Entrepreneurship: Meaning of rural entrepreneurship, need for rural entrepreneurship, problems of rural entrepreneurship, NGOs and rural entrepreneurship, Training and Development of rural Entrepreneurs.

UNIT- IV Entrepreneurship Development programmes (EDPs): Need for EDPs, Objectives of EDPs, Course content and curriculum of EDPs, Phases of EDPs, Evaluation of EDPs. Project Identification and Selection, STARTUP, SEED, PMKVY, TREAD, STEP, ATAL INNOVATION MISSION, MAKE IN INDIA, PRISM, Project Formulation and Appraisal.

UNIT- V Agencies Supporting Entrepreneurs: District Industries Centre (DICs), Micro, Small and Medium Enterprise (MSME), National Small Industries Corporation (NSIC)

DRT 602- History of Indian traditional Medicine

UNIT- I History of Indian system of medicine viz. Ayurveda, Siddha, Surgery etc.

UNIT- II Different methods for prevention of diseases, use of medicinal plants in rural areas.

UNIT- III Simple physical and breathing exercise, Acupressure, yoga and other techniques based on traditional knowledge and wisdom for sound health and sound mind.

UNIT- IV WHO's approach to deal with Rural Health and Sanitation, Personal hygiene and environmental hygiene, Sanitation programme and implementation, Appropriate treatment against serious acute ailment such as diarrhoea, dehydration, and health care for the vulnerable groups.

UNIT- V Local health traditions, primary health care, medicinal plant garden for conservation and utilization of medicinal plants; Scientific documentation of traditional and indigenous knowledge related to plants used for healthcare.

DRT- 603- Science, Technology and Society Interactions

UNIT–I Concept of Science: Nature of scientific knowledge. Scientific method, demarcation between science and non science, Scientific temper vs. humanistic temper.

UNIT–II Science, Technology and Culture; Science and Politics, Public Understanding of Science, Science and Religion, Science and Ethics

UNIT–III Technology – Society Interface: Techno science, Social Construction of Technology, .Gender and Technology, Innovation and its impact in the society

UNIT–IV Development of Science in India: Pre-colonial Science; Colonial science; Science in Post Independent India; Origin and growth of scientific institutions and societies in India; Evolution of S&T Policy.

UNIT–V Innovation and Intellectual Property Rights: Pre-IPR system of protection- Secrecy/Trade guilds/Cartels; Basic forms of IPRs- Patent, copyright, trademark, 0industrial design; TRIPS, IPR in India; Traditional knowledge, IPR and Benefit sharing, Indigenous knowledge and its appropriation IPR & Traditional Medicine, Private vis-à-vis community based ownership, Bio piracy, Breeders vis à-vis Farmers rights.

DRT 604- Design and Innovation in Integrated Rural Health Management

UNIT-I Safe Drinking water, Concept and need, Rural Technology to get safe drinking water, Different schemes and programmes.

UNIT-II Women health in Rural India; factors, Sex ratio. Health neglect and its changing scenario in the context of government programme. Mortality and morbidity factors, influencing nutrition and health.

UNIT-III Government Health insurance schemes, bank insurance, smart card for BPL families. Various schemes for family, including free vasectomy, single girl child reward, etc.

UNIT-IV Community Health centre schemes and government hospital schemes for poor.

UNIT-V Corporate Social Responsibility: Evidences and The practice of CSR in the context of rural development in India.

DRT 635- Practical of DRT)- 601 and DRT- 602

Health: Practice of physical and breathing exercise, acupressure and yoga. Identification and use of some commonly available medicinal plants. First aid techniques for common injuries and

accidents. Visit to a community health centre, primary health centre and sub centre. Preparation of ORS. A field work survey for health care

DRT- 636- Practical of DRT- 603 and DRT- 604

Human Nutrition and Nutrition Education. Preparation of a balanced and nutritional value chart for commonly available fruits and vegetables Safe Drinking water: Preparation of water filter using locally available materials, Use of lime, alum etc. to purify water. Sanitation: Construction of soak pit, garbage pit, Visit and study of different components of low cost latrines and its construction, Preparation of posters and leaflets for awareness programme. Reporting and recommendation of various human diseases in Rural Area.

SEMESTER- IV Syllabus

DRT- 605- Economic status of Rural India

UNIT- I Unemployment and Underemployment in Rural Areas- Problems, Causes.

UNIT- II Poverty- Causes of Rural Poverty, Poverty alleviation programmes in India- Success and Failure analysis. Poverty alleviation through Micro Finance

UNIT- III Empowerment of Rural Women through Self Help Groups. Commercial Banks, Cooperative Banks, NABARD, Rural Insurance.

UNIT- IV Component and classification of rural markets, Rural credit Institutions, Problems in Rural marketing, rural demand. Finace schemes related to economics, Rural Credit – Sources of Credit, Institutional and Non- Instititutional, Institutional Credit for Rural Development in India.

UNIT- V Civil Society and NGO Management, Understanding Civil Societies, Role of Civil Societies, Administrative and financial structure of NGOs, Guideline for NGO Management, NGOs as Society, NGOs as non-profit company, NGOs as Trust.

DRT 606-IT in Rural Development **Credits: 3**

UNIT-I Elementary knowledge about computer hardware and software, operating system, MS-Office.

UNIT-II Data analysis and appropriate software, Different graph type, operating SPSS

UNIT-III Numerical methods of Data Presentation: Mean, Median, Mode, Standard deviation, Correlation, Correlation, Regression, Chi Square Test.

UNIT-IV Audio-Visual Aids: Materials and Equipment-Planning Preparation and use of different types of audio-visual aids-Projectors Films-Tape recorder Television.

UNIT-V Introduction of GIS and its components-spatial data organization and management, Remote sensing and its application in rural development.

DRT 607: Dissertation / Thesis / Prototype development

The topic would be decided by the candidate in consultation with the respective supervisor. Dissertation / thesis will be based on existing branches of botany and the title will be decided keeping the view on the modern aspect in the related discipline. It will be the part of semester IV; however, the title of dissertation / thesis will be assigned by concerned faculty member/board in the beginning of semester III to provide sufficient time to complete dissertation / thesis.

DRT- 637- Practical of DRT- 605 and DRT- 606

To identify the causes of rural unemployment through survey in villages. Measurement of farm holdings with special reference to land situation and study of land ownership pattern. To study a functional SHG(Self Help Group) to understand method and procedure, record-keeping, linkages and income generating activities. Study of a village market to analyze the marketing chain and its functioning.

Elective Papers- (There shall be four elective papers, and student has to opt only one)

DRT 651: Innovation in Rural Entrepreneurship **Credits: 3**

UNIT I: Entrepreneurship: Concept, knowledge and skills requirement; characteristic of successful entrepreneurs; role of entrepreneurship in economic development; entrepreneurship process; factors impacting emergence of entrepreneurship; managerial vs. entrepreneurial approach and emergence of entrepreneurship

UNIT II: Starting the venture: generating business idea – sources of new ideas, methods of generating ideas, creative problem solving, opportunity recognition; feasibility study – market feasibility, technical/operational feasibility, financial feasibility; drawing business plan; preparing project report; presenting business plan to investors, STARTUP, SEED, PMKVY, TREAD, STEP, ATAL INNOVATION MISSION, MAKE IN INDIA.

UNIT III: Functional plans: marketing plan – marketing research for the new venture, steps in preparing marketing plan, organizational plan – form of ownership, designing organization structure, job design, manpower planning; Financial plan – cash budget, working capital, Performa income statement Performa cash, perform balance sheet, break even analysis.

UNIT IV: Sources of finance: debt or equity financing, commercial banks, venture capital; financial institutions supporting entrepreneurs; Intellectual Property Rights.

UNIT V: Rural Entrepreneurship: need for rural entrepreneurship, problems of rural entrepreneurship, NGOs and rural entrepreneurship, Training and Development of rural Entrepreneurs

DRT-652: Rural Health Management **Credits: 3**

UNIT I: Health Education, health planning & management, school health, health economics Information System, hospital waste management, Disaster management.

UNIT II: Health Status of Women in Rural Area; Nutritional Anaemia; Child Development: Status, education, health, Governmental Programmes for children development.

UNIT III: Epidemiology: Definition & aims Epidemiological approach. Basic measurement in Epidemiology, Types of Epidemiological studies.

UNIT IV: Infectious disease, Investigation of an epidemic of Leptospirosis, Malaria, Dengue in Rural set Up & in post disaster situations, Health advice to travelers, Screening for diseases

UNIT V: Prevention of accidents, investigation of public health problems as relevant to basic sciences for a health officer, First aid.

DRT-653-Innovative Commercial production technologies **Credits: 3**

Unit-I Commercial production technologies-nature, concept, applications and recent technical advancement.

Unit-II **Mushroom Cultivation**: Morphology and life-cycle, Importance of mushroom as a health food, a cash crop and eco- friendly commodity, Wild and cultivated mushroom, Edible and poisonous types, Tropical and temperate species, Mushroom spawns, media and substrate for different species.

Unit-III **Biofertilizers**: Bacterial, algal and fugal, Production technology and post-harvest handling of fresh and processed products and their marketing.

Unit-IV **Vermicomposting**: Principles and functions of Vermicomposting, Biological mechanism of Vermicomposting, large- scale and small- scale production of vermicomposts.

Unit-V **Biopesticides and Biosupplements**; herbal soaps, fumigants and hygienic products

DRT 654-IT in Rural Development **Credits: 3**

UNIT-I Elementary knowledge about computer hardware and software, operating system, MS-Office.

UNIT-II Data analysis and appropriate software, Different graph type, operating SPSS

UNIT-III Numerical methods of Data Presentation: Mean, Median, Mode, Standard deviation, Correlation, Correlation, Regression, Chi Square Test.

UNIT-IV Audio-Visual Aids: Materials and Equipment-Planning Preparation and use of different types of audio-visual aids-Projectors Films-Tape recorder Television.

UNIT-V Introduction of GIS and its components-spatial data organization and management, Remote sensing and its application in rural development.

Regulations, Course Structure & Syllabus

of

5-year Integrated UG and PG Food Technology Programme

Centre of Food Technology
Institute of Professional Studies
University of Allahabad

Objectives of the Programme

- To impart knowledge of various areas related to Food Science and Technology.
- To familiarize the students about the processing and preservation techniques of pulses, oilseeds, spices, fruits and vegetables, meat, fish, poultry, milk, & milk products.
- To emphasize the importance of food safety, food quality, food plant sanitization, food laws and regulations, food engineering and packaging in food industry.
- To inculcate ability to develop new food products and establish owns enterprise.

Regulations for 5-year Integrated UG and PG*Food TechnologyProgrammeEligibility for admission:

S.No.	Eligibility	Entry Point	Exit Point after successful completion	Degree offered
1.	A candidate must have passed 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture having scored not less than 50% marks (45% for SC&ST candidates) in aggregate.	First Semester	Second Semester / One year	***Certificate (Food Technology)***
		-	Fourth semester / Two year	***Diploma (Food Technology)***
		-	Sixth semester / Three year	***UG(Food Technology)***
		-	Eight Semester/ Four year	***UG (Food Technology) 'With Research'***
		-	Tenth Semester/ Five year	**5-year Integrated UG and PG Food Technology Programme**

**Presently B.Sc. and M.Sc.*

I. Duration of Programme:

(i) The UG programme shall extend over a period of 8 consecutive semesters spread over 4 academic years – two semesters constituting one academic year with multiple exit points outlined in S. No. I and 5-year Integrated UG and PG Food Technology Programme shall extend over a period of 10 consecutive semesters spread over 5 academic years. The duration of each semester shall normally be 15 weeks excluding examinations.

II. No. of Seats

5-year Integrated UG and PG Food Technology: **50**
(University reservation policy will be implemented for admission)

III. Fees:

The fees (per semester) in 5-yearIntegrated UG and PG Food Technology Programme is as follows:

S. No.	Semester	Amount (Rs.)
1	Semester I	30,000/- + 5000/-(caution money Refundable as per rule) = 35,000/-
2.	Semester II	30,000/-
3	Semester III	30,000/-
.4.	Semester IV	30,000/-
5.	Semester V	30,000/-
6.	Semester VI	30,000/-
7.	Semester VII	35,000/-
8.	Semester VIII	35,000/-
9.	Semester IX	35,000/-
10.	Semester X	35,000/-

IV. Examination and Assessment, Scheme of examination, Revision of Regulations and Curriculum will be as per "*University of Allahabad Regulations for Choice Based Credit System (CBCS) on the academic programmes in the University(Framed under Clauses 1(a)(i) and 3(a)(x) of Ordinance LX: The Organization and Conduct of Examinations.)" vide letter no. CoE/456/2016 dated 23/8/2016.*

Types of Courses

- **Core Course (CC):** A course which should compulsorily be studied by a candidate as a core requirement is termed as a Core Course.
- **Elective / Minor Course:** Generally, a course which can be chosen from a pool of courses which may be very specific, specialized or advanced or supportive to the discipline / subject of study which provides the extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called and Elective Course.
- **Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University /Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
- **Generic Elective (GE) Course:** An elective course chosen generally from an unrelated discipline/ subject, with an intention to seek exposure is called a Generic Elective.
- **Ability Enhancement Course (AEC)/Foundation Course:** An elective course offered as a part of foundation course aiming in building the basic skills and abilities to increase the proficiency of the candidate is called Ability Enhancement Course.
- **Skill Enhancement Course (SEC):** An course chosen from specific courses related to the subject expertise of the programme to develop expertise and skills in the concerned field is called as Skill Enhancement Course.
- **Dissertation/ Thesis/Project:** An elective course design to acquire special/advanced knowledge such as supplement study/support study through a project work and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called Dissertation/Thesis/Project.

Revised Course Structure
5-year Integrated UG and PG Food Technology Programme

Sem I	Title	Credits	Course Type	Exit Qualification
FFT 131	Fundamentals of Food Processing	2-0-1-3	Core Course (CC)	
FFT 132	Concepts of Food Science	3-0-1-4	Core Course (CC)	
FFT 133	Basic Food Chemistry-I	3-0-1-4	Core Course (CC)	
FFT 105	General Bioscience	2-0-0-2	Generic Elective (GE)	
FFT 106	Conversation and Documentation Skills	2-0-1-3	Ability Enhancement Course (AEC)/Foundation course	
FFT 107	Concepts of Laboratory Techniques	0-0-2-2	Skill Enhancement Course (SEC)	
Total		**18**		**Certificate(Food Technology)**
Sem II	**Title**	**Credits**	**Course Type**	
FFT 134	Introduction to Food Hygiene and Sanitation	2-0-1-3	Core Course (CC)	
FFT 135	Principles of Food Microbiology	2-0-1-3	Core Course (CC)	
FFT 136	Food Packaging	2-0-1-3	Core Course (CC)	
FFT 137	Fruits and Vegetable Processing	2-0-1-3	Skill Enhancement Course (SEC)	
FFT 108	Environmental Studies*	3-0-0-3	Foundation / Ability Enhancement Course (AEC)	
FFT 104	Introduction to Computer Application*	2-0-1-3	Foundation / Ability Enhancement Course (AEC)	
Total		**18**		
Grand Total		**36**		
Sem III	**Title**	**Credits**	**Course Type**	**Exit Qualification**
FFT 231	Basic Food Chemistry-II	2-0-1-3	Core Course (CC)	
FFT 232	Food Quality and Analysis	3-0-1-4	Core Course (CC)	
FFT 233	Food Processing Operations	3-0-0-3	Core Course (CC)	
FFT 234	Technology of Cereals, Pulses and Oilseed	3-0-1-4	Core Course (CC)	
FFT 208	Disaster and Risk Management	2-0-0-2	Generic Elective (GE)	
ELECTIVE-I (Any Two)				
FFT 255	Bakery and Confectionery Products Technology	2-0-1-3	Discipline Specific Elective (DSE)	
FFT 256	Beverage Technology		Discipline Specific Elective (DSE)	
FFT 257	**Basics of Nutrition**	**3-0-0-3**	**Discipline Specific Elective (DSE)**	
Total		**22**		**Diploma (Food Technology)**
Sem IV	**Title**	**Credits**	**Course Type**	
FFT 235	Meat, Fish and Poultry	2-0-1-3	Core Course (CC)	
FFT 236	Dairy Science	3-0-1-4	Core Course (CC)	
FFT 237	Food Quality Management and Quality Assurance	3-0-1-4	Skill Enhancement Course (SEC)	
FFT 209	Data Analysis	1-1-0-2	Generic Elective (GE)	
FFT 210	Technical Writing*	1-0-0-1	Foundation / Ability Enhancement Course (AEC)	
FFT 280	Industrial Training for 15-30 days	0-0-2-2	Skill Enhancement Course (SEC)	
FFT 258	**Crop Production**	**2-0-02**	**Generic Course**	
	Total	**19**		
Grand Total		**77**		

Sem V	Title	Credits	Course Type	Exit Qualification
FFT 331	Fundamentals of Food Engineering	3-0-1-4	Core Course (CC)	**Three Year UG Degree (Food Technology)**
FFT 332	Biochemistry and Human Nutrition	3-0-0-3	Core Course (CC)	
FFT 333	Concepts of Biotechnology	2-0-1-3	Generic Elective (GE)	
FFT 334	Waste Management Practices	2-0-0-2	Generic Elective (GE)	
FFT 380	Seminar	0-0-1-1	Skill Enhancement Course (SEC)	
ELECTIVE-II (*Any Two)*				
FFT 353	Technology of Indigenous milk Products	2-0-1-3	Discipline Specific Elective (DSE)	
FFT 356	Food Fermentation Technology		Discipline Specific Elective (DSE)	
FFT 357	**Nutraceuticals and Functional Foods**	**3-0-03**	**Discipline Specific Elective (DSE)**	
	Total	**19**		
Sem VI	**Title**	**Credits**	**Course Type**	
FFT 335	Food and Agribusiness Management	2-0-0-2	Skill Enhancement Course (SEC)	
FFT 336	Plant Design and Layout	2-0-0-2	Skill Enhancement Course (SEC)	
FFT 385	Industrial Project (10 weeks which may extend during summer vacation)	0-0-10-10	Core Course (CC)	
FFT 358	**Medicinal Plants**	**2-0-0-2**	**Generic Course (SEC)**	
	Total	**16**		
Grand Total		**109**		

Sem VII	Title	Credits	Course Type	Exit Qualification
FFT 504	Research Methodology and Statistics	3-1-0-4	Generic Elective (GE)	**Four year UG Degree (Food Technology) 'With Research'**
FFT 555	**Food Additives**	**2-0-0-2**	**Discipline Specific Elective (DSE)**	
FFT 390	Thesis	0-0-10-10	Discipline Specific Elective (DSE)	
	Total	**16**		
Sem VIII	**Title**	**Credits**	**Course Type**	
FFT 390	Thesis	0-0-20-20	Discipline Specific Elective (DSE)	
Grand Total		**147**		

Sem IX	Title	Credits	Course Type	
FFT 503	Instrumentation and Analytical Techniques	3-0-1-4	Core Course (CC)	
FFT 557	Spices and Flavour Technology	3-0-0-3	Skill Enhancement Course (SEC)	
FFT 509	Food Quality, Safety Standards and Certification	3-0-0-3	Core Course (CC)	
ELECTIVE-Any Four				
FFT 651	Entrepreneurship in Food Processing	2-0-0-2	Discipline Specific Elective (DSE)	
FFT 653	Food Rheology		Discipline Specific Elective (DSE)	
FFT 654	Food Product Development		Discipline Specific Elective (DSE)	
FFT 658	Food By-product management		Discipline Specific Elective (DSE)	
FFT 659	Advanced Food Chemistry		Discipline Specific Elective (DSE)	
FFT 553	**Speciality Foods**		Discipline Specific Elective (DSE)	
	Total	**18**		
Sem X				
FFT 507	Packaging of Food Materials	3-0-0-3	Core Course (CC)	
FFT 508	Food Engineering	3-1-0-4	Core Course (CC)	
FFT 510	Advanced Food Microbiology	3-0-1-4	Core Course (CC)	
Elective- Any Two				
FFT 660	**Processing of Fruits and Vegetables**	**1-0-1-2**	Discipline Specific Elective (DSE)	
FFT 552	Intellectual Property Rights	2-0-0-2	Discipline Specific Elective (SEC)	
FFT 554	Fundamentals of Nutrition		Discipline Specific Elective (SEC)	
FFT 652	Food Fermentation and Microbial Technology		Discipline Specific Elective (SEC)	
FFT 641	Seminar	0-0-1-1	Skill Enhancement Course (SEC)	
	Total	**16**		
	Grand Total	**181**		

5-year Integrated UG&PG Food Technology Programme

CC: Core Course, AEC: Ability enhancement Course/ Foundation course, SEC: Skill Enhancement Course, GE: Generic Elective, DSE: Discipline Specific Elective, Elective / Minor courses to be opted from other dept. relevant to research work

SEMESTER-I

Core Course FFT 131 :Fundamentals of Food Processing

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective: To acquaint with principles of different techniques used in processing and preservation of foods.

Course Content

UNIT I 5 lectures

Introduction: Definition and scope of Food Science and Technology, Sources of food, scope and benefit of industrial food preservation, perishable, non perishable food, causes of food spoilage.

UNIT II 10 lectures

Thermal processing methods of preservation: Principle: Canning, blanching, pasteurization, sterilization, evaporation.

Use of low temperature: Principle and effect on quality. Chilling, cold storage, freezing.

Preservation by drying dehydration and concentration: Principle, Methods and effect on quality.

Preservation by radiation: Definition, Methods of Irradiation, Direct & Indirect effect, measurement of radiation dose, dose distribution, effect on microorganisms.

UNIT III 5 lectures

Presentation of foods by Preservatives: chemicals, antioxidants, mold inhibiters, antibodies, acidulates etc.

Preservation by salt & sugar: Principle, Method and effect on food quality.

UNIT IV 5 lectures

Preservation by fermentation: Definition, Advantages, disadvantages.

UNIT V 5 lectures

Recent methods in preservation: Pulsed electric field processing, High pressure processing, processing using ultrasound, dielectric, ohmic and infrared heating.

Practical

- Introduction to food laboratory.
- To study the effect of enzymatic browning in fruits and vegetables.
- To study different types of blanching of fruits and vegetables.
- Preservation of food by canning.
- To perform cut out analysis of caned product.
- Preservation of food by high concentration of sugar i.e. jam.
- Preservation of food by high concentration of salt/acid i.e. pickle.
- Preservation of food by addition of chemicals i.e. tomato ketchup.
- Preservation of food by drying in a cabinet drier.
- Preservation of fruits & vegetables by freezing.
- Preservation of milk by pasteurization and sterilization.

Reference Books:

- Food Processing Technology by P.J.Fellows, Woodhead publishing ltd.
- Food Science by N.N. Potter, CBS publishing.
- Physical principles of Food Preservation. Vol. II by M. Karel, O.R. Fenema and D.B. Lurd,Maroel, Dekker Inc. New York.
- The technology of food preservation by N.W.Desrosier and J.N. Desrosier, CBS publishing.

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Core Course FFT 132: Concepts of Food Science

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective: To impart knowledge of various areas related to Food science and technology.

Course Content

UNIT I 14 lectures

Introduction to Food Science*:* Historical development of food science and technology, Evolution of Food Processing from prehistoric times till date, Introduction to various branches of Food Science and Technology

Cereals and Millets: Wheat- structure and composition, types (hard, soft/ strong, weak). Process of malting, Gelatinization of starch, types of browning. Rice- Composition of rice obtained by different dehusking methods, parboiling of rice- advantages and disadvantages. Millets -Varieties, composition and uses of maize, sorghum, barley, rye, oats, triticale, pearl millet and finger millet.

Pulses: Introduction, common names and scientific names of different pulses. Chemical composition of pulses, processing of pulses- soaking, germination, decortications, cooking and fermentation. Toxic constituents in pulses and its detoxification processes.

UNIT II 6 lectures

Fats and Oils: Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids. Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, and hydrogenation. Rancidity - hydrolytic and oxidative rancidity and its prevention. Definition margarine, butter, hydrogenated vegetable oil, lard.

UNIT III 8 lectures

Fruits and Vegetables: Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments. Post harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes during the storage of fruits and vegetables.

UNIT IV 12 lectures

Flesh Foods - Meat, Fish, Poultry: Meat - Definition of carcass, composition of meat, concept of red meat and white meat. Fish - Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish, spoilage of fish. Poultry - Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality.

Milk and Milk Products: Definition of milk, typical chemical composition of milk of different species i.e. buffalo, cow, goat. Composition of milk, its constituents, various steps in processing of milk. An overview of types of market milk and milk products-cheese, paneer, ice cream, ghee, butter, flavoured milk, imitation milk.

Condiments and spices: Composition and importance of spices.

UNIT V 5 lectures

Sensory evaluation of food: Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duo-trio test, triangle test, hedonic scale, chemical dimension of basic tastes.

Practical

- To study the gelatinization temperature range and % sag of various cereal starches.
- To study the factors affecting gelatinization of cereal starches.
- To study germination of whole pulses and legumes.
- To study fermentation in cereals and pulses.
- To study non-enzymatic browning; caramelization in various sugars.
- To detect the adulteration in fats and oils by qualitative tests.
- To detect the presence of adulterants in milk.
- To perform the recognition test for the four basic tastes.
- To perform the sensitivity / threshold tests for four basic tastes.
- To recognize few odors and to learn to memorize them.

Reference Books:

- Food Science by B. Srilakshmi, publishing, New Age International (P) ltd. publications.
- Food Science by N.N. Potter, CBS publishing.
- Food Science by S. Manay, New Age International (P) ltd. publications.

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Core Course FFT 133 : Basic Food Chemistry-I

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective:

• To understand the chemistry of foods - composition of food, role of each component and their interaction.
• To understand the functional aspects of food components and to study their role in food processing.

Course Content

UNIT I 8 lectures

Introduction to Food Chemistry: Definition, Composition of food, Water: Definition of water in food, Structure of water and ice, Types of water, Sorption phenomenon, Water activity and packaging, Water activity and shelf-life

UNIT II 10 lectures

Lipids: Classification of lipids, Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point; Chemical properties-reichertmeissel value, polenske value, iodinevalue, peroxide value, saponification value; Effect of frying on fats; Changes in fats and oils- rancidity, lipolysis, flavor reversion, Auto-oxidation and its prevention; Technology of edible fats and oils- Refining, Hydrogenation and Interesterification, Fat Mimetics

UNIT III 10 lectures

Proteins: Protein classification and structure; Nature of food proteins(plant and animal proteins); Properties of proteins (electrophoresis, sedimentation, amphoterism and denaturation); Functional properties of proteins eg. organoleptic, solubility, viscosity,binding; gelation / texturization, emulsification, foaming.

UNIT IV 9 lectures

Carbohydrates: Classification(mono, oligo and poly saccharides); Structure of important polysaccharides(starch, glycogen, cellulose, pectin,hemicellulose, gums); Chemical reactions of carbohydrates –oxidation, reduction , with acid &alkali; Modified celluloses and starches

UNIT V 8 lectures

Vitamins: Structure, Importance and Stability; Water soluble vitamins; Fat soluble vitamins
Flavour: Definition and basic tastes; Chemical structure and taste; Description of food flavours; Flavour enhancers

Practicals:

- Preparation of primary and secondary solutions
- Estimation of moisture content
- Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR.
- Determination of refractive index and specific gravity of fats and oils.
- Determination of smoke point and percent fat absorption for different fat and oils.
- Determination of percent free fatty acids
- Estimation of saponification value
- Estimation of reducing and non-reducing sugars using potassium ferricyanide method.

Reference Books:

- Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York,1996
- Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada,2002
- Wong, Dominic WS, Food Enzymes, Chapman and Hall, New York, 1995
- Potter,N.N.andHotchkiss,J.H, Food Science, 5th Ed., Chapman & Hall,1995
- DeMan, J.M., Principles of Food Chemistry, AVI, NewYork, 1980

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Generic Elective Course FFT 105: General Bioscience

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective: Fundamentals of Bioscience is based on the structural organisation of the human body and the general functions of the body systems, emphasizing the relationship between structure and function.

Course Content:

UNIT I 3 lectures
Level of organization in life (water to protein).

UNIT II 5 lectures
Cytology - cell composition, structure and function.

UNIT III 9 lectures
Animal systems and plant physiology with introductory food biochemistry.
Plant and animal taxonomy - With reference to edible groups and their identification.
Domestication, improvement and disease control of animal and plants species.

UNIT IV 7 lectures
Economic biology - Cereals, pulses, fruits, Vegetables, Beverages, Meat, Dairy, Piggery, aquaculture, and other edible animal and plant product.
Introduction of Ecology and environment of edible species of plant and animals.

UNIT V 6 lectures
Brief introduction of genetics and evolution of Taxa with human interaction.
Plant and animal breeding, genetic engineering and GM Food (a brief introduction).

Reference Books:

- Biosciences by Taylor, Cambridge University Press.
- Biology by Storer, Viva publishing.

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Ability Enhancement Course FFT 106: Conversation and Documentation Skills
Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: Basic knowledge of English

Objective: To equip the students with skills to write to communicate and articulate in English (verbal as well as writing) and to acquaint the students with the knowledge and use of computers and to introduce the basic principles, organization and operational aspects of computers.

Course Content

UNIT I 6 lectures
Introduction to Communication & Grammar : Consonant & Vowel Sounds, Indianism, Syllable & Syllable Stress, Determiners, Articles, Tense & Time, Preposition, Prepositional Phrases, Subject-Verb Agreement, Active – Passive Voice, Intonation & Modulation, Conjunctions

UNIT II 7 lectures
Formal Writing Skills: Composition Writing: Business Letters (Functions of a Business Letter, Layout of a Business Letter, Salient Features of a Business Letter, Kinds of Business Letter, Application Writing)

UNIT III 5 lectures
Conversation Skills: Nature of Conversation, Purpose of Conversation, Guidelines for Effective Conversation Skills, Proverbs used in Everyday Conversation with their Meanings/Explanations

UNIT IV 5 lectures
Documentation Skills: Introduction to Documentation: Meaning, Purpose, Need.

UNIT V 7 lectures
A short introduction to Computers, digitalized era, global connection via net, Drafting of Text, Excel, E Mails, Making Presentations, MS Word

Practical

Communication Skills

- Verbal &Non Verbal Communication
  Verbal Communication - Extempore, Just a Minute, Declamation, Dialogue, Monologue
  Non verbal Communication - Guess the Mime, Dumb Charades, Formal & Informal Writing, Facial Expressions, Dressing & Clothing

- Oral Communication - Day to today talk, formal talk, informal talk, conversation
- Body Language
  Right body postures, Eye Contact, Pet Fiddles, how to walk, talk and present oneself.
- Group Discussion Skills (Meaning, Characteristic, Do's & Don'ts, Relevance, Moderating a group Discussion
- Presentation Skills - Confidence, Effective Delivery of ideas, Convincing the audience, basic courtesies
- Public Speaking - Oration, Debates
- English Movie Sessions

Documentation Skills

- Basics of Computers, usage of short cut keys, taking out print outs, page set ups.
- Making of Power point Presentation
- E- Mail (Subject line, salutation, subscription, how to mark cc, drafting, sending of mails, reverts, forwarding of mails, attaching pictures and documents, attaching ppts
- Differentiation between hardware and software and practical usage of both.
- Diagrammatic representation of pie-charts, tabular presentation of data/info, Etc
- Basic use of MS Excel/Spread Sheets

Reference Books:

- High School English Grammar and Composition - Wren & Martin, Publisher - Churchill Livingstone
- Anthology of English Language and Communication Skills - Sharma S R, Jacob, Mark Publications
- Language and Communication Skills - Shastri, Rameshchandra, ABD Publications
- A Course in Academic Writing - Renu Gupta, Orient Blackswan Publications.

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SkillEnhancement Course FFT 107: Concepts of Laboratory Techniques

Credits: (0-0-2-2)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective: To acquaint the students with handling and analyzing the high end equipment and to learn the concept and principles of food analysis equipment.

Course Content

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware

Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution, Handling techniques of solutions; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values.

Preparation of different agro-chemical doses in field and pot applications

Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability

Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

General Laboratory Safety: Preparing for laboratory work, during laboratory work and cleaning up before leaving, General Characteristics & procedure for handling & storage of hazardous materials and control of hazards.

Reference Books

- Furr A.K. 2000. CRC Hand Book of Laboratory Safety. CRC Press.
- Gabb M.H.&Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

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SEMESTER-II

Core Course: FFT 134: Introduction to Food Hygiene and Sanitation

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective:

The knowledge and skills required to produce healthy meals for the family with regard to safety, effective organisation and management of family resources, and the needs and lifestyles of family members

Course Content

UNIT I 2 lectures

Principles of hygiene and its relation to food preparation.

UNIT II 8 lectures

General hygienic and sanitary practices to be followed by different food business operators - fruits and vegetable, milk and milk product, meat and meat product, catering etc.

UNIT III 10 lectures

General hygienic and sanitary requirements for different areas - location and surroundings, layout and design of food establishment premises, equipment & containers, facilities, food operations and controls, management and supervision, food testing facilities, audit, documentation and records, sanitation and maintenance of establishment premises, personal hygiene, product information and consumer awareness, training.

UNIT IV 5 lectures

Water quality - water standards and analysis of physical, chemical and microbiological characteristics of water.

UNIT V 5 lectures

Waste treatment - fundamentals of physical, biological & chemical waste treatments.

Practical

- Analysis of water used in food industries
  - Determination of acidity of the given sample of water.
  - Determination of alkalinity of the given sample of water.
  - Determination of the total hardness of Water.
  - Determination of pH of the given sample of Water.
  - Determination of Conductivity of the given sample of Water.
  - Determination of Total Solids of the given sample of Water.
  - Determination of Total Dissolved Solids of the given sample of Water.
  - Determination of Turbidity of the given sample of Water.
- Assessment of surface sterilization using swab and rinse method.
- Case Study of food hygiene and sanitation (GMP/GHP) of a food industry.
- Preparation of HACCP Plan

Reference Books:

- Food plant sanitation – Packer and Litchfield (Reinhold Publ.)
- Handbook of analysis and quality control for fruits and vegetables products by S. Ranganna, Mcgraw Hill Pub. Co. New York.

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Core Course FFT 135:Principles of Food Microbiology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food.

Course Content

UNIT I 5 lectures

Introduction of microbiology, History and significance of food microbiology.

Classification of microbes, Structure of microbes, Metabolism of microbes.

UNIT II 5 lectures

Environmental microbiology: microbiology of air and water.

UNIT III 5 lectures

Food contamination and public health: food poisoning

UNIT IV 10 lectures

Food microbiology and spoilage of fruits and vegetables, milk and milk products, cereals and cereal products.

Industrial microbiology: Industrial application of microbes.

UNIT V 5 lectures

Thermal inactivation of microbes: pasteurization, sterilization etc. concept of TDT, F, Z and D values. Factors affecting heat resistance.

Antimicrobial agents: mechanism and action

Practical

- An introduction to microbiology, aseptic technique and safety.
- Preparation of culture media.
- To sterilize the media and equipment.
- To prepare serial dilutions.
- Plating techniques
- Culturing the bacteria on a solid media by using serial dilution method and determining the number of viable cells in the culture (standard plate count).
- Introduction to microscopy and to study cell morphology with simple staining.
- To study cell morphology and cell arrangement with negative stain.
- To stain bacteria with gram stain.
- To stain bacterial cells by wet-mount technique to check the mobility (flagellin) in bacterial cell.
- To stain bacterial cells with malachite green stain to check the presence of endospore.

Reference Books:

- Food microbiology by V. Ramesh, MJP publishing.
- Food microbiology by W.C. Frazier, Ist Edition by Mcgraw Hill Pub. Co. New York.
- Modern Food Microbiology, J.M. Jay. CBS publisher.

Core Course FFT 136: Food Packaging

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: A basic course on food processing

Objective: To acquaint the students with packaging methods, packaging materials, packaging machineries, modern packaging techniques etc.

Course Content

UNIT I 7 lectures

Packaging–Concepts, definition, Significance, classification. Deteriorative changes in food and packaging methods for prevention.

UNIT II 7 lectures

Primary packaging media – Properties and application of Paper, paper boards, metals, plastics, glass. Food containers-rigid containers and flexible packaging materials. Application of different packaging materials in food industry. eg. bags, pouches, wrappers, cartons etc.

UNIT III 8 lectures

Factors determining the packaging requirements of various foods, Packaging of perishable and processed foods.

UNIT IV 8 lectures

Advancements in packaging: Biodegradable packaging, Edible packaging, Active packaging, Modified atmosphere packaging, Vacuum packaging, Aseptic packaging

Practical

- Familiarization of different types of packaging materials.
- To perform vacuum packaging of food sample and carry out its storage study.
- To perform modified atmospheric packaging of food sample and carry out its storage study.
- Cut out analysis of canned food
- Determination of wax absorptiveness of paper

Reference Books

- Robertson, G.L. "Food Packaging: Principles and Practice". 2nd Edition. Taylor & Francis, 2006.
- Ahvenainen, Raija. "Novel Food Packaging Techniques". Wood Head Publishing, 2003.
- Mathlouthi, M. "Food packaging and Preservation". Aspen Publications, 1999.
- Paine, F.A. and Paine, H.Y. 1983. A Handbook of Food Packaging. Leonard Hill, Glasgow, UK.

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Core Course FFT 137: Fruits and Vegetable Processing

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course on Food Science

Objective

To acquaint with the proper handling technologies of fruits and vegetables to reduce post harvest losses and acquaint with principles and methods of preservation of fruits and vegetables into various products.

Course Content

UNIT I 2 lectures

Pre-packaging of fresh fruits and vegetables. Storage techniques for fresh fruits and vegetables.

UNIT II 6 lectures

Primary processing: grading, sorting, cleaning, washing, peeling, slicing and blanching

UNIT III 6 lectures

Dehydration of fruits and vegetables using various drying technologies like sun drying, solar drying, osmotic, tunnel drying, fluidized fed drying, freeze drying.

UNIT IV 8 lectures

Processing of juices: Processing of vegetable juice, Processing of fruit juice

Manufacturing of fruit juices concentrates, puree and pastes, Preparation of jam, jellies and marmalades.

UNIT V 8 lectures

Preparation of preserve and candied fruits, Pickling of fruits and vegetables,Waste management in fruits and vegetable processing units

Practical

- Determination of ascorbic acid, acidity, total soluble soild.
- Evaluation of pectin content.
- Preparation and quality evaluation of fruit jam, fruit jelly, fruit marmalade; squash
- Processing of tomato products; Ketchup
- Preparation of dehydrated vegetables.
- Determination of chemical preservatives- benzoic acid, KMS
- Visit to commercial storage, and canning unit.

Reference Books

- Lal G, Siddapa GS &Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.
- Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.

- Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.
- Verma LR. & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

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Ability Enhancement Course FFT 108:Environmental Studies

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the natural resources and the ecosystem, and ecology.

Course Content

UNIT I 5 lectures

The Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance.

Natural Resources: Renewable and Non-Renewable Resources, Natural Resources and Associated Problems, Renewable Resources

UNIT II 15 lectures

Ecosystems: Concept of an Ecosystem, Structure and Functions of an Ecosystem, Energy Flow in the Ecosystem: The Water Cycle, The Carbon Cycle, The Oxygen Cycle, The Nitrogen Cycle, The Phosphorus Cycle, The Sulphur Cycle, The Energy Flow, Integration of Cycles in Nature, Food Chains, Food Webs and Ecological Pyramids, Introduction, Types, Characteristic Features, Structure and Functions.

UNIT III 3 lectures

Biodiversity: Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation, Conservation of Biodiversity: In Situ and Ex Situ.

UNIT IV 15 lectures

Pollution: Definition, Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards, Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Waste, Pollution Case Studies, Social Issues and the Environment From Unsustainable to Sustainable Development, Urban Problems Related to Energy, Water Conservation, Rainwater Harvesting, Watershed Management, Consumerism and Waster Products

Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents an Holocaust.

UNIT V 7 lectures

The Environmental (Protection) Act- The Air (Prevention and Control of Pollution) Act, TheWater(Preventionand Control of Pollution) Act

Value Education: Environmental Values, Valuing Nature, Valuing Cultures, Social Justice, Human Heritage, Equitable Use of Resources, Common Property Resources, Ecological Degradation.

Reference Books

- Kumarasamy, K., A.Alagappa Moses And M.Vasanthy, 2004. Environmental Studies, Bharathidsan University Pub, 1, Trichy
- Rajamannar, 2004, Environmental Studies, Evr College Pub, Trichy
- Kalavathy,S. (Ed.) 2004, Environmental Studies, Bishop Heber College Pub., Trichy

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Ability Enhancement Course FFT 104:Introduction to Computer Application

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective: To acquaint the students with the knowledge and use of computers and to introduce the basic principles, organization and operational aspects of computers.

Course Content

UNIT I 5 lectures

Microsoft Word and its applications (in relation with Food Industry)

Font formatting, Paragraph formatting, Inserting images, auto shapes symbols, diagrams, header & footer, References, watermarks and Hyperlinks, Style & Formatting, Mail Merge through word, Excel, Access database, Page setup, Printing a document

UNIT II 5 lectures

MS Excel and its applications (in relation with Food Industry)

Making column chart & pie chart and chart formatting, Use of general functions & formula (autosum, using basic arithmetic operators: +,-,*,/), Use of filter & sorting, Cell references, header & footer, age setup, use of page break preview, printing worksheets.

UNIT III 10 lectures

MS PowerPoint and its applications (in relation with Food Industry)

Creating own design, formatting objects on a slide, Use of Slide Master to control the design & formatting of a presentation, Use of Image, audio, video in the presentation, Slide show setup, slide transition, use of animation, Use of narration in presentation, Print setup & Printing handouts of a presentation.

UNIT IV 5 lectures

Internet & Web Applications (in relation with Food Industry

UNIT V 5 lectures

Websites, Internet applications, Google Applications (G mail, Google search, G Drive, Google Docs) and other Email Services, Industry customer approach.

Practical

- Applications of MS Excel to solve the problems of food technology
- Statistical quality control, Sensory evaluation of food, and Chemical kinetics in food processing;
- Use of word processing software for creating reports and presentation;
- Familiarization with the application of computer in food industries -Milk plant, Bakery Units, Fruit & Vegetable processing Unit;
- Familiarization with software related to food industry;
- Ergonomics application in the same; Visit to Industry and case study problems on computer.
- Visit to Industry and case study problems on computer.

Reference Books

- Fundamentals of Computers by E. Balagurusamy (Author) Publisher: McGraw Hill Education (India) Private Limited
- Ms Office 2007 in a Nutshell by S. Saxena (Author) Publisher: S.Chand (G/L) & Company Ltd
- Computer Fundamentals Paperback – by P. K. Sinha (Author) Publisher: BPP

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SEMESTER-III

Core Course FFT 231: Basic Food Chemistry - II

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: Basic Food Chemistry -I

Objective :

To acquaint with properties and role of various constituents in foods, interaction and changes during processing.

Course Content

UNIT I 8 lectures

Minerals: Major and minor minerals, Metal uptake in canned foods, Toxic metals

UNIT II 9 lectures

Natural Food Pigments: Introduction and classification; Food pigments(chlorophyll, carotenoids, anthocyanins and flavonoids,beet pigments, caramel)

UNIT III 10 lectures

Browning Reactions In Food: Enzymatic browning, Non – Enzymatic browning, Maillard reaction, Caramelization reaction, Ascorbic acid oxidation

UNIT IV 8 lectures

Enzymes: classification, General characteristics, Enzymes in food processing, Industrial Uses of Enzymes, Immobilized enzymes

UNIT V 10 lectures

Physico-chemical and nutritional changes occurring during food processing treatments: Drying and dehydration, Irradiation, Freezing, Canning

Practicals

1. Estimation of total ash
2. Estimation of minerals
3. Determination of thermal inactivation time of enzymes in fruits and vegetables.
4. Estimation of iodine value
5. Estimation of peroxide value
6. Determination of carotenoids w.r.t flour pigments.
7. Extend of non-enzymatic browning by extraction methods.

Reference Books:

1. deMan, John M., Principles of Food Chemistry ,3rd Ed., Springer 1999
2. Desrosier, Norman W. and Desrosier., JamesN.,The technology of food preservation , 4th Ed., Westport, Conn. : AVI Pub. Co., 1977.
3. Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York,1996
4. Fuller, Gordon W, New Product Development From Concept to Marketplace,CRC Press,2004.
5. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada,2002

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Core Course FFT 232: Food Quality and Analysis

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A basic course in Laboratory Techniques

Objective

To develop an understanding and methodologies of instrumental techniques in food analysis used for objective methods of food quality parameters.

Course Content

UNIT I 10 lectures

Introduction to quality attributes: Appearance, flavour, textural factors and additional quality factors.

Sensory Analysis: Introduction to sensory analysis; general testing conditions, Requirements of sensory laboratory; organizing sensory evaluation programme. Factors influencing sensory measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and gloss; Detection, threshold and dilution tests, discrimination, descriptive, affective; Ranking tests; Methods of sensory evaluation of different food products.

UNIT II 10 lectures

Colour:Importance and need of colour determination, methods of colour determination with Hunter Colour lab, CIE system and their applications. classification- artificial and natural.

Flavour: Importance of flavour, food flavours, factors affecting food product flavours, measurement of food flavours. Texture: Food texture, Physical characteristics of food, working of texture measuring instruments such as Texture Analyser, Texture Profile Analysis (TPA).

UNIT III 10 lectures

Chromatography: Principle and working of Gas chromatography (GC), High pressure liquid chromatography (HPLC), Thin layer chromatography (TLC), Column Chromatography, chromatographic methods applied as quality control.

Spectroscopy: Beers and Lambert's Law. General principles of colorimeters and spectrophotometers, Atomic absorption spectroscopy, IR spectroscopy, Flouremetry.

UNIT IV 7 lectures

Methods for food analysis: Estimation of carbohydrates, protein, fat, vitamins and minerals

Food Adulteration: Definition, types of adulterants and their detection.

UNIT V 8 lectures

Natural toxins. Contaminants formed during processing – nitrosamines, acrylamide etc. natural food contaminants and contaminants form packaging materials.

Food Additives: Introduction, need of food additives in food processing and preservation. Characteristics and classification of food additives. Safety and quality evaluation of additives and contaminants, Acute and chronic studies, NOEL, ADI, LD50.

Antimicrobial agents. -Nitrites, sulphides, sulphur-di-oxide, sodium chloride, hydrogen peroxide.

Antioxidants - Introduction, mechanism of action, natural and synthetic anti-oxidants, technological aspect of antioxidants.

Practical

- Preparation of standard solutions for the chemical analysis i.e. HCl, H_2SO_4, $KMnO_4$, Sodium Thiosulphate and Iodine.
- Determination of proximate composition of food- moisture, protein, crude fat, crude fiber, ash, total carbohydrates and Calorific Value by standard AOAC procedures
- Determination of minerals in food products: Calcium by Titration, Phosphorus by Spectrophotometer, Iron by Spectrophotometer,
- Determination of pH and total acidity of various food samples.
- Determination of total sugars, reducing and non-reducing sugars in various food samples.
- Detection of adulterants in various food (turmeric, red chilli, coffee, honey, flour)etc.
- Qualitative analysis of compounds by chromatography techniques- a) Thin layer Chromatography, b) Paper Chromatography: Descending, Ascending and Circular Paper chromatography.
- Estimation of metals - Fe, Ca, Cu, Cu, Pb, Zn, Sn and Cr- by atomic absorption spectrometer and flame photometer. Demonstration of AAS for estimation of metals.
- Colour measurement (L a b values) by X Rite.
- Use of electrophoresis in the determination of proteins.
- To conduct sensory evaluation of the given samples using descriptive method.
- To perform the difference testes (Paired comparison test, Duo trio test and Triangle test) in the given sample
- Texture analysis of raw and processed foods.

Reference Books

- Clifton M & Pomeranz Y. 1988. Food Analysis - Laboratory Experiments. AVI Publ.
- Gruenwedel DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. I. Physical Characterization. Marcel Dekker.
- Nollet LML. 1986. Handbook of Food Analysis. Vol. I. Marcel Dekker.

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Core Course FFT 233: Food ProcessingOperations

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on food processing

Objective

To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I 5 lectures

Introduction: Basic principles of food processing, Conservation of mass and energy, Units and dimensions of engineering parameters, dimensionless ratios, and calculations involving various physical parameters.

UNIT II 10 lectures

Distillation: Distillation, Steam distillation, applications and equipment – determination of height equivalent of theoretical plate (HETP) – McCabe-Thiele method – reflux ratio. Molecular distillation, theory and examples. Mass transfer phenomenon applied to food systems

UNIT III 10 lectures

Evaporation: Needs, basic principles, Calculations, Single and multiple effect evaporation, Heat economy – enthalpy balances for evaporators, Vapour recompression, Thermo and mechanical systems, boiling point elevation, Falling film, climbing film tubular evaporators, plate evaporators, thin film and scraped surface evaporators.

UNIT IV 10 lectures

Contact Equilibrium Separation Processes: Concentrations, Gas-liquid equilibria, Solid liquid equilibria, Equilibrium concentration relationships, operating conditions; Basics of Solid-liquid extraction processes, liquid-liquid extraction, with food application examples, Crystallization

UNIT V 10 lectures

Leaching and Extraction: Leaching – Leaching equipments – principles of continuous and countercurrent leaching. Liquid extraction – extraction equipment – principles of extraction. Special extraction techniques – supercritical fluid extraction. Applications; extraction of Fatty acids, oleoresins and essential oils; Relative advantages, limitations and economics. Mechanical extraction – Expellers, screw press, filter press.

Reference Books

- Albert Ibarz, Cannovas, G.V. Unit Operations in Food Engineering. CRC Press. 2003.
- J.M. Coulson, J.F. Richardson, J.H. Harker - Coulson & Richardson's Chemical Engineering - Vol 2 Particle Technology and Separation Processes, Fifth Edition, 2002. Butterworth & Heinemann - Elsevier science Ltd.

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Core Course: FFT 234 : Technology of Cereals, Pulses and Oil Seeds

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course in Food Science

Objective

To acquaint with production and consumption trends, structure, composition, quality evaluation, and processing technologies for product development and value addition of various cereals, pulses and oilseeds.

Course Content

UNIT I 2 lectures

Status, production and major growing areas of cereals, in India and world.

UNIT II 20 lectures

Wheat Processing: Wheat classification, Functionality of wheat flour components.

Rice Processing: Classification, paddy Processing, Parboiling and treatment for quality improvement, Milling, rice products.

Coarse Cereals Products: Maize- Dry and wet milling of corn, corn products, sorghum, pearl millet and small millets processing.

UNIT III 10 lectures

Pulses: Pre-treatment of pulses for milling, milling of major pulses. Methods to improve recovery, Nutrition and anti-nutritional factors in pulses.

UNIT IV 7 lectures

Oil seeds Processing: Groundnut, Mustard, Soybean, Sunflower, Safflower, Sesame and other oil seeds processing.

UNIT V 6 lectures

Special Topics: Processing & Utilization of Soya bean for value added products, Innovative products from cereals, pulses and oilseeds. Extrusion technology for cereals

Practical:

- Physico-chemical examination of wheat and its products test weight, kernel hardness, gluten content.
- Millingof rice with emphasis on quality and recovery.
- Physicochemical tests of rice and flour quality of wheat- gelatinization temperature, water absorption tests.
- Determination of Yeast activity used in fermented cereal products.
- Quality test for wheat flour used in the baked products. Maltose Number, Water Absorption, Sedimentation value, Alcohol Acidity
- Quality tests for oils.
- Texture profile analysis of baked cereal food products by texture analyzer.
- Products of Soybean- tofu, soya milk,
- Estimation of antinutritional factors in pulses- Trypsin inhibitors and tannins.
- Visit to dhal mills

Reference Books

- Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.
- Dendy DAV &Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
- Hamilton RJ &Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.
- Hoseney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed. AACC.

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General Elective Course FFT 208: Disaster and Risk Management

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To familiarize the students with the concept of disaster, how to response to disaster and field work to access the cause.

Course Content

UNIT I 10 lectures

Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and Local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

UNIT II 5 lectures

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT III 5 lectures

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction.

UNIT IV 5 lectures

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion.

UNIT V 5 lectures

Field work / Case studies, Hazard mapping of vulnerable areas, Vulnerability assessment (physical, social, organizational, economical, technological) Risk mitigation planning for vulnerable areas.

Reference Books

- Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan.
- Hodgkinson PE & Stewart M. 1991. Coping with Catastrophe: A Handbook of Disaster Management. Routledge.
- Sharma VK. 2001. Disaster Management. National Centre for Disaster Management, India.

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Discipline Specific Elective Course FFT 255: Bakery and Confectionery Products Technology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on processing of cereals technology

Objective

To familiarize the students with different form of bakery confectionary and the analysis equipment involved, and to acquire the knowledge of manufacturing process of bakery and confectionary products in range.

Course Content

UNIT I (6 lectures)

Bakery and Confectionery industry; raw materials and quality parameters; dough development; dough chemistry;

UNIT II (6 lectures)

Rheological testing of dough-principles of Farinograph, Mixograph, Extensograph, Amylograph / Rapid Visco Analyzer, Falling number, Hosney's dough stickiness tester.

UNIT III (6 lectures)

Technology for the manufacture of bakery products- detailed description of unit operations for the manufacturing of bread, biscuits, cakes and the effect of variations in formulation.

UNIT IV (6 lectures)

Manufacturing of confectionary products: Characteristics and processing of raw material; Technology of manufacturing of toffee, chocolate, hard boiled candies, bars, chewing gums, bubble gums and Characteristics of finished products.

UNIT V (6 lectures)

Equipment used in bakery and confectionary industry: Construction and working of various equipments like Mixers, proofing chambers, dough dividers, moulder and sheeter, baking ovens, cooling chamber, sealing and packaging machines, Rolling and cutting machines.

Practical

- Quality test for wheat flour used in the baked products. Maltose Number, Water Absorption, Sedimentation value, Alcohol Acidity
- Preparation and quality evaluation of cakes
- Preparation and quality evaluation of biscuits
- Preparation and quality evaluation of nan khatai
- Preparation and quality evaluation of cookies
- Effect of syrup consistency and temperature on the quality characteristics of hardboiled sweets
- Preparation and quality evaluation of chocolate
- Visit to bakery and confectionery industries.

Reference Books

- Dubey SC. 2002. Basic Baking. The Society of Indian Bakers, New Delhi.
- Francis FJ. 2000. Wiley Encyclopedia of Food Science & Technology. John Wiley & Sons.
- Manley D. 2000. Technology of Biscuits, Crackers & Cookies. 2nd Ed. CRC Press.

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Discipline Specific Elective Course FFT 256: Beverage Technology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A basic course in Food Science

Objective

In this the students will be exposed to the knowledge of beverage types and manufacturing process involved in different beverage manufacturing industries.

Course Content

UNIT I 6 lectures

Types of beverages and their importance; status of beverage industry in India;

UNIT II 4 lectures

Manufacturing technology for juice-based beverages; synthetic beverages; technology of still, carbonated, low-calorie and dry beverages; isotonic and sports drinks;

UNIT III 4 lectures

Specialty beverages based on tea, coffee, cocoa, spices, plant extracts etc.

UNIT IV 8 lectures

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, wine and related beverages, distilled spirits.

UNIT V 8 lectures

Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, carbonated water.

Practical

- Chemical and microbiological analysis of raw water quality;
- Preparation of regional fruit juices;
- Preparation of whey-based beverages;
- preparation of crush, nectar, blended juice
- Preparation of soy milk, fruit milkshakes, herbal beverages;
- Visit to relevant processing units.

Reference Books

- Srivastava RP & Kumar S. 2003. Fruit and Vegetable Preservation - Principles and Practices. International Book Distributors.
- Hardwick WA. 1995. Handbook of Brewing. Marcel Dekker.
- Hui YH. et al 2004. Handbook of Food and Beverage Fermentation Technology. Marcel Dekker.
- Priest FG & Stewart GG. 2006. Handbook of Brewing. 2nd Ed. CRC.
- Richard P Vine. 1981. Commercial Wine Making - Processing and Controls. AVI Publ.

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Discipline Specific Elective Course FFT 332: Food Biochemistry and Human Nutrition

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students about importance of human nutrition, basic concept of biochemistry and their integrated and role in health.

Course Content

UNIT I 9 lectures

Introduction to the Macro and Micronutrients. Digestion, absorption and Transport.

Calorific value of food, BMR & factors affecting it, Specific Dynamic Action (SDA) of food, calculation of energy requirement (REE), Energy Expenditure.

Recommended Dietary Allowances (RDA)- principles and factors.

Sensory Evaluation of foods – *Organoleptic Analysis, Methods and Tests of Sensory Evaluation, Organizing Sensory Evaluation Programmes, Computer-Aided Sensory Evaluations*

UNIT II 10 lectures

Carbohydrates: Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances

Resistant Starches and Dietary Fibre – *Definition, Sources and Functions*

Metabolic Pathways - *Glycolysis, Gluconeogenesis, Glycogenesis, Glycogenolysis, Citric Acid Cycle* Regulation of blood glucose level.

Diabetes mellitus – Types, etiology, diagnosis, prognosis, altered metabolism and pathophysiology. Hypoglycemia

UNIT III 9 lectures

Proteins & Amino Acids : Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances. Protein Energy Malnutrition

Metabolic Pathways - *Transamination, Deamination, Decarboxylation, Urea Cycle*.

Stress and Anti-freeze Proteins; Protein Isolates and Concentrates. Denaturation of Proteins . Evaluation of Protein Quality .Biochemical Markers- types, examples and diagnostic applications. Immunoglobulins.

UNIT IV 8 lectures

Lipids & Fats: Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances.

Metabolic Pathways - *Fatty Acid Oxidation, Biosynthesis of Fatty Acids* Synthesis and Functions of Cholesterol; Ketogenesis

Rancidity of Fats .Emulsions

UNIT V 9 lectures

Role of Water in Food and Human Health

Vitamins & Minerals: Classification, Functions, Dietary Sources, Deficiencies and Excess, Recommended Dietary Allowances

Anti-nutritional Factors in Foods.

Pigments, Phytonutrients, Antioxidants, Flavour Components – *Definition, Classification, and Functions* and its role in health, food and nutraceutical industry.

- Nelson, D. L. (2003). Lehninger Principles of Biochemistry. Macmilan Worth Publishers, India.
- Deb, A.C. (2004). Biochemistry. Book Agency (P) Ltd. Calcutta, India.
- Satyanarayana, U. (2009). Biochemistry. Books and Allied (P) Ltd. Calcutta, India
- Nutrition Science by B. Srilakshmi
- Fundamentals of Foods & Nutrition by Sumati R. Mudambi

SEM IV

Core Course: FFT 235: Meat, Fish and Poultry

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on Food Science

Objective

To provide an understanding of the technology for handling, processing, preservation and bi-product utilization of meat, poultry and fish products processing.

Course Content

UNIT I 8 lectures

Development of meat and poultry industries in India. Ante-mortem examination of animals and poultry birds. Slaughter and dressing, post-mortem examination. Post-mortem changes in meat and factors affecting them.

UNIT II 5 lectures

Nutritive value of meat. Whole sale and retail cuts. Meat tenderization methods.

UNIT III 10 lectures

Canning of meat and meat products, Restructured meat products, sausages, curing and smoking of meat. Disposal and utilization of meat industry by- products

Chilling and freezing of carcass and meat; canning, cooking, drying, pickling, curing and smoking; prepared meat products like salami, kebabs, sausages, sliced, minced, corned; intermediate moisture and dried meat products; Packaging of meat products.

UNIT IV 10 lectures

Structure, composition and nutritive value of poultry eggs. Poultry dressing, Functional properties of eggs, internal quality of eggs and its preservation.

UNIT V 12 lectures

Fish structure and composition. Cold storage, freezing preservation and canning of fish. Picking of fish, fish protein concentrates, fish meal and by products of fish processing industry

Practical:

- Slaughtering and dressing of meat animals
- Study of post-mortem changes; meat cutting and handling
- Evaluation of meat quality
- Evaluation of quality of eggs
- Preparation of meat products
- Visit to meat processing plants.

Reference Books

- Forrest JC. 1975. Principles of Meat Science. Freeman.
- Govindan TK. 1985. Fish Processing Technology. Oxford & IBH.
- Hui YH. 2001. Meat Science and Applications. Marcel Dekker. 32
- Kerry J. et al. 2002. Meat Processing. Woodhead Publ. CRC Press.
- Pearson AM & Gillett TA. 1996. Processed Meat. 3rd Ed. Chapman & Hall.

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Core Course FFT 236: Dairy Science

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course in food science

Objective

To acquaint with techniques and technologies of testing and processing of milk into various products and by products.

Course Content

UNIT I 9 lectures

Physical properties of milk: Color, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing, boiling point, specific heat, OR, electrical conductivity.

UNIT II 10 lectures

Lactose: Lactose (alpha and beta forms). Significances of lactose in dairy industry.

Milk fat: Composition and structure, and physical properties, crystallization, structure of fat granules, lipolysis, autoxidation, fat constants (saponification value, iodine value, RM value, Polenske value, peroxide value).

Protein and Enzymes: General structure, amphoteric nature, difference between casein and serum protein, different types of casein (acid and rennet), uses of casein, fractionation of protein. Enzymes- catalase, alkaline phosphatase, lipases and proteases.

UNIT III 10 lectures

Market milk industry and milk products: Systems of collection of milk, Reception, Platform testing, Various stages of processing: Filtration, Clarification, Standardization,Homogenization, Pasteurization, Sterilization, Packaging and Storage, Cleaning and Sanitation

UNIT IV 8 lectures

Description and working of clarifier, cream separator, homogenizer and plate heat exchanger.

UNIT V 8 lectures

Flow diagram for manufacture of following milk products: Flavoured milk, Butter, ice-cream, milk powder.

Practical

- To perform platform tests in milk. (Acidity and COB).
- To estimate moisture content in milk.
- To estimate skim milk protein by titration method.
- To estimate milk fat by Gerber method, SNF and specific gravity of milk.
- To check the efficiency of sterilization of milk by Turbidity test.
- To prepare casein and calculate its yield.
- Preparation of flavoured milk
- Preparation of butter
- Visit to a milk industry

Reference Books

- Aneja RP, Mathur BN, Chandhan RC & Banerjee AK. 2002. *Technology of Indian Milk Products*. Dairy India Publ., Delhi.
- De S. 1980. *Outlines of Dairy Technology*. Oxford Univ. Press Publ., New Delhi.
- Smit G. 2003. *Dairy Processing – Improving Quality*. CRC-Woodhead Publ.
- Walstra P, Geurts TJ, Noomen A, Jellema A & Van Boekel MAJS. 1999. *Dairy Technology – Principles of Milk Properties and Processes*. Marcel Dekker.

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Skill Enhancement Course: FFT 237:Food Quality Management and Quality Assurance

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: Course in Food hygiene and Food plant sanitation

Objective

To acquaint the students about quality management in food production chain and the certifications involved in raw material food and industries and different organizational system such as HACCP, GMP/GHP and auditing and surveillance.

Course Content

UNIT I 5 lectures

Quality inspection, quality control, Quality Assurance.

Quality Management System- ISO 9000

UNIT II 10 lectures

Management Principles, Process Model, principles and requirements of ISO 9001

Total quality management; Good Manufacturing Practices, Good Agricultural Practices, Good Laboratory Practices, Quality Management systems QSS. Quality Circles, SQC.

UNIT III 10 lectures

Food Safety Management System- Key role, Principles of FSMS, ISO-22000.

UNIT IV 10 lectures

HACCP- Prerequisites; Principles and steps of HACCP Plan, Hazard Identification, Risk assessment Risk communication with communication agencies and Hazard analysis, CCP Decision Tree, HACCP Plan.

Cleaning and Sanitation, Pest Control, Recall Procedures.

UNIT V 10 lectures

Auditing, Surveillance; Audit, Mock audit, third party quality certifying audit, Auditors and Lead auditors.

Certification, Certification procedures, Certifying bodies, Accrediting bodies, International bodies.

Practical:

- To conduct Hazard Analysis & Risk Assessment of identified hazards
- Determination of CCP through CCP Decision Tree
- Formation of CCP Monitoring Checklist
- Identification of PRP's (GHP & GMP) of food plant
- Preparation of detail flow diagram of manufacturing process & identification of potential hazards of food at each step/process
- Preparation of sample pages of Quality Manual
- Preparation of sample pages of Management System Procedure (MSP)
- Preparation of sample pages of Standard Operating Procedure (SOP)
- Preparation of sample pages of Formats for Quality Management System
- Preparation of on-site audit plan
- Preparation of an Audit CheckList /Observation Sheet
- To conduct Document Review (Adequacy Audit) before Audit
- To conduct opening meeting of audit
- To conduct Closing Meeting
- Preparation of Audit Plan Schedule before an Internal Audit
- To conduct an Audit Meeting before conducting Internal/External Audit
- Preparation of Corrective /Preventive Action Recommendation for the organization after Audit (Report Writing)
- Preparation of report by auditee after correction of non-conformities
- To conduct audit Follow-up

Reference Books

- Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Krammer A &Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ.

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General Education Course FFT 209: Data Analysis

Credits: (1-1-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

The students will be exposed to various research methods and statistical tools required to analyze the experimental data in food research and industry. The focus will be on providing knowledge related to research process, data collection and data analysis etc.

Course Content

UNIT I 6 lectures

Scientific Approach to Research: Meaning, significance, variables

Research Process: Formulating the problem, objectives, hypothesis, Experimental design, sample design, collecting data, analysis of data, interpretation, preparation of report.

UNIT II 6 lectures

Sampling Techniques: Probability and non probability sampling.

Experimental designs: Randomized Block design

UNIT III 6 lectures

Measurements: measurement scale, Frequency distribution, graphical presentation of data.

Measures of Central Tendency: Mean, median and mode, their uses.

UNIT IV 7 lectures

Measures of variability: Mean deviations, Quartile deviation, standard deviation, their uses.

Correlation: Spearman and Pearson's techniques of correlation, Linear regression

UNIT V 5 lectures

Tests of significance of difference between means: t-test, F-test, One way ANOVA.

Applications to food quality assessments

Reference Books

- Aggarwal BL. 2003. Basic Statistics. New Age.
- Kothari CR. 1989. *Research Methodology*. Wiley Eastern.
- Gupta SP. 2004. *Statistical Methods*. S. Chand & Sons

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Ability Enhancement Course FFT 210:Technical Writing

Credits: (1-0-0-1)

Level: Undergraduate

Semester: Spring

Pre-requisite: A basic course on Communication and Documentation skills

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. and equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Course Content

UNIT I 5 lectures

Grammar: Expressions, Modals & Moods, Word Stress, Fluency, Voice, Enhancing Vocabulary Punctuations

UNIT II 5 lectures

Technical Writing: Introduction to Technical writing – Definition, types, characteristics, Report Writing, CV & Resume making, Research paper

UNIT III 5 lectures

Effective Communication Skills: Power Point Presentations (Subject-Oriented), Soft Skills - Proper Body Postures, Right/Positive Body Language, Eye Contact, Public speaking, Interactive Communication Skills -Group Discussions, Debates, Conversations, Telephonic Etiquettes, Facing an interview

UNIT IV Tutorial 5 lectures

Communication Skills: How to make Delivery of Content Effective, Proper Articulation, Modulation, Voice Throw, Proper Stress on Words, Presenting PPT's, Confidence Building, Motivation, Writing Covering Letters , Filling Application Forms

UNIT V Tutorial 10 lectures

Technical Writing : Documentation of Academic credentials, Writing of Introduction, Acknowledgement, Abstract & Conclusion, Commonly used Abbreviations in the Thesis & Research Communication, Structuring the Presentation, Learning how to make PPT's, number of Slides, font, font size, Table Insertions, Picture, Clip Art, Chart, Grammatical Accuracy

Reference Books

- Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek, Chandigarh.
- Shelton James H. 1994. Handbook for Technical Writing. NTC Business Books, Chicago.
- Wren PC & Martin H.2006. High School English Grammar and Composition. S. Chand, New Delhi.

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Skill Enhancement Course FFT 280: Industrial Training-II for 15 days

Credits: (0-0-2-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: Any course in Food Processing

Generic Course FFT 258: Crop Production

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the basics of agriculture and crop farming so as to learn the related field of food processing such as farm machinery, land & water resources, and horticulture.

Course Content

UNIT I 5 lectures

Agriculture and its role in national development, food security; General features of climate - India; Crop environment, weather and significance of various weather elements;

Crop production - definition and scope, crop classification based on season, life cycle, taxonomy and economic use; Growth and yield of crops, growth parameters, yield attributes and factors affecting them

UNIT II 5 lectures

Quality of good seed, ideal condition for germination, seed treatment, hybrid and composite seeds, categories of seeds (certified, foundation and breeder seed); Importance of sowing time, seed rate, sowing methods, plant population; Tillage and Inter-culture operations.

UNIT III 5 lectures

Irrigation - scheduling, methods and water use efficiency; Harvesting, threshing, winnowing, storage and processing.

UNIT IV 10 lectures

Crop rotations, mixed cropping, inter cropping, its objectives and importance; Definitions of mono-cropping, double cropping, multiple/intensive cropping, relay cropping.

Soil as a three phase disperse system, its physical chemical and biological properties; Soil fertility and soil productivity, manures and fertilizers,

UNIT V 5 lectures

Classification of vegetable crops; Types of vegetable farming; Principles of vegetable production; Raising of vegetable seedlings under different environmental conditions

Concepts in Horticulture - methods of propagation, systems of planting and layout, fruit growth and development, fruit maturity and ripening, Post harvest management of fruits.

Reference Books

- Batnakar S &Schware R. 2000. Information and Communication Technology in Development- Cases from India. Sage Publ.
- Meera SN. 2008. ICTs in Agricultural Extension: Tactical to Practical. Ganga- Kaveri Publ. House. JangamWadiMath, Varanasi.
- Willem Zip. 1994. Improving the Transfer and Use of Agricultural Information – A Guide to Information Technology. The World Bank, Washington.

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SEMESTER V

Core Course FFT 331: Fundamentals of Food Engineering

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on unit operations in food processing

Objective

To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I 10 lectures

Process time calculations; Sterilizers and accessories used in canning industries; Engineering aspects of pasteurizer; homogenizer, evaporators (basic principle and single-effect evaporator) and concentrators used in food industries; Seaming machine.

UNIT II 8 lectures

Construction of cold storage; Different types of freezers including plate contact freezer, air blast freezer, cryogenic freezing and refrigerated vans.

UNIT III 9 lectures

Various types of driers (basic principle and drying time) – Tray drier, roller drier, spray drier, fluidized bed drier, freeze drier and solar drier.

UNIT IV 9 lectures

Heat exchangers (including paraflow HEs); Extruders – Basic principles and types, Difference between single- and twin-screw extruders; Kneader; Oil expeller

UNIT V 9 lectures

Advanced separation processes: Dialysis, ultrafiltration, reverse osmosis, electro dialysis and membrane separation.

Practical:

- Determination of viscosity of Newtonian fluid, Non Newtonian fluids;
- Determination of conductivity, calorific value and filtration properties of food& water.
- Calculation of freezing time for some typical foods
- Determination of Textural characteristics TPA of food product
- Evaluation of Bulk density and basics of true and bulk density

Reference books

- Fundamentals of Food Engineering by Stanley Charm.
- Introduction to Food Engineering - R.Paul Singh, Dennis R.
- Fundamentals of Food Process Engineering; Toledo RT; 2nd ed, 2000, CBS Publishers.
- Food process engineering, D.R.Heldman and R.P.Singh

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Core Course FFT 332: Biochemistry and Human Nutrition

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students about importance of nutrition, balanced diets, therapeutic diets for health and role of food and nutraceuticals in health.

Course Content

UNIT I 8 lectures

Introduction to human nutrition.

Macronutrients and micronutrients- Classification and functions.

Digestion, absorption and assimilation of nutrients.

UNIT II 10 lectures

Energy metabolism- Components of energy expenditure, Basal Metabolic Requirements and Activity,
Recommended Dietary Allowances, Food Groups, Concept of a balanced diet, Methods of evaluation of nutritive value of foods.
Nutritional assessment and nutritional policies- Salient features, concept of community nutrition

UNIT III 10 lectures

Carbohydrates- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Proteins- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT IV 7 lectures

Fat- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT V 10 lectures

Vitamin- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Minerals- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Water and electrolytes- Concept and importance

Reference books

- Nutrition Science by B. Srilakshmi
- Fundamentals of Foods & Nutrition by Sumati R. Mudambi
- Textbook of Nutrition : A Life cycle approach by Ravinder Chadha

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General Elective Course FFT 333:Concepts of Biotechnology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on basic microbiology

Objective

To acquaint the students with the fundamental of bio-technology, industrial microbiology and fermentation processes.

Course Content

UNIT I 6 lectures

Prospectus of biotechnology- definition, scope and importance, DNA structure, function and metabolism.

UNIT II 6 lectures

GMO, genetic recombination mechanisms and technique used for improvement in microbial strains; Methods of recombinant DNA technology; Nucleic acid hybridization; Plant and animal cell and tissue culture techniques and their applications.

UNIT III 6 lectures

Molecular markers and their applications; DNA sequencing; Genetic engineering and transgenics; Genomics, transcriptomics and proteomics.

UNIT IV 6 lectures

General application of biotechnology in food industry, pharmaceuticals and agriculture Public perception of biotechnology; Bio-safety and bioethics issues.

UNIT V 6 lectures

Introduction to nanotechnology, history and recent developments, sources of nanoparticles, microbial production of nanoparticles, advantages of microbial nanoparticles and their applications.

FFT 303 Introductory Biotechnology Practical

- Isolation of genomic DNA from different sources
- Gel electrophoresis techniques
- Restriction enzyme digestion, ligation, transformation and screening of transformants
- Demonstration of PCR

Reference Books

- Becker JM, Coldwell GA &Zachgo EA. 2007. Biotechnology – a Laboratory Course. Academic Press.
- Brown CM, Campbell I & Priest FG. 2005. Introduction to Biotechnology. Panima Pub.
- Gupta PK. 2004. Biotechnology and Genomics. Rastogi Publications.
- Sambrook J, Fritsch T &Maniatis T. 2001. Molecular Cloning – a Laboratory Manual. 2nd Ed. Cold Spring Harbour Laboratory Press.

- Singh BD. 2007. Biotechnology Expanding Horiozon. Kalyani Publishers
- Fundamentals of Biotechnology, Prave. P. Faust, V. Sitih. W., Sukatsh, DA, 1987. ASM press.

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Generic Elective Course FFT 334:Waste Management Practices

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on hygiene and plant sanitation

Objective

To acquaint the students with the major source of living ie water, its treatment, analysis and how to make it potable.

Course Content

UNIT I 6 lectures

Selection of sanitizing agents for cleaning, packaging sanitation, food storage sanitation, transport sanitation and water sanitation.

UNIT II 6 lectures

By-products obtained from cereals, pulses, legumes, oil seeds, fruit and vegetables, dairy plant, sugar and bakery, plantation crops and spices egg and poultry processing industry and meat, Fermentation industry.

UNIT III 6 lectures

Characterization of food industry wastes e.g., BOD, COD and total organic content, floatable and suspended solids in water.

UNIT IV 6 lectures

Pretreatment, secondary treatments of solid waste, sludge volume index, advanced techniques activated bio-filtration, biological fluidized bed reactor, dried bacteria culture process

UNIT V 6 lectures

tertiary treatments or advanced waste water treatment system (AWT); polishing ponds, DAF Techniques, micro trainers treatment and disposal of sludge, sand filters, removal of nitrogen, phosphorus, sulphur, physical chemical treatment process.

Reference Books

- Energy Conservation through Waste Utilization, American Society of Mechanical Engineers, New York.
- Kreit F & Goswami DY. 2008. Energy Management and Conservation Handbook. CRC Press.
- Murphy WR &Mckay G. 1982. Energy Management. BS Publ. Patrick DR. 1982.. Energy Management and Conservation. Elsevier Publ.
- Patrick DR., Fardo SW, Richardson RE & Steven 2006. Energy Conservation Guidebook. The Fairmont Press.
- Wulfinghoff DR. Energy Efficiency Manual. Energy Institute Press

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Skill Enhancement Course FFT 380: Seminar

Credits :(0-0-1-1)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on Food Processing/Food Science

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Discipline Specific Elective Course: FFT 353:Technology of Indigenous Milk Products

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on Dairy Technology

Objective

To acquaint the students with the milk and milk based product preparations and the nutritional composition and health effect (good/bad).

Course Content

UNIT I 2 lectures

Status and significance of traditional milk products in India.

UNIT II 7 lectures

Khoa: Classification of types, standards methods of manufacture and preservation factors affecting yield of khoa. Physico-chemical changes during manufacture and storage of khoa. Confectioneries made from Khoa-Burfi, peda, Milkcake, Kalakhand, Gulabjaman and their compositional profile and manufacture practices.

Rabri and Basundhi: Product identification, process description, factors affecting yield physico-chemical changes during manufacture.

UNIT III 7 lectures

Channa: Product description, Standards method of manufacture, packaging and preservation.

Chhana-based sweets, Mechanization of manufacturing process.

Paneer: Product description standards method of manufacture packaging and preservation. Physico-chemical changes during manufacture and storage.

UNIT IV 7 lectures

Srikhand: Chakka product description, standards method of manufacture, small scale and industrial, packaging and preservation aspects. Physico-chemical changes and quality assurance during manufacture and storage.

Sandesh, Mistidahi: Product description method of manufacture and packaging process.

Kheer and Payasam: Product description methods of manufacture, innovations in manufacturing and packaging processes.

UNIT V 7 lectures

Microbiology of indigenous milk products: predominance of spoilage & pathogenic organisms in Curd, Khoa, Channa, Paneer, Shrikhand, control measures & legal specifications.

Biopreservative principles in enhancing the shelf-life of indigenous milk products including active packaging.

Practical:

- Preparation of khoa from cow and buffalo milk.
- Preparation of chhana from buffalo milk.
- Preparation of paneer from buffalo milk.
- Analysis of khoa, chhanna and paneer for total solids, moisture, fat and acidity.
- Preparation of mistidahi, chhaka and srikhand.
- Microbiological examinations of traditional dairy products: Khoa, paneer, coliform counts, yeast and molds counts etc.

Reference Books

- Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. *Technology of Indian Milk Products*. Dairy India Publ.
- De S.1980. *Outlines of Dairy Technology*. Oxford Univ. Press.
- Rathore NS *et al.* 2008. *Fundamentals of Dairy Technology - Theory & Practices*. Himanshu Publ.

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Discipline Specific Elective Course: FFT 356:Food Fermentation Technology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on basic Food Microbiology

Objective:

To understand the principles of food fermentation technology and study the types of starters used in Food Industry

Course Content

UNIT I (5 Lectures)

Importance in food (bacteria, fungi and viruses) Significance of spores.

Types of Microorganisms in Food, Classification and Nomenclature, Morphology and Structure

UNIT II (6 Lectures)

Microbial Growth in Food: Bacterial growth curve, Factors affecting the growth of micro organisms in food.

UNIT III (6 Lectures)

Cultivation of Micro-organisms: Pure culture technique, Methods of isolation and cultivation, Enumeration of Microorganisms- qualitative and quantitative, Rapid Methods of Detection

UNIT IV (6 Lectures)

Fermentation –definition and types, Microorganisms used in food fermentations
Study of a Bio fermentor – its design and operation, Down Stream Processing and Product recovery.

UNIT V (7 Lectures)

Fermented Foods-types, starter cultures and their types, methods of manufacture for vinegar, sauerkraut, yoghurt, soya sauce, tempeh, miso, beer wine and traditional Indian foods, Dairy Fermentations, concept of probiotics.

Practical:

1. Preparation and sterilization of nutrient broth and media
2. Morphological study of bacteria and fungi using permanent slides
3. Simple staining and Gram's staining
4. Standard Plate Count Method
5. Bacteriological Analysis of Water
6. Maintenance of starter cultures, biochemical confirmation tests
7. Development of fermented foods.

Reference books:

1) Frazier William C and Westhoff, Dennis C. Food Microbiology, TMH, New Delhi,2004
2) Jay, James M. Modern Food Microbiology, CBS Publication, New Delhi, 2000
4) Pelczar MJ, Chan E.C.S and Krieg, Noel R. Microbiology, 5th Ed., TMH, New Delhi, 1993.
5) Microbiology of Fermented Foods. Volume II and I. By Brian J. Wood.ElsieverAppliedScience Publication.1997
6) Principles of Fermentation Technology by Stanbury, P.F., Whitekar A. and Hall. 1995.,Pergaman. McNeul and Harvey.

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Discipline Specific Elective Course FFT 357: Nutraceuticals and Functional Foods

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective:

To understand the interrelationship between nutraceuticals and health maintenance and to explain the nutraceutical benefits obtained from different types of foods.

Course Content

Unit 1 (5 lectures)

Functional Food and Nutraceuticals- Definition, history, types and classification.
Perceived effect of diet on disease prevention
Understanding benefits of functional foods and nutraceuticals

Unit 2 (8 lectures)

Microbial and algal nutraceuticals : Probiotics- Important features of probiotic micro- organisms; Health effects of probiotics including mechanism of action; Probiotics in various foods: fermented milk products, non-milk products etc; Quality Assurance of probiotics and safety. Synbiotics for maintaining good health
Algae as source of omega - 3 fatty acids, antioxidants and minerals - extraction and enrichment.

Unit 3 (8 lectures)

Prebiotics- Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases. Perspective for food applications for the – Non-digestible carbohydrates/oligosaccharides, Dietary fibre, Resistant starch, Gums.

Unit 4 (12 lectures)

Nutraceuticals of plant and animal origin: Plant secondary metabolites, classification and sub-classification - Alkaloids, phenols, Terpenoids, Polyphenols: Flavonoids, catechins, isoflavones, tannins, Phytoesterogens, Phytosterols, Glucosinolates, Organo sulphur compounds, Other components – Phytates, Protease. Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases.

Animal metabolites: Sources and extraction of nutraceuticals of animal origin. Examples: chitin, chitosan, glucosamine, chondroitin sulphate and other polysaccharides of animal origin, uses and applications in preventive medicine and treatment. Concept of cosmoceuticals and aquaceuticals.

Unit 5 (12 lectures)

Malnutrition and factors responsible for nutritional disorders and anti-nutritional factors (cyanogens, lectins, enzyme inhibitors, phytoallexins and phytates). Concept of antioxidants - use of antioxidants as dietary supplements in prevention and treatment of cancer, obesity and stress. Role of nutraceuticals and functional foods in pediatrics, geriatrics, sports, pregnancy and lactation. Proteins, Peptides and nucleotides, Conjugated linoleic acid and n-3 fatty acids, Vitamins and Minerals.

Regulations ofNutraceuticals and Functional Foods in India and rest of the world.

Reference Books:

Aluko, Rotimi,Functional Foods and Nutraceuticals,Springer-Verlag New York Inc.,2012.

Satinder Kaur Brar, Surinder Kaur and Gurpreet Singh Dhillon,Nutraceuticals Functional Foods,2014.

Robert E.C. Wildman, Robert,Wildman, Taylor C,Handbook of Nutraceuticals and Functional Foods, Third Edition,Wallace,2002.

Handbook of nutraceuticals Vol I by YahwantVishnupant Pathak, CRC press.2009

Handbook of nutraceuticals Vol II by YahwantVishnupant Pathak, CRC press,2011

SEMESTER-VI

Skill Enhancement Course FFT 335: Food and AgriBusiness Management

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To give basic fundamentals to students for managing the food processing operations starting for raw material procurement to the end consumer and familiarizing them with international trade.

Course Content

UNIT I 3 lectures

Business Management: introduction, theories and functions, food industry management, marketing management and human resource development, personal management. Sectors in food industry and scale of operations in India.

UNIT II 5 lectures

Human Resource Management: Study the basics about HR and related policies and capacity mapping approaches for better management.

UNIT III 7 lectures

Consumer behavior towards food consumption, Consumer Surveys by various Institutes and Agencies, various journals on consumer behavior and market research, internet based data search.

UNIT IV 8 lectures

International trade: basics, classical theory, theory of absolute advantage, theory of comparative modern theory, free trade- protection, methods of protection, quotas, bounties, exchange control, devaluation, commercial treaties, terms of trade, balance of payments, Exim policy, foreign exchange, mechanics of foreign exchange, GATT, WTO, role of WTO. International trade in agriculture. World trade agreements related with food business, export trends and prospects of food products in India.

UNIT V 7 lectures

World consumption of Food: patterns and types of food consumption across the globe. Ethnic food habits of different regions. Govt. Institutions related to international ad trade; APEDA, Tea board, spice board, wine board, MoFPI etc. management of export import organization, registration, documentation, export import logistics, case studies. Export and import policies relevant to horticultural sector.

Reference Books

- Chhabra TN &Suria RK. 2001. Management Process and Perspectives. Kitab Mahal.
- Jhingan ML. 2005. International Economics. 5th Ed. Virnda Publ.
- Kotler P. 2000. Marketing Management. Prentice Hall.
- Reddy SS, Ram PR, Sastry TVN &Bhavani ID. 2004. Agricultural Economics. Oxford & IBH.

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Skill Enhancement Course FFT 336:Plant Design and Layout

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course of unit operations in food processing

Objective

To acquaint the students with the plant layout operation which is required by all industries to check their comparative factors as equipment position raw material handling and end product delivery

Course Content

UNIT I 5 lectures

Introduction : Plant design concepts - situations giving rise to plant design problems - differences in design of food processing and non-food processing plants

UNIT II 8 lectures

General design considerations, Food Processing Unit Operations, Prevention of Contamination, Sanitation, Deterioration, Seasonal Production, Flow Chart for Plant Design, Identification Stage, Looking for a need, Finding a product, Preliminary Screening of ideas, Comparative rating of product ideas: Present Market, Market Growth potential, Costs, Risks,

UNIT III 6 lectures

Plant location: Introduction, Location Decision Process, Factors involved in the plant location decision, Subjective, Qualitative and Semi-Quantitative Techniques

UNIT IV 4 lectures

Food Plant Utilities: Process Water, Steam, Electricity, Plant Effluents.

UNIT V 7 lectures

Plant layout : Importance, Flow Patterns, Basic Types of plant layouts, Product or line layout, Process or functional layout, Cellular or group layout, and Fixed position layout, Plant Layout factors, Layout design Procedure., Maintenance of Food Plant Building

Reference Books

- Peters, M.s and Timmerhaus, K.D, Plant Designs and Economics for Chemical Engineers, 4th Edition McGraw Hill,1991
- Biegler L., grossmann I.E. and Westeberg A.W., Systematic Methods of Chemical Engineering and Process Designs, prentice Hall ,1997.
- Z. B. Maroulis and G. D. Saravacos, Food Process Design, Marcel Dekker 2003.

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Generic Course FFT 358: Medicinal Plants

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with Medicinal plant diversity & local healthcare

Course Content:

UNIT I 5 lectures

MAPs: definition, history, importance and future prospects. Medicinal Plants – past and present status in world and India. MAPs as industrial crops - constraints and remedial measures. Medicinal plant diversity & local healthcare.

UNIT II 5 lectures

Promotion of medicinal plant sector at national level: National Medicinal Plant Board and State Medicinal Plant Boards - objectives and functions. Demand and supply of medicinal plants. Herbal industries.

UNIT III 6 lectures

Important medicinal plants of India with their systematics, geographical distribution and uses. Acorus calamus, Adhatodavasica, Abrus precatorius Aloe vera, Phyllanthus amarus, Stevia rebaudiana, Belladona and Cinchona.

UNIT IV 5 lectures

Medicinal use of aromatic plants of India with their systematics, geographical distribution and uses. Introduction and historical background of aromatic plants.

UNIT V 9 lectures

Major, minor and less known aromatic plants of India. Uses of important aromatic plants – citronella, davana, damask rose, geranium, khus grass, large cardamom, lavender, lemon grass, mentha, holy basil, patchouli, rosemary Palmarosa, vetiver, artemisia, eucalyptus, thyme, marjoram and oreganum. Aromatic spices - clove, cinnamon, nutmeg, ajwain, dill, celery, tamarind, garcinia, curryleaf and saffron.

Reference Books:

- Medicinal Plants of Uttarakhand by C.P. Kala (2010). Syllabus - M. Sc. Medicinal and Aromatic Plants 2
- Indian Medicinal Plants by P.C. Trivedi (2009).
- Medicinal Plants of Indian Himalaya by S.S. Samant and U. Dhar.
- Hand Book of Aromatic Plants by S.K. Bhattacharjee (2004).
- Handbook of MAPs by S.K. Bhattacharjee (2009).

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Core Course FFT 385 :Industrial Project

Credits (0-0-10-10)

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SEMESTER-VII

General Elective Course FFT 504 : Research Methodology and Statistics

Credits: (3-1-0-4)

Level: Post Graduate

Semester: Spring

Pre-requisite: Basic knowledge of mathematics

Objective:

The students will be exposed to various statistical tools required to analyze the experimental data in nutrition and community research

Course Content

UNIT I (10 lectures)

Scientific Approach to Research: Meaning, significance, types of research studies.

Research Process: Formulating the problem, objectives, hypothesis, Experimental design, sample design, collecting data, analysis of data, interpretation, preparation of report.

UNIT II (15 lectures)

Sampling design: Census vs. sample survey. Steps, types.

Scaling techniques: Continuum, Reliability, Validity, Scale construction techniques.

Experimental designs: Randomized Block design

Processing of data: Development of code book.

UNIT III (15 lectures)

Measurements: Nature of measurements, types of measurement scale, Frequency distribution, graphical presentation of data.

Measures of Central Tendency: Computation of mean, median and mode, their uses.

Measures of variability: Computation of mean deviations, Quartile deviation and standard deviation, their uses.

UNIT IV (10 lectures)

Correlation: Regression, Meaning, Spearman and Pearson's techniques of correlation, Linear regression. Chi Square:

UNIT V (10 lectures)

Tests of significance of difference between means: t-test. Analysis of Variance (ANOVA): One way and two ways. Applications to food quality assessments

Reference Books

- Aggarwal BL. 2003. Basic Statistics. New Age.
- Kothari CR. 1989. Research Methodology. Wiley Eastern.
- Gupta SP. 2004. Statistical Methods. S. Chand & Sons.

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Discipline Specific Elective Course FFT 555: Food Additives
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite:A course of unit operations in food processing

Objective: To understand the principles of chemical preservation of foods and to understand the role of different food additives in the processing of different foods and their specific functions in improving the shelf life, quality, texture and other physical and sensory characteristics of foods.

Course Content:

UNIT I

Definition, role of food additives, classification of food additives based on their role, Risks and benefits of food additives. Safety in the use of food additives in foods; regulations and monitoring.

Preservatives – definition; natural preservatives; chemical preservatives; Permitted preservatives in foods, Antioxidants; natural and chemical antioxidants; mechanism of antioxidant function; primary and secondary antioxidants.

Unit II

Permitted Natural and synthetic colors; inorganic pigments; application of colors in food industry; Flavoring agents – concept of flavors in foods; natural flavors; nature identical flavors; artificial flavoring substances.

Unit III

Emulsifiers, Stabilizers and Thickeners: role of emulsifiers, different classes of emulsifiers and their chemical structure, their HLB values and role in emulsion stabilization; role of different stabilizers and other substances in emulsion stability; permitted emulsifiers and stabilizers and food applications. Thickeners – definition, chemical structure, role in food processing and product end characteristics, list of permitted thickeners and food applications.

Unit IV

Natural and chemical sweeteners; nutritive and non-nutritive sweeteners; chemical structure & sweetness; saccharine, acesulfame K, aspartame, sucrolose, Food acids – their function and application in foods; permitted food acids; nutritive additives; enrichment of foods.

Unit V

Other Food Additives and Food Ingredients: Anticaking agents, Antifoaming, Glazing agents, Bulking agents, Humectants, Firming agents, Softening agents, Crystal modifiers, Flour improvers, Flour treatment agents, Dough conditioners, and Enzymes – definition, role and mode of action, permitted list of agents and food application. Proteins, starches and lipids as functional ingredient and their applications in foods.

Reference Books:

- Mahindru, S.N. “Food Additives: Characteristics, Detection and Estimation”. Tata McGraw-Hill, 2000.
- Brennen, Alfred Larry. “Food Additives”. 2nd Edition, CRC Press,
  Clydesdale, Fergus M. “Food Additives- Toxicology Regulation and Properties”. CRC Press, Emerton, Victoria, “Food Colours”. Blackwell Publishing, 2008.
- Wilson, Rachel. “Sweeteners” Blackwell Publising, 2007.
  Hutchings, John B. “Food Color and Appearance”. Aspen Publication,1999.

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Discipline SpecificElective Course FFT 390 : Thesis
Credits: (0-0-10-10)

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SEMESTER-VIII

Discipline Specific Elective Course FFT 390 : Thesis
Credits: (0-0-20-20)

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SEMESTER-IX

Core Course: FFT 503 Instrumentation and Analytical Techniques
Credits: (3-0-1-4)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Graduation in any stream of science.

Objective: To develop an understanding and methodologies of instrumental techniques in food analysis used for objective methods of food quality parameters.

Course Content

UNIT I (6 lectures)

Preparation of chemical solutions: Concept of molar, molal, and normal solutions. pH and Buffers: Importance and measurement of pH.

UNIT II (11 lectures)

Chromatographic techniques: General principles. Partition and adsorption chromatography. Paper, thin layer, gas liquid, ion exchange and affinity chromatography. Gel filtration. Introduction to High Pressure Liquid Chromatography.

UNIT III (8 lectures)

Electrophoretic Techniques: General principles. Paper and gel electrophoresis. Polyacrylamide gel electrophoresis.

UNIT IV (11lectures)

Spectroscopy: Beers and Lambert's Law. Extinction coefficient. General principles of colorimeters and spectrophotometers, Atomic spectroscopy, Emmission spectroscopy, IR spectroscopy.

UNIT V (9 lectures)

Flourimetry: Spectroflourometers. Flame photometry and atomic absorption spectrophotometry.Use of radioisotopes. Microbiological assays. Microscopy

Practical

- Qualitative analysis of compounds by chromatography techniques: Thin layer Chromatography, Paper Chromatography: Descending, Ascending and Circular Paper chromatography.
- Qualitative analysis of compounds By using High Performance Liquid Chromatography.
- Column chromatography: Separation of beta carotene
- Use of electrophoresis in the determination of proteins.
- Determination of Rheological properties by using texture analyzer.
- Learning Outcome: Students will get acquainted with analytical methods used for quality control analysis of raw material and processed food commodities.

Reference Books

- Hand Book of Food Analysis by Nollet &Toldra, CRC publishing ltd.
- Hand Book of Analysis & Quality Control for Fruit & Vegetable Products by Rangana, Tata Mcgraw hill publishing.
- Introduction to the chemical analysis of foods by Nielson, CBS publishing.

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Skill Enhancement Course: FFT 556 Spices and Flavour Technology
Credits: (3-0-0-3)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Graduation in any stream of science.

Objective: To impart basic knowledge about the importance and production technology of spices and to know chemistry and physiology of taste, flavouring compounds in foods

Course Content

Unit I (7 lectures)

Spice processing Introduction, classification, composition and functions. Standards specification of spices and flavours, Spice processing, spice reconditioning, spice grinding, post- processing treatments.

Unit II (7 lectures)

Processing of Major Spices: Pepper, cardamom, ginger, onion, garlic, vanilla, cinnamon, chilli and turmeric – method of manufacture; chemistry of the volatiles; enzymatic synthesis of flavour identical.

Unit III (8 lectures)

Processing of Minor Spices, herbs and leafy vegetables: processing and utilization, All spice, Annie seed, sweet Basil, Caraway seed, Cassia, Cinnamon, Clove, Coriander, cumin, Dill seed Fern seed nutmeg mint marjoram, Rose merry, saffron, sage.

Unit IV (11 lectures)

Spice extractives, Value added spice products: Spice volatile oils, spice oleoresins, Use of spice extractives, replacement of spices with oils and oleoresins, alternative products, Ground spices, processed spices, organic spices, curry powders.Packaging of spices and spice products

Unit V (12 lectures)

Chemistry and physiology of taste, flavouring compounds in foods, Separation, purification and identification of natural flavouring materials& Synthetic flavouring agents and their stability: Processing quality control of Savory, Thyme, Ajowan, Curry leaves, Asafoctida, Tea, Coffee, Cocoa, Vanilla and annatto. Flavours of soft drinks, Baking and confectionery industry.

Learning Outcomes: The students are expected to have learnt importance and production technology of spices and flavours.

Reference Books:

- Spices – vol. II Parry J. W.
- Spice and condiments Pruthi J. S.
- Herbs and spices by Rosemery Hemphill
- The book of spices by Rosen garten, F. and Livington Jr.
- Spices and herbs for the Food Inudstryby Lewies, Y.S.
- Spices Vol. I and II by Tropical Agril. Series. Purseglove, J. W. Brown E. G.,
- Green C. L. And Robbins SRJ. Food Flavourings P. R. Ashust.
- Food Flavouringcomposition,manafacture and uses. by J. Merrory

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Core Course: FFT 509 Food Quality, Safety Standards and Certification
Credits: (3-0-0-3)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Completed basic course on Food Processing

Objective: To acquaint with food quality parameters and control systems, food standards, regulations, specifications.

Course contents:

UNIT I (5 lectures)

Quality Assurance: Introduction, Importance and Difference. Food Quality and Food Safety: Scope and difference.

UNIT II (12 lectures)

Raw materials & Finished product quality: Quality parameters and evaluation procedures: Appearance, color, texture, viscosity, consistency, flavor.

Sensory evaluation: Selection of panel of judges, sensory characteristics of foods, types of tests.

UNIT III (12 lectures)

Food standards and laws: International – Concept of Codex alimentarius, HACCP, GMP, GHP, USFDA, ISO 9000, ISO 22000, ISO 14000. National – Introduction of BIS/IS, Food Safety and standards – 2006, Food Safety and standard regulation 2010, FPO, MPO, MMPO, Agmark. Prevention of food adulteration Act: Food Adulteration: definition, common adulterants in different foods, contamination, methods of detection. Food additives and legislation; coloring matter, preservatives, poisonous metals, antioxidants and emulsifying and stabilizing agents, insecticides and pesticides. PFA specification for food products, Nutritional labeling

UNIT IV (6 lectures)

Quality Certification &Accrediation: Introduction and procedure.

UNIT V (10 lectures)

Water Quality: Water standards and Analysis physical, chemical and microbiological characteristics of water analysis. Waste treatment: Fundamentals of Physical, Biological & Chemical waste treatments

Learning Outcome: The students must have an understanding about food laws and standards, quality parameters and sensory evaluation of food.

Reference Books

Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.

Krammer A & Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ

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Discipline Specific Elective Course FFT 651 : Entrepreneurship in Food Processing
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Completed basic course on Food Processing.

Objective: To enable the student to plan and prepare a project report for food processing unit and to provide capability to execute and evaluate the same and to introduce students to the methodology of project formulations and the implementation procedures and strategic planning of new projects.

Course contents:

UNIT I (6 lectures)

Aggregate Planning-: General design considerations, Financial Analysis, plant location and plant layout, Flowcharts and their design, equipment selection

UNIT II (4 lectures)

Design of service facilities

UNIT III (4 lectures)

Human resource planning: Planning and design of marketing system, worker's safety and plant hygiene

UNIT IV (6 lectures)

Introduction to Marketing and economics: Demand, Supply, Sample survey techniques, marketing information, consumer trends, consumer behavior.

UNIT V (10 lectures)

Introduction to Operations Research: Definition, applications. Inventory control, Linear Programming. Queuing Theory, Transportation and Assignment. Forecasting

Learning Outcome: The students would have been acquainted with designing and planning of food plant layout and operations research.

Reference Books:

- Chandra P. 2005. Project Management. Tata McGraw Hill.
- Gopal Krishan P & Nagarajan K. 2005. Project Management. New Age.
- Hisrich RD & Peters MP. 2002. Entrepreneurship. Tata McGraw Hill.
- Kaplan JM. 2003. Patterns of Entrepreneurship. John Wiley & Sons.
- Nandan H. 2007. Fundamentals of Entrepreneurship Management. Prentice Hall.

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Discipline Specific Elective course: FFT 654 Food Product Development

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Basic knowledge of Food Science.

Objective:

To acquaint the students about the need, types, basic technique and details of food product development to plan nutritious products.

Course Content

UNIT I (6 lectures)

Concept of product development - product success and failure, factors for success, process of product development, managing for product's success. Innovation strategy - possibilities for innovation, building up strategy, product development programme.

UNIT II (5 lectures)

The product development process - product strategy, product design and process development, product commercialization, product launch and evaluation.

UNIT III (6 lectures)

The knowledge base for product development technology - knowledge and the food system, knowledge management, knowledge for conversion of product concept to new product, technological knowledge (product qualities, raw material properties, processing, packaging requirement, distribution and marketing.

UNIT IV (5 lectures)

Role of consumers in product development - consumer behaviour, food preferences, avoiding acceptance, integration of consumer needs in product development and sensory needs.

UNIT V (8 lectures)

Managing the product development process, - principles of product development management, people in product development management, designing the product development process, key decision points, establishing outcomes, budgets and constraints, managing and organizingproduct development process, innovative matrices, striving for continuous improvement, Improving success potential of new products, market exploration and acquisition, Legal aspects of new product launch.

Learning Outcome: The course must have acquainted the students with principles of food product design and development.

Reference Books:

- Clarke & Wright W. 1999. Managing New Product and Process Development. Free Press.
- Earle R, Earle R & Anderson A. 2001. Food Product Development. Woodhead Publ.
- Fuller 2004. New Food Product Development - from Concept to Market Place. CRC.

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Discipline Specific Elective Course (DSE): FFT 658 Food By-Product Management
Credit: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Basic knowledge of Food Science.

Objective:

To acquaint the students about the types food by-products and techniques for their treatment especially from an industrial perspective.

Course Content

UNIT I (6 lectures)

Food industry By-products and Waste:

Introduction, status in India, definition, origin and type of waste and by products, their identification, classification, composition and characterization, need for treatment and utilization, impact on environment, food waste as source of biogenic raw material and energetic utilization .

UNIT II (6 lectures)

Introduction to Food Waste Treatment: Basic unit operations, techniques & equipment for treatment, primary treatments like screening, sedimentation, skimming, floatation coagulation & flocculation, flow equalization, filtration, adsorption, chemical oxidation, membrane separation, ion exchange. Anaerobic & aerobic digestion of organic wastes, activated sludge process, biomass generation & its utilization.

UNIT III (6 lectures)

Food Wastes and By-products Related to Specific Processing Industries: Like fruit and vegetables (apple, orange, mango, potato etc.), dairy industry, oil and oil seeds industry, sugar industry, grains and milling industry, fermentation (alcohol and beer), livestock and poultry, fish, meat.

UNIT IV (6 lectures)

Applications of By-product utilizationinvolving (i) utilization of whey from dairy industry, (ii) Utilization of specific plant by-products for recovery of proteins, pectins, dietary fibres, antioxidants, colorants etc. (iii) Utilization of biomass for production of animal feed, compost and bio-gas.

UNIT V (6 lectures)

Introduction to Food Packaging Waste & Handling and treatment, Farm wastes. Incineration of solid food waste and its disposal. Future Trends: Introduction to legal and statutory requirements for food waste handling, treatment and disposal.

Reference Books:

- Waste Management for the Food Industries, by Ioannis S. Arvanitoyannis, First edition 2008, Elsevier Inc, USA.
- Food and Agricultural Wastewater Utilization and Treatment, Sean X. Liu, First edition 2007 Blackwell Publishing, Iowa 50014, USA.
- Managing Food Industry Waste, ROBERT R. ZALL, First edition, 2004, Blackwell Publishing Professional, Iowa, USA.

Discipline Specific Elective Course (DSE): FFT 653 Food Rheology

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: FFT 508

Objective: To explain the basics of food rheology and to familiarize the students with rheological instruments and their use in relation to food products.

UNIT I (6 lectures)

Food rheology and structure: stress and strain tensors, viscometric properties, shear stress-shear rate relationships, units in rheological measurements, types of fluid flow behaviour, apparent viscosity, intrinsic viscosity, stress-strain behaviour of solid foods, linear viscoelasticity, phase transitions in foods.

UNIT II (6 lectures)

Flow and functional models for rheological properties of fluid foods: Time independent flow behaviour, Apparent viscosity- shear rate relationships of shear- thinning foods, models for timedependent flow behaviour, role of solids fraction in rheology of dispersions, affect of temperature on viscosity, treatment of rheological data using models.

UNIT III (6 lectures)

Tube viscometry, Rotational viscometry: introduction

UNIT IV (6 lectures)

Viscoelasticity: introduction, transient tests for viscoelasticity, oscillatory testing. Rheology of food gum and starch dispersions: effect of heating, effect of sugar and protein, rheological behaviour of starch, rheology of starch- gum dispersions.

UNIT V (6 lectures)

Rheological behaviour of processed fluid, semisolid foods and food gels: rheological tests to evaluate properties of gel systems, gel point and sol-gel transition by rheological measurements. Application of rheology to fluid food handling and processing

Learning Outcome: It is expected that the students would have learnt concepts of rheology and structure of food systems.

Reference Books:

- Bourne MC. 2002. Food Texture and Viscosity: Concept and Measurement. Academic Press
- Deman JM. et al. 1976. Rheology and Texture in Food Quality. AVI Publ.
- Mohsanin NN.1989. Physical Properties of Plant and Animal Material. Vol. I, II. Gordon and Breach Science Publ.
- Steffe JF. 1992. Rheology and Texture in Food Quality. AVI Publ.

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Discipline Specific Elective Course (DSE): FFT 659 :Advanced Food Chemistry

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Basic knowledge of Food Science.

Objective: To go beyond basic chemistry and nutrition in to advances with the aim of developing healthy and nutritious foods for normal and special category of population groups.

Course Content:

Unit I (12 lectures)

Interactions among food components and their effect on sensory, nutritional and processing quality, Natural antioxidants, mechanisms of action and their evaluation techniques, Free radical chemistry, photosensitized oxidation, metal catalyzed reactions. Antioxidants: chemistry and mechanisms of action, techniques of evaluation of antioxidant activity, uses.

Unit II (11 lectures)

Water relationships in foods: water activity and its relevance to deteriorative processes in foods (chemical, enzymic, physical and microbial changes). Glass transitions and molecular mobility in foods, their relevance to quality and stability of food products.

Unit III (12 lectures)

Fragrance and flavouring compounds: essential oils, terpenoids-oleoresins-biochemical pathways for the production of volatile compounds in specific plant species; Biological Interactions among food components and flavours, Interactions

among food flavours and packaging materials, Interactions among food additives and their significance in food processing.

Unit IV (10 lectures)

Food Carbohydrates: structural, analytical, physicochemical, nutritional and functional aspects of small mol. wt. carbohydrates and polysaccharides of plant and microbial origin.

Chemistry of alkaloids, flavonoids and other phenolics.

Learning Outcome: It is expected that the students would have learnt concepts of interactions within Food constituents.

Reference Books:

- Aurand LW, Woods A & Wells MR. 1987. Food Composition and Analysis. AVI Publ.
- Baynes JW, Monnier VM, Ames JM & Suzanne R. 2005. The Maillard Reaction: Chemistry at the
- Interface of Nutrition, Aging, and Disease Thorpe. Annals of the New York Academy of Science.
- Birch GG & Lindley MG.1986. Interactions of Food Components. Elsevier.
- Fennema OR. 1996. Food Chemistry. Marcel Dekker.
- Kumar A & Gaonkar G. 1995. Ingredient Interaction: Effect on Food Quality. Marcel Dekker.

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Discipline Specific Elective Course FFT 553: Speciality Foods

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Basic knowledge of Food Science and Nutrition at undergraduate level.

Objective:

To make students understand the need, importance and process of developing healthy and nutritious foods for special category of population groups.

Course Contents:

UNIT I (6 lectures)

Need and scope of specialty foods: Specialty food based on ease in preparation cost health benefits; Functional foods, Convenience food, Health care and medical benefits, Nutritional status, Low cost foods.

UNIT II (6 lectures)

Specialty foods based on sources; Cereals and millets, Legumes and pulses, Fruits and vegetables, Animal food sources, By product based, Non conventional foods.

UNIT III (6 lectures)

Specialty foods based on process; Innovative process technology, Food additives basis, Bioactive components, Novel nutraceuticals products, Packaging techniques, Adaptable technology basis, Fast and PET foods.

UNIT IV (5 lectures)

Specialty food based on genetics; Genetically modified foods, Transgenic foods, Biotechnological aspects of detoxification. Proprietary foods. Supplementary foods.

UNIT V (7 lectures)

Therapeutic foods; Modification of diets in disorders, feeding purposes, Disease oriented of different organs ex: digestive tract, liver, cardiovascular system, kidney, metabolic disorders, allergy, endocrine disorders.

Specific consumer oriented foods; Defence persons, Space / astronaut, High altitude mountain climbers, Disaster situation – crises, care, maintenance. Specialty foods based on growing condition -organic, inorganic farming.

Learning Outcome: After completion of course the students would have an understanding of various specialty foods and their development based on variation of sources, process and genetics.

Reference Books

- Gibson GR & William CM. 2000. Functional Foods - Concept to Product.
- Robert EC. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.
- Manson P.2001. Dietary Supplements. 2nd Ed. Pharmaceutical Press.
- Bamji MS, Rao NP & Reddy V. 2003. Textbook of Human Nutrition. Oxford & IBH.

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SEMESTER-X

Core Course: FFT 507 Packaging of Food materials

Credits: (3-0-0-3)

Level: Post Graduate

Semester: Spring

Pre-requisite: FFT 501

Objective: To acquaint the students with packaging methods, packaging materials, packaging machineries, modern packaging techniques etc.

Course Content:

UNIT I (11 lectures)

Definitions and functions of packaging and packaging materials. Packaging requirements and selection of packaging materials; Types of packaging materials: paper: pulping, fibrillation and beating, types of paper and their testing methods; Glass: composition, properties, methods of making bottles and jars; Metals: Tin plate containers, tinning process, components of tin plate, tin free steel (TFS), types of cans, aluminum containers, lacquers; Plastics: types of plastic films, laminated plastic materials, coextrusion, edible films and biodegradable plastics.

UNIT II (11 lectures)

Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation; Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods.

Different packaging systems for dehydrated foods, frozen foods, dairy foods, fresh fruits and vegetables, meat, poultry and sea foods.

UNIT III (8 lectures)

Process of Packaging: Material handling, filling, air removal, sealing, retorting, Modified atmosphere packaging, vacuum and gas packaging. Package sterilization techniques, cushioning, unitizing, palletizing, stacking and containerization.

UNIT IV (8 lectures)

Quality Control: Evaluation of Packaging materials, toxicity, corrosion prevention, shelf life testing, minimization of transport losses, Hazards in handling and storage and packaging and their minimization.

UNIT V (7 lectures)

Packaging Laws and Regulations, Standards of Weights and Measures Act, Advancement in packaging Technology: Smart packaging, Active packaging, Anti-microbial packaging etc.

Learning Outcomes: Students will have learnt about packaging materials, methods and their applications in food industry.

Reference Books:

- Coles R, McDowell D and Kirwan MJ, Food Packaging Technology, CRC Press, 2003
- Robertson GL, Food Packaging – Principles and Practice, CRC Press Taylor and Francis Group, 2012
- Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic and Professional, 1992

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Core Course FFT 508: Food Engineering

Credits: (3-1-0-4)

Level: Post Graduate

Semester: Spring

Pre-requisite: B.Sc. with Chemistry as one paper.

Objective: To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I (9 lectures)

Mass, Energy balance and Heat transfer: Steam injection, steam infusion, plate heat exchangers, tubular heat exchangers and scraped surface heat exchangers, Pasteurization: Theory and application, pasteurization of packaged and unpacked foods, pasteurization calculations, equipments. Thermal processing: Death kinetics, thermal death curve, decimal reduction time. Z-factor, heat penetration curve, process time calculations, mathematical curve, process time calculations. Mathematical and graphical solutions

UNIT II (10 lectures)

Size reduction process: Principles, theories and laws, energy considerations, equipments. Mixing and forming, theory and applications, mixing indices, equipments for solid and liquid. Separation processes: Filtration and centrifugation, theories and mathematical descriptions, constant rate and constant pressure filtration, equipment. Membrane Technology- Reverse osmosis and Ultra filtration, Micro filtration

UNIT III (4 lectures)

Fluid flow, laminar, turbulent and transitional ranges, velocity distribution profiles, basic equations, thermal velocity calculations.

UNIT IV (10 lectures)

Evaporation: heat and mass balance, steam economy, heat recovery, efficiency, process calculations,

Food dehydration: constant and falling rate periods, drying rate calculations. Chilling, refrigeration and freezing: theories, characteristics curve, cooling rate calculations.

UNIT V (12 lectures)

Advanced Technologies: Extrusion: Theory and applications, extrusion cookers and cold extrusion, single and twin screw extruders, design considerations., Supercritical gas extraction, Advances in fortification: Synthetic nutrients. Techniques of food fortification. Stability of nutrients in relation to processing. Encapsulations: design and structure of microcapsules, release rate and mechanism. Techniques of micro encapsulation, advantages and application of encapsulation. Non thermal Processing: High pressure processing, Pulsed electric processing, Ohmic heating.

Learning Outcomes: After completing the course the students shall be well acquainted about different food engineering processes and various principles working behind them.

Reference Books:

- S. K. Sharma, S.J.Mulvaney, and S.S.H.Rizvi, Food Process Engineering: Theory and Laboratory Experiments, Wiley and Sons, 2000
- H. Pandey, H.K. Sharma, R.C.Chouhan, B.C. Sarkar and M.C. Bera, Experiments in Food Process Engineering, CBS Publishers and Distributors, 2004
- M.A. Rao, S.S. H.Rizvi and A.K.Dutta, Engineering properties of Foods, 3rd ed., Marcel Dekker, 2005

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Core Course FFT 510 : Advanced Food Microbiology

Credits: (3-0-1-4)

Level: Post Graduate

Semester: Spring

Pre-requisite: Science (Biology) as a subject in Class X.

Objective: To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food.

Course Content:

UNIT I (10 lectures)

General characteristics of microorganisms: Classification and identification of yeasts, molds and groups of bacteria important in food industry. Source of contamination: Air, water, soil, sewage, post processing contamination. Intrinsic and extrinsic factors influencing growth of microorganisms in foods.

UNIT II (8 lectures)

Classification of foods and general principles involved in their preservation. Effects on microbes of: Low temperature preservation, lethal effects of chilling, freezing and thawing; high temperature preservation. Heat resistance of microorganism, heat penetration and thermal processing. Pasteurization, sterilization, canning and dehydration; chemical preservation and its toxic effects; irradiations.

UNIT III (9 lectures)

Food fermentations: Bacterial, yeast and mold cultures; single and mixed cultures, propagation, maintenance and evaluation of cultures; factors affecting activity of cultures, bacteriophages, residual antibiotics and chemicals.

UNIT IV (8 lectures)

Microbiology of fermentation: Fermented milks. Cereal foods, vinegar, oriental foods, alcoholic beverages. Therapeutic value of fermented foods. Food Biotechnology: Use of biotechnologically improved enzymes in food processing industry

UNIT V (10 lectures)

Food spoilage: Spoilage of fresh and processed fruit and vegetables, spoilage of meat, fish, eggs and poultry products. Microbial toxins.

Pathogens in foods: Microbial infections and intoxications. Growth and survival of pathogens in food.

Food borne diseases. Investigation and control

Practical:

- Determination of microbial counts: Total viable, thermophilic, proteolytic, lipolytic and aerobic spore farmers, coliform counts, yeast and mold count.
- Determination of activity of starter cultures used and dairy industry.
- Dye reduction test.
- Determination of thermal resistance of enzymes and microorganisms

Learning Outcomes: After completing the course, the students will have knowledge about different groups of micro-organisms and their beneficial as well as harmful effects related to food.

Reference Books:

- Food microbiology by V. Ramesh, MJP publishing.
- Food microbiology by W.C. Frazier, Ist Edition by Mcgraw Hill Pub. Co. New York.
- Modern Food Microbiology, J.M. Jay. CBS publisher.

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Discipline Specific Elective Course FFT 660: Processing of Fruits and Vegetables
Credits: (1-0-1-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Introduction to Food Processing

Objective: To acquaint with the proper handling technologies of fruits and vegetables to reduce post harvest losses and acquaint with principles and methods of preservation of fruits and vegetables into various products.

Course Content

UNIT I (3 lectures)

Fruits and vegetables as living products: Chemical composition; pre and post harvest changes, maturity standards for storage, desirable characteristics of fruits and vegetables of processing.

Post harvest handling of fresh fruits and vegetables: Role of plants growth regulators in relation to storage; physical and chemical treatment to increase the shelf-life, conditions for transportation and storage, disease and injuries during marketing.

UNIT II (5 lectures)

Storage of fresh fruits and vegetables. Containers: Tin, glass and other packaging materials used in fruits and vegetables preservations. Canning and bottling: quality of raw materials, preparation of materials, preparation of syrups and brines, canning and bottling, effect of canning and bottling on nutritive value, spoilage of canned foods, detection and control.

Fruit and vegetable juices: Preparation of juice, syrups, squashes, cordials, and nectars; concentrations and drying of juice, packaging and storage and concentrations and powders; fortified and soft drinks.

Preparation of preserve and candied fruits

UNIT III (2 lectures)

Preservation by freezing, general methods for freezing of fruits and vegetables; problem relating to storage of frozen products; standards for frozen food products.

Dehydration of fruits and vegetables: Methods; packaging, storage, quality control during and after dehydration.

UNIT IV (3 lectures)

Pickles and chutneys: Preparation of various types of pickles- theory and practice; preparation of sauces and chutneys; problems relating to the shelf life of pickles and chutneys; quality control.

Tomato products: preparation of various tomato products, food standards and quality control.

Pectin: Raw materials; processes and uses of pectin; products based on pectin manufacture and quality control.

UNIT V (2 lectures)

Food additives: Use in fruit and vegetable preservation.

Vinegar: General methods of preparation, food standards and quality control. Uses

Utilization of waste from fruit and vegetables processing plant.

Practical

- Analysis of canned food products for chemical and microbiological spoilage.
- Tin coating test
  - Tin coating weight measurement (Clarke's Test)

  - Determination of the continuity of tin coating
  - Sulphide stain test and corrosion resistance test
- Determination of Ascorbic acid content in food products.
- Determination of lycopene content
- Determination of tannins in food products.
- Dehydration of fruits and vegetables
- Preparation of tomato products like ketchup, puree & past
- Preparation of Jam, Jelly, marmalade, preserve and fruit candy
- Pectin determination in fruits and vegetable products.
- Determination of chemical preservatives in fruits and vegetables products.
- Preparation and analysis of fruits beverages i.e. Squash and cordial.
- Use of flame photometry in the estimation of trace metals like Sodium and Potassium

Learning Outcomes: Students would have learnt different post harvest handling methods of fruits and vegetables.

Reference Books

- Lal G, Siddapa GS & Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.
- Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.
- Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.

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Discipline Specific Elective Course (DSE): FFT 552 : Intellectual Property Rights
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Graduation in any stream.

Objective:

To sensitize the students regarding the essentials of Intellectual Property Rights, its fundamentals, legislations and significance to it in the development of agriculture, food and nutritional security.

Course Content

UNIT I (6 lectures)

Need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement.

UNIT II (7 lectures)

Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties.

UNIT III (5 lectures)

Fundamentals of patents, copyrights, geographical indications, designs and layout, trademarks.

UNIT IV (6 lectures)

Protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection;

UNIT V (6 lectures)

International Treaty on Plant Genetic; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement

Learning Outcome: The course is expected to acquaint the students with different IPR and its their importance in protecting individual rights.

Reference Books:

- Erbisch FH & Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI, Wallingford.
- Ganguli, Prabudha. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill, New Delhi.

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Elective Course FFT 554 : Fundamentals of Nutrition
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: FFT 502

Objective: To acquaint the students about importance of nutrition, balanced diets, therapeutic diets for health and role of food and nutraceuticals in health.

Course Content

UNIT I (7 lectures)

Introduction to human nutrition. Macronutrients and micronutrients - Classification and functions. Digestion, absorption and assimilation of nutrients. Energy metabolism- Components of energy expenditure, Basal Metabolic Requirements and Activity, Recommended Dietary Allowances, Food Groups, Concept of a balanced diet, Methods of evaluation of nutritive value of foods.

UNIT II (5 lectures)

Carbohydrates- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT III (5 lectures)

Proteins- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT IV (5 lectures)

Fat- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT V (8 lectures)

Vitamin- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

Minerals- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

Water and electrolytes- Concept and importance. Nutritional assessment and nutritional policies- Salient features, concept of community nutrition

Learning Outcomes: The students would be well informed about human nutrition concepts and various food groups after completing the course.

Reference books:

- Nutrition Science by B. Srilakshmi
- Fundamentals of Foods & Nutrition by Sumati R. Mudambi
- Textbook of Nutrition : A Life cycle approach by Ravinder Chadha

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Discipline Specific Elective Course (DSE): FFT 652 Food Fermentation and Microbial Technology
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Must have completed one course / paper on Microbiology / Food Microbiology.

Objective: To familiarize about the various microbial processes/systems/activities which have been used for the development of industrially important products/processes.

Course Content

Unit I (6 lectures)

Fermentation: History, definition and types. Study of a Bio fermentor – its design and operation, Down Stream Processing and Product recovery. Its measurement and control in fermentation, Aeration and agitation in fermentation: Oxygen requirement, sterilization of air and media; scale up in fermentation.

Unit II (6 lectures)

Recovery of particulate matter, product isolation, distillation, centrifugation, whole broth processing, filtration, aqueous two-phase separation, solvent extraction, chromatography and electrophoresis.

Unit III (8 lectures)

Production of alcoholic beverages, organic acids, enzymes and immobilization of enzymes. Biological waste treatment.

Unit IV (4 lectures)

Dairy Fermentations-starter cultures and their types, concept of probiotics.

Unit V (6 lectures)

Microbial enzymes, role in various industrial processes, Bio-transformations, Immobilized enzymes based bioreactors; production of antibiotics, vaccines, and biocides; Bioconversion of substrates, anti-nutritional factors present in feeds; Microbial detoxification of aflatoxins; Bioinsecticides; Biofertilizers.

Learning Outcome: The course will make the students learn about fermentation techniques and industrial microbiology.

Reference Books:

- Huffnagle GB & Wernick S. 2007. The Probiotics Revolution: The Definitive Guide to Safe, Natural Health. Bantam Books.
- Nout RMJ, de Vos WM and Zwietering MH. 2005. Food fermentation. Wageningen Academic Publishers, Netherlands.

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Skill Enhancement Course: FFT 641 Seminar
Credits: (2-0-0-2)

Revised Syllabus

M. Sc. Food Technology

Centre of Food Technology
University of Allahabad
Allahabad

Regulations for M.Sc. Degree in Food Technology

1. Eligibility for admission:

The eligibility for entry is: B.Sc. Food Technology / Agriculture/ Home Science with Chemistry/ B.Tech. (Food Tech. or Dairy Tech.) / B.Voc degree in Food Technology (NSQF Level 7) or equivalent degree

2. Duration of Programme:

The M.Sc. programme shall extend over a period of 4 consecutive semesters spread over 2 academic years – two semesters constituting one academic year. The duration of each semester shall normally be 15 - 18 weeks excluding examinations.

Eligibility to appear in end semester examination: 75% attendance is compulsory with a provision of relaxation of attendance up to 20% in a paper based on the specific recommendations of the Head of the department/ Dean in case of ill health/ Sports/ NCC/ NSS.

3. Examination and Assessment

(a) The performance of the students will be evaluated on a comprehensive system of continuous evaluation.

(b) The award list along with answer sheets of End Semester examination shall be submitted by the Course Coordinator to the Controller of Examinations for consolidation and publication of results.

(c) There shall be 40% sessional marks and 60% for the end-Semester examination in each theory paper and practical.

(d) The sessional assessment will be based on tests / assignment / presentations / quiz etc. The best two out of the three tests will be taken for computing the sessional marks.

(e) The aggregate marks of Sessional and End Semester examination of each paper shall be communicated to the Controller of Examinations.

(f) For the conduct of the Practical Examination, there shall be a Board comprising of two internal examiners.

(g) For the conduct of Project/Thesis evaluation, there shall be a Board comprising of external and internal examiners.

(h) The implementation of the evaluation process shall be monitored by the Departmental Examination Committee.

4. Assessment and evaluation:

a) Choice Based Credit System of the University of Allahabad will be adopted for assessment and evaluation.

b) The evaluation of the continuous assessment for each semester shall be made on the basis of credit hour earn by the student.

c) One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week. Accordingly, one Credit would mean equivalent of 15-18 periods of 60 minutes each or 30-36 hrs of workshops/labs.

5. Revision of Regulations and Curriculum:

The syllabi and course structure of each course shall be developed and formulated by the Programme Committee (PC) of the Centre which shall be free to modify and update the courses from time to time and to amend the Regulations. The changes made by the PC shall be reported to the higher bodies of the university.

Programme Objectives

- To develop knowledge, understanding and skills in areas of Food Technology required to work independently in research and development or equally qualified employment in food technology
- To develop ability to analyze and evaluate critically various technical solutions in the field for establishing own enterprise.
- To demonstrate an ability to acquire new knowledge in the field and to integrate this with existing knowledge.
- To develop ability to choose and design technologies for the industrial manufacture of food products and processes , with regard to raw materials, energy, economics and sustainability in the system of industrial food technology.

M.Sc in Food Technology

Course Structure

Semester	Paper Code		Title of paper	Credits			
				L	**T**	**P**	**Total (C)**
I	**FFT 501**		Principles of Food Processing	3	1	0	4
	FFT 502		Food Chemistry	3	0	1	4
	FFT 503		Instrumentation and Analytical Techniques	3	0	1	4
	FFT 504		Research Methodology and Statistics	3	1	0	4
	FFT 591		Communication Skills	1	0	1	2
	FFT 592		Basics of Computer Application	1	0	1	2
			TOTAL	**14**	**2**	**4**	**20**
II	**FFT 505**		Post Harvest Technology of Horticulture Crops	2	0	1	3
	FFT 506		Food Microbiology	3	0	1	4
	FFT 507		Packaging of Food Materials	3	0	0	3
	FFT 508		Food Engineering	3	1	0	4
	Elective- I (Any two)	**FFT 551**	Processing of Meat, Fish and Poultry Products	2	0	0	2
		FFT 552	Intellectual Property Rights				
		FFT 553	Specialty Foods				
		FFT 554	Fundamentals of Nutrition				
		FFT 557	Spices and Flavour Technology				
	FFT 593		Communication skills and Scientific writing	1	0	1	2
			TOTAL	**16**	**1**	**3**	**20**
III	**FFT 601**		Processing of Cereals, Pulses and Oilseeds	3	0	1	4
	FFT 602		Processing of Milk and Milk Products	3	0	1	4
	FFT 603		Quality Control, Food Standards and Food laws	3	0	0	3
	Elective- II (Any two)	**FFT 651**	Entrepreneurship in Food Processing	2	0	0	2
		FFT 652	Food Fermentation and Microbial Technology				
		FFT 653	Food Rheology				
		FFT 654	Food Product Development				
		FFT 655	Advanced Food Analysis	1	0	1	2
	FFT 691		Workplace Skills	1	0	1	2
	FFT 604		Training and Workshop	0	0	2	2*
	FFT 641		Seminar	0	0	1	1
			TOTAL	**14**	**0**	**6**	**20**
IV	**FFT 646**		Thesis	**0**	**0**	**20**	**20**
			Total Credits	**44**	**3**	**33**	**80**

*Non Credit Requirement

SEMESTER I

Core Course: FFT 501 Principles of Food Processing
Credits: (3-1-0-4)

Level: Post Graduate

Semester: Autumn

Pre-requisite: B.Sc. with Chemistry / Biochemistry as one of the paper/course.

Objective:
To acquaint with principles of different techniques used in processing and preservation of foods.

Course Content

UNIT I (5 lectures)
Introduction: Definition and scope of Food Science and Technology, historical development of food processing and preservation, general principles of food preservation.

UNIT II (15 lectures)
Preservation by heating: Principles of the method, Types of microorganisms, bacterial load, sterilization and commercial sterility, thermal resistance of the microorganisms and enzymes..
Canning and bottling: General aspects of canning and bottling, processing operations exhausting and sealing, retorting, ultra-high temperature processes, determination of thermal process time, processing equipments, canning/ bottling of various food products.
Chemical preservation: Preservation of foods by use of sugar, salt, chemicals and antibiotics and by smoking. Effect of various food processing operations on the nutrients of foods.

UNIT III (15 lectures)
Refrigeration and freezing preservation: Refrigeration and storage of fresh foods, major requirements of a refrigeration plant, controlled atmospheric storage, refrigerated storage of various foods, freezing point of selected foods, influence of freezing and freezing rate of the quality of food products, methods of freezing, storage and thawing of frozen foods.

UNIT IV (13 lectures)
Drying and dehydrations: Sun drying of various foods, water activity and its effect on the keeping quality, sorption isotherms and their use. Characteristics of food substances related to their dehydration behavior, drying phenomenon, factors affecting rate of drying, methods of drying of various food products, type of driers and their suitability for different foods; intermediate moisture foods.
Concentration (Evaporation): Application in food industry, processes and equipment for manufacture of various concentrated foods and their keeping quality, Properties of liquid, single and multiple effect evaporation,

UNIT V (12 lectures)
Radiations: Sources of radiations, effect on microorganisms and different nutrients; Radiation units and doses for foods, dose requirements for radiation preservation of foods, safe limits, irradiation mechanism and survival curve, irradiation of packaging materials. Microwave Heating: Principles and application in food processing.

Learning Outcomes: The students will have knowledge about different processing and preservation methods and principles involved.

Reference Books

- Food Processing Technology by P.J. Fellows, Woodhead publishing ltd.
- Food Science by N.N. Potter, CBS publishing.
- Physical principles of Food Preservation. Vol. II by M. Karel, O.R. Fenema and D.B. Lurd, Maroel, Dekker Inc. New York.

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Core Course: FFT 502 Food Chemistry
Credits: (3-0-2-4)

Level: Post Graduate

Semester: Autumn

Pre-requisite: B.Sc. with Chemistry as one paper / course.

Objective: To acquaint with properties and role of various constituents in foods, interaction and changes during processing.

Course Content

UNIT I (4 lectures)
Water: properties, bonding and chemistry.

UNIT II (8 lectures)
Carbohydrates: Classification, structure and properties of carbohydrates. Role of carbohydrates in food industry. Sugar, starch, cellulose, glucans, hemicelluloses, gums, pectic substances, polysaccharides. Browning reaction in foods: Enzymatic and non-enzymatic browning in foods of vegetable and animal origin during storage and processing of foods.

UNIT III (12 lectures)
Proteins: Classification, structure, properties, purification and denaturation of proteins. Protein interaction and degradation, protein-protein interaction, protein-lipid complexes and protein-carbohydrate complex. Major protein systems and factors affecting them, the nature of interaction in proteins derived from milk. Egg proteins, meat proteins, fish muscle proteins, oil seed proteins and cereal proteins.
Enzymes: Nature, classification and properties of food enzyme, enzyme activity in different food systems, commercial availability. Food enzyme technology. Immobilization of enzymes, removal of toxicants through enzymes, flavor production by enzymes.

UNIT IV (10 lectures)
Lipids: Classification and physico-chemical properties of food lipids. Refining of crude oils, hydrogenation and winterization. Vegetable and animal fat, margarine, lard, butter. Frying and shortening. Flavor changes in fats and oils, lipid oxidation, factors affecting lipid oxidation, auto-oxidation, biological significance of auto-oxidation of lipids.

UNIT V (11 lectures)
Vitamins: Role of vitamins in food industry, effect of various processing treatments and fortification of foods. Minerals: Role of minerals in food industry, effects of various processing treatments.
Biological changes in foods: Plant pigments and their roles in food industry. Bitter substance and tannins. Flavour Composition of Foods and beverages. Emulsion: Definition, Theory, Emulsifiers: Properties, role & action in stabilizing an emulsion.

Practical

- Preparation of standard solutions for the chemical analysis i.e. HCl, H_2SO_4, $KmnO_4$, Sodium Thiosulphate and Iodine.
- Determination of pH and acidity of foods
- Determination of proximate composition of Foods: Moisture, Protein, Fat, Total ash, Crude fibre, Carbohydrate, Calorific Value
- Determination of minerals in food products: Calcium by Titration, Phosphorus by Spectrophotometer, Iron by Spectrophotometer
- Estimation of reducing, non-reducing, total sugars in cereals and fruits & vegetable products.
- Determination of starch content in food products.
- Estimation of fats & Oils: Free fatty acid, Peroxide value, Saponification value, RM Number, TBA test, Iodine value, Fat adulteration test
- Determination of NaCl content in food products.
- Determination of trypsin inhibitors.

Learning Outcome: The students will gain information about various food constituents, and changes that occur in them during food processing.

Reference Books

- Belitz HD.1999. Food Chemistry. Springer Verlag.
- DeMan JM. 1976. Principles of Food Chemistry. AVI.
- Fennema OR.1996. Food Chemistry. Marcel Dekker.
- Meyer LH. 1987. Food Chemistry. CBS

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Core Course: FFT 503 Instrumentation and Analytical Techniques
Credits: (3-0-2-4)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Graduation in any stream of science.

Objective: To develop an understanding and methodologies of instrumental techniques in food analysis used for objective methods of food quality parameters.

Course Content

UNIT I (3 lectures)
Preparation of chemical solutions: Concept of molar, molal, and normal solutions. pH and Buffers: Importance and measurement of pH.

UNIT II (8 lectures)
Chromatographic techniques: General principles. Partition and adsorption chromatography. Paper, thin layer, gas liquid, ion exchange and affinity chromatography. Gel filtration. Introduction to High Pressure Liquid Chromatography.

UNIT III (5 lectures)
Electrophoretic Techniques: General principles. Paper and gel electrophoresis. Polyacrylamide gel electrophoresis.

UNIT IV (8 lectures)
Spectroscopy: Beers and Lambert's Law. Extinction coefficient. General principles of colorimeters and spectrophotometers, Atomic spectroscopy, Emmission spectroscopy, IR spectroscopy.

UNIT V (6 lectures)
Flourimetry: Spectroflourometers. Flame photometry and atomic absorption spectrophotometry.
Use of radioisotopes. Microbiological assays. Microscopy

Practical

- Qualitative analysis of compounds by chromatography techniques: Thin layer Chromatography, Paper Chromatography: Descending, Ascending and Circular Paper chromatography.
- Qualitative analysis of compounds By using High Performance Liquid Chromatography.
- Column chromatography: Separation of beta carotene
- Use of electrophoresis in the determination of proteins.
- Determination of Rheological properties by using texture analyzer.

Learning Outcome: Students will get acquainted with analytical methods used for quality control analysis of raw material and processed food commodities.

Reference Books

- Hand Book of Food Analysis by Nollet & Toldra, CRC publishing ltd.
- Hand Book of Analysis & Quality Control for Fruit & Vegetable Products by Rangana, Tata Mcgraw hill publishing.
- Introduction to the chemical analysis of foods by Nielson, CBS publishing.

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Core Course FFT 504 : Research Methodology and Statistics
Credits: (3-1-0-4)

Level: Post Graduate
Semester: Spring
Pre-requisite: Basic knowledge of mathematics
Objective:
The students will be exposed to various statistical tools required to analyze the experimental data in Food Technology.
Course Content
UNIT I 11 lectures
Introduction to Research; Types of Research: (Basic & Applied) and their applications. Formulating a Research Problem; Research Design: Definition, Characteristics & Components. Research Questions, Objectives & Assumptions. Generation of Hypothesis. Data Collection: Tools, Primary & Secondary methods of Data collection.

UNIT II 12 lectures

Sampling methods: Rationale & Characteristics. Types of Sampling: Probability & Non-probability sampling. General consideration in and Scaling Techniques. Consideration and Calculation of Sample Size.
Data management & Analytics: Editing & Coding of Data, Tabulation & Graphical Representation of Research Data using MS Excel & Statistical software.

UNIT III 10 lectures

Design of Experiments (DOE): Applications of Randomized Block Design (RBD) and its types, Factorial Design, Fractional Factorial Design, Latin Square Design (LSD), Critical Difference (CD), Split Plot Design.

UNIT IV 15 lectures

Descriptive Statistics: Measures of Central Tendency – (Mean, Mode, and Mode for Grouped and Ungrouped Data). Measures of Variability – Range, Variance, Standard Deviation and Standard Error. Measures of Relative Positions - Sigma Scores, Standard Scores, Percentiles, Percentile Ranks. Measures of Relationships (Correlation and Regression Analysis). Normal Distribution & its applications; Measures of Shape – (Skewness, Kurtosis). Calculations and Interpretation of Statistical Procedures

UNIT V 12 lectures

Hypothesis Testing in Research: Confidence Intervals and Levels of Significance. Degrees of Freedom Tests of Significance . Parametric Tests – Z-test, t-Test, and F-test, ANOVA (One way & Two Way) . Non-Parametric Tests – Chi-Square. Calculations and Interpretation of Parametric and Non-Parametric Tests – use of statistical software.

Learning Outcomes: The students are expected to have learnt statistical tools for analyzing data.

Reference Books

- Jackson SL. 2012. Research Methods and Statistics: A Critical Thinking Approach. Fourth Edition. Wadsworth Cengage Learning.
- Krishnan V. 2011. Statistics for Beginners. Atlantic Publishers and Distributors (P) Ltd.
- Singh YK. 2006. Fundamentals of Research Methodology and Statistics. New Age International Publishers.
- Aggarwal BL. 2003. Basic Statistics. New Age.
- Kothari CR. 1989. Research Methodology. Wiley Eastern.
- Gupta SP. 2004. Statistical Methods. S. Chand & Sons.

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Foundation Course: FFT 591 Communication Skills
Credits: (1-0-2-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: English as a subject at secondary level.

Objective: To equip the students with skills to write, communicate and articulate in English (verbal as well as written).

Course Content

Unit I 2 lectures

Introduction to communication – Definition, Purpose, Basic communication model, need for effective communication, process & barriers to communication

Unit II 4 lectures

Grammar - Noun, Articles, Adjective & Degrees of comparisons, Preposition, Subject-verb agreement, Present, past & future Tense, Modals & Moods, Active & passive voice, Reported speech

Unit III 4 lectures

Oral Communication –Identification of sounds (Phonetics), Consonant & Vowel sounds, Indianism, Syllable & Syllable Stress, Intonation & modulation, Word stress, Development of Speaking Skills

Unit IV 3 lectures

Written Communication –Formal & informal letter writing, Introduction to Essay writing,

Unit V 2 lectures

Vocabulary building - Learning new words, Synonyms, Antonyms, use of suffix/prefix.

Practical:

- Ice breaker session
- creating new words
- exercise on picture description
- story completion
- oral practice of vowel sounds and syllable stress (phonetics)
- Comprehension Practical
- Dictionary Quiz
- Paragraph writing
- Vocabulary building exercises
- Paragraph Reading

Learning Outcomes: The students are expected to be able to communicate effectively in English after completing the course.

Reference books:

- English Grammar Composition & Usage. J C Nesfield
- Essential Grammar in Use, Raymond Murphy, Cambridge
- Oxford English Grammar , Sidney Greenbaum, Oxford University Press

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Foundation Course FFT 592: Basics of Computer Application

Credits: (1-0-2-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Graduation in any stream.

Objective: To educate students about the basic use, applications and web applications so as to facilitate learning**.**

Course Content

UNIT I (2 lectures)
Introduction to Computer (Hardware / Software) (2 lectures)
UNIT II
Microsoft Word and its applications (Documentation and Formatting) (4 lectures)
UNIT III
MS Excel and its applications (Making Tabular data, charts & formatting, Use of general functions & formulae) (4 lectures)
UNIT IV
MS PowerPoint and its applications (Creating own design, design & formatting of a presentation, Use of Image, audio, video in the presentation) (3 lectures)
UNIT V
Use of Internet & Web Applications and Email Services, Industry customer approach.

Practical

- Basics of Computers, usage of short cut keys, taking out print outs, page set ups.
- Making of Power point Presentation
- E- Mail (Subject line, salutation, subscription, how to mark cc, drafting, sending of mails, reverts, forwarding of mails, attaching pictures and documents, attaching ppts
- Differentiation between hardware and software and practical usage of both.
- Diagrammatic representation of pie-charts, tabular presentation of data/info, Etc
- Basic use of MS Excel/Spread Sheets

Learning Outcomes: Learning of basic computer applications and use of web services will be completed after studying the course.

Reference Books

- Fundamentals of Computers by E. Balagurusamy (Author) Publisher: McGraw Hill Education (India) Private Limited
- Ms Office 2007 in a Nutshell by S. Saxena (Author) Publisher: S.Chand (G/L) & Company Ltd

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SEMESTER II

Core Course: FFT 505 Post Harvest Technology of Horticultural Crops

Credits: (2-0-2-3)

Level: Post Graduate

Semester: Spring

Pre-requisite: FFT 501

Objective: To acquaint with the proper handling technologies of fruits and vegetables to reduce post harvest losses and acquaint with principles and methods of preservation of fruits and vegetables into various products.

Course Content

UNIT I (4 lectures)

Fruits and vegetables as living products: Chemical composition; pre and post harvest changes, maturity standards for storage, desirable characteristics of fruits and vegetables of processing.

Post harvest handling of fresh fruits and vegetables: Role of plants growth regulators in relation to storage; physical and chemical treatment to increase the shelf-life, conditions for transportation and storage, disease and injuries during marketing.

UNIT II (8 lectures)

Storage of fresh fruits and vegetables. Containers: Tin, glass and other packaging materials used in fruits and vegetables preservations. Canning and bottling: quality of raw materials, preparation of materials, preparation of syrups and brines, canning and bottling, effect of canning and bottling on nutritive value, spoilage of canned foods, detection and control.

Fruit and vegetable juices: Preparation of juice, syrups, squashes, cordials, and nectars; concentrations and drying of juice, packaging and storage and concentrations and powders; fortified and soft drinks.

Preparation of preserve and candied fruits

UNIT III (4 lectures)

Preservation by freezing, general methods for freezing of fruits and vegetables; problem relating to storage of frozen products; standards for frozen food products.

Dehydration of fruits and vegetables: Methods; packaging, storage, quality control during and after dehydration.

UNIT IV (8 lectures)

Pickles and chutneys: Preparation of various types of pickles- theory and practice; preparation of sauces and chutneys; problems relating to the shelf life of pickles and chutneys; quality control.

Tomato products: preparation of various tomato products, food standards and quality control.

Pectin: Raw materials; processes and uses of pectin; products based on pectin manufacture and quality control.

UNIT V (6 lectures)

Food additives: Use in fruit and vegetable preservation.

Vinegar: General methods of preparation, food standards and quality control. Uses

Utilization of waste from fruit and vegetables processing plant.

Practical

- Analysis of canned food products for chemical and microbiological spoilage.
- Tin coating test
  - Tin coating weight measurement (Clarke's Test)
  - Determination of the continuity of tin coating
  - Sulphide stain test and corrosion resistance test
- Determination of Ascorbic acid content in food products.
- Determination of lycopene content
- Determination of tannins in food products.
- Dehydration of fruits and vegetables
- Preparation of tomato products like ketchup, puree & past

- Preparation of Jam, Jelly, marmalade, preserve and fruit candy
- Pectin determination in fruits and vegetable products.
- Determination of chemical preservatives in fruits and vegetables products.
- Preparation and analysis of fruits beverages i.e. Squash and cordial.
- Use of flame photometry in the estimation of trace metals like Sodium and Potassium

Learning Outcomes: Students would have learnt different post harvest handling methods of fruits and vegetables.

Reference Books

- Lal G, Siddapa GS & Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.
- Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.
- Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.

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Core Course FFT 506 : Food Microbiology
Credits: (3-0-2-4)

Level: Post Graduate

Semester: Spring

Pre-requisite: Science (Biology) as a subject in Class X.

Objective: To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food.

Course Content

UNIT I (10 lectures)
General characteristics of microorganisms: Classification and identification of yeasts, molds and groups of bacteria important in food industry. Source of contamination: Air, water, soil, sewage, post processing contamination. Intrinsic and extrinsic factors influencing growth of microorganisms in foods.

UNIT II (8 lectures)
Classification of foods and general principles involved in their preservation. Effects on microbes of: Low temperature preservation, lethal effects of chilling, freezing and thawing; high temperature preservation. Heat resistance of microorganism, heat penetration and thermal processing. Pasteurization, sterilization, canning and dehydration; chemical preservation and its toxic effects; irradiations.

UNIT III (9 lectures)
Food fermentations: Bacterial, yeast and mold cultures; single and mixed cultures, propagation, maintenance and evaluation of cultures; factors affecting activity of cultures, bacteriophages, residual antibiotics and chemicals.

UNIT IV (8 lectures)
Microbiology of fermentation: Fermented milks. Cereal foods, vinegar, oriental foods, alcoholic beverages. Therapeutic value of fermented foods. Food Biotechnology: Use of biotechnologically improved enzymes in food processing industry

UNIT V (10 lectures)
Food spoilage: Spoilage of fresh and processed fruit and vegetables, spoilage of meat, fish, eggs and poultry products. Microbial toxins.
Pathogens in foods: Microbial infections and intoxications. Growth and survival of pathogens in food.
Food borne diseases. Investigation and control

FFT 605 Food Microbiology Practical

- Determination of microbial counts: Total viable, thermophilic, proteolytic, lipolytic and aerobic spore farmers, coliform counts, yeast and mold count.
- Determination of activity of starter cultures used and dairy industry.
- Dye reduction test.
- Determination of thermal resistance of enzymes and microorganisms

Learning Outcomes: After completing the course, the students will have knowledge about different groups of micro-organisms and their beneficial as well as harmful effects related to food.

Reference Books

- Food microbiology by V. Ramesh, MJP publishing.

- Food microbiology by W.C. Frazier, Ist Edition by Mcgraw Hill Pub. Co. New York.
- Modern Food Microbiology, J.M. Jay. CBS publisher.

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Core Course: **FFT 507 Packaging of Food materials**

Credits: (3-0-0-3)

Level: Post Graduate

Semester: Spring

Pre-requisite: FFT 501

Objective: To acquaint the students with packaging methods, packaging materials, packaging machineries, modern packaging techniques etc.

Course Content

UNIT I (11 lectures)
Definitions and functions of packaging and packaging materials. Packaging requirements and selection of packaging materials; Types of packaging materials: paper: pulping, fibrillation and beating, types of paper and their testing methods; Glass: composition, properties, methods of making bottles and jars; Metals: Tin plate containers, tinning process, components of tin plate, tin free steel (TFS), types of cans, aluminum containers, lacquers; Plastics: types of plastic films, laminated plastic materials, coextrusion, edible films and biodegradable plastics.

UNIT II (11 lectures)
Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation; Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods.
Different packaging systems for dehydrated foods, frozen foods, dairy foods, fresh fruits and vegetables, meat, poultry and sea foods.

UNIT III (8 lectures)
Process of Packaging: Material handling, filling, air removal, sealing, retorting, Modified atmosphere packaging, vacuum and gas packaging. Package sterilization techniques, cushioning, unitizing, palletizing, stacking and containerization.

UNIT IV (8 lectures)
Quality Control: Evaluation of Packaging materials, toxicity, corrosion prevention, shelf life testing, minimization of transport losses, Hazards in handling and storage and packaging and their minimization.

UNIT V (7 lectures)
Packaging Laws and Regulations, Standards of Weights and Measures Act, Advancement in packaging Technology: Smart packaging, Active packaging, Anti-microbial packaging etc.

Learning Outcomes: Students will have learnt about packaging materials, methods and their applications in food industry.

Reference Books

- Coles R, McDowell D and Kirwan MJ, Food Packaging Technology, CRC Press, 2003
- Robertson GL, Food Packaging – Principles and Practice, CRC Press Taylor and Francis Group, 2012
- Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic and Professional, 1992

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Core Course FFT 508: Food Engineering

Credits: (3-1-0-4)

Level: Post Graduate

Semester: Spring

Pre-requisite: B.Sc. with Chemistry as one paper.

Objective: To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I (9 lectures)

Mass, Energy balance and Heat transfer: Steam injection, steam infusion, plate heat exchangers, tubular heat exchangers and scraped surface heat exchangers, Pasteurization: Theory and application, pasteurization of packaged and unpacked foods, pasteurization calculations, equipments. Thermal processing: Death kinetics, thermal death curve, decimal reduction time. Z-factor, heat penetration curve, process time calculations, mathematical curve, process time calculations. Mathematical and graphical solutions

UNIT II (10 lectures)

Size reduction process: Principles, theories and laws, energy considerations, equipments. Mixing and forming, theory and applications, mixing indices, equipments for solid and liquid. Separation processes: Filtration and centrifugation, theories and mathematical descriptions, constant rate and constant pressure filtration, equipment. Membrane Technology- Reverse osmosis and Ultra filtration, Micro filtration

UNIT III (4 lectures)

Fluid flow, laminar, turbulent and transitional ranges, velocity distribution profiles, basic equations, thermal velocity calculations.

UNIT IV (10 lectures)

Evaporation: heat and mass balance, steam economy, heat recovery, efficiency, process calculations,
Food dehydration: constant and falling rate periods, drying rate calculations. Chilling, refrigeration and freezing: theories, characteristics curve, cooling rate calculations.

UNIT V (12 lectures)

Advanced Technologies: Extrusion: Theory and applications, extrusion cookers and cold extrusion, single and twin screw extruders, design considerations., Supercritical gas extraction, Advances in fortification: Synthetic nutrients. Techniques of food fortification. Stability of nutrients in relation to processing. Encapsulations: design and structure of microcapsules, release rate and mechanism. Techniques of micro encapsulation, advantages and application of encapsulation. Non thermal Processing: High pressure processing, Pulsed electric processing, Ohmic heating.

Learning Outcomes: After completing the course the students shall be well acquainted about different food engineering processes and various principles working behind them.

Reference Books

- S. K. Sharma, S.J.Mulvaney, and S.S.H.Rizvi, Food Process Engineering: Theory and Laboratory Experiments, Wiley and Sons, 2000
- H. Pandey, H.K. Sharma, R.C.Chouhan, B.C. Sarkar and M.C. Bera, Experiments in Food Process Engineering, CBS Publishers and Distributors, 2004
- M.A. Rao, S.S. H.Rizvi and A.K.Dutta, Engineering properties of Foods, 3rd ed., Marcel Dekker, 2005

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Elective Course FFT 551 : Technology of Meat and meat Products

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Graduate in Science and must have completed a course Food Science / Food Chemistry.

Objective: To provide an understanding of the technology for handling, processing, preservation and bi-product utilization of meat, poultry and fish products processing.

Course Content

UNIT I (8 lectures)

Scope of meat & meat products industry in India. Structure of meat tissue. Chemical composition and nutritive value of meat Mechanism of muscle contraction and relaxation.
Postmortem changes-factor affecting post-mortem changes, thaw rigor and cold shortening Properties of fresh meat. Meat carcass grading and cuts. Restructured meat products, Pre rigor processing of meat. Meat tenderization -and its techniques.

UNIT II (6 lectures)

Preservation of meat & poultry- chilling, freezing, curing, smoking, canning, dehydration, irradiation, freeze drying, antibiotics, microwave, chemicals

UNIT III (2 lectures)
Utilization of meat industry by-products.
UNIT IV (10 lectures)
Eggs - structure, composition, nutritive value and functional properties of eggs. Internal quality of eggs- evaluation, quality troubleshooters in eggs, egg grading. Preservation and maintenance of internal quality of eggs, Egg products-Egg powders, frozen eggs, egg foams, factors influencing foaming.
Poultry -types, factors affecting quality, chemical composition and nutritive value of poultry meat
Poultry dressing - ante and postmortem examination, methods of stunning, slaughter, scalding & dressing. Tenderness of poultry, problem factors in poultry meat. Utilization of poultry industry by-products.
UNIT V (4 lectures)
Fish structure and composition. Cold storage, freezing preservation and canning of fish. Picking of fish, fish protein concentrates, fish meal and by products of fish processing industry

Learning Outcome: Students will have learnt about chemistry of meat and various processing methods used for meat, fish, poultry and eggs.

Reference Books

- Govindan TK. 1985. Fish Processing Technology. Oxford & IBH.
- Hui YH. 2001. Meat Science and Applications. Marcel Dekker. 32
- Kerry J. et al. 2002. Meat Processing. Woodhead Publ. CRC Press.
- Pearson AM & Gillett TA. 1996. Processed Meat. 3rd Ed. Chapman & Hall.

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Elective Course FFT 552 : Intellectual Property Rights

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Graduation in any stream.

Objective:

To sensitize the students regarding the essentials of Intellectual Property Rights, its fundamentals, legislations and significance to it in the development of agriculture, food and nutritional security.

Course Content

UNIT I (6 lectures)
Need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement.

UNIT II (7 lectures)
Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties.

UNIT III (5 lectures)
Fundamentals of patents, copyrights, geographical indications, designs and layout, trademarks.

UNIT IV (6 lectures)
Protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection;

UNIT V (6 lectures)
International Treaty on Plant Genetic; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement

Learning Outcome: The course is expected to acquaint the students with different IPR and its their importance in protecting individual rights.

Reference Books

- Erbisch FH & Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI, Wallingford.
- Ganguli, Prabudha. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill, New Delhi.

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Elective Course FFT 553 : Specialty Foods
Credits: (2-0-0-2)

Level: Post Graduate
Semester: Spring

Pre-requisite: Basic knowledge of Food Science and Nutrition at undergraduate level.

Objective:
To make students understand the need, importance and process of developing healthy and nutritious foods for special category of population groups.

Course Contents

UNIT I (6 lectures)
Need and scope of specialty foods: Specialty food based on ease in preparation cost health benefits; Functional foods, Convenience food, Health care and medical benefits, Nutritional status, Low cost foods.

UNIT II (6 lectures)
Specialty foods based on sources; Cereals and millets, Legumes and pulses, Fruits and vegetables, Animal food sources, By product based, Non conventional foods.

UNIT III (6 lectures)
Specialty foods based on process; Innovative process technology, Food additives basis, Bioactive components, Novel nutraceuticals products, Packaging techniques, Adaptable technology basis, Fast and PET foods.

UNIT IV (5 lectures)
Specialty food based on genetics; Genetically modified foods, Transgenic foods, Biotechnological aspects of detoxification. Proprietary foods. Supplementary foods.

UNIT V (7 lectures)
Therapeutic foods; Modification of diets in disorders, feeding purposes, Disease oriented of different organs ex: digestive tract, liver, cardiovascular system, kidney, metabolic disorders, allergy, endocrine disorders.

Specific consumer oriented foods; Defence persons, Space / astronaut, High altitude mountain climbers, Disaster situation – crises, care, maintenance. Specialty foods based on growing condition -organic, inorganic farming.

Learning Outcome: After completion of course the students would have an understanding of various specialty foods and their development based on variation of sources, process and genetics.

Reference Books

- Gibson GR & William CM. 2000. *Functional Foods - Concept to Product.*
- Robert EC. 2006. *Handbook of Nutraceuticals and Functional Foods*. 2nd Ed. Wildman.
- Manson P.2001. Dietary Supplements. 2nd Ed. Pharmaceutical Press.
- Bamji MS, Rao NP & Reddy V. 2003. Textbook of Human Nutrition. Oxford & IBH.

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Elective Course FFT 554 : Fundamentals of Nutrition

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: FFT 502

Objective: To acquaint the students about importance of nutrition, balanced diets, therapeutic diets for health and role of food and nutraceuticals in health.

Course Content

UNIT I (7 lectures)
Introduction to human nutrition. Macronutrients and micronutrients - Classification and functions. Digestion, absorption and assimilation of nutrients. Energy metabolism- Components of energy expenditure, Basal Metabolic Requirements and Activity, Recommended Dietary Allowances, Food Groups, Concept of a balanced diet, Methods of evaluation of nutritive value of foods.

UNIT II (5 lectures)
Carbohydrates- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT III (5 lectures)

Proteins- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT IV (5 lectures)

Fat- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT V (8 lectures)

Vitamin- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

Minerals- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

Water and electrolytes- Concept and importance. Nutritional assessment and nutritional policies- Salient features, concept of community nutrition

Learning Outcomes: The students would be well informed about human nutrition concepts and various food groups after completing the course.

Reference books

- Nutrition Science by B. Srilakshmi
- Fundamentals of Foods & Nutrition by Sumati R. Mudambi
- Textbook of Nutrition : A Life cycle approach by Ravinder Chadha

Elective Course: FFT 557 Spices and Flavour Technology
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: FFT 502.

Objective: To impart basic knowledge about the importance and production technology of spices and to know chemistry and physiology of taste, flavouring compounds in foods

Course Content

Unit I (5 lectures)

Spice processing Introduction, classification, composition and functions. Standards specification of spices and flavours, Spice processing, spice reconditioning, spice grinding, post- processing treatments.

Unit II (7 lectures)

Processing of Major Spices: Pepper, cardamom, ginger, onion, garlic, vanilla, cinnamon, chilli and turmeric – method of manufacture; chemistry of the volatiles; enzymatic synthesis of flavour identical.

Unit III (5 lectures)

Processing of Minor Spices, herbs and leafy vegetables: processing and utilization, All spice, Annie seed, sweet Basil, Caraway seed, Cassia, Cinnamon, Clove, Coriander, cumin, Dill seed Fern seed nutmeg mint marjoram, Rose merry, saffron, sage.

Unit IV (5 lectures)

Spice extractives, Value added spice products: Spice volatile oils, spice oleoresins, Use of spice extractives, replacement of spices with oils and oleoresins, alternative products, Ground spices, processed spices, organic spices, curry powders.Packaging of spices and spice products

Unit V (8 lectures)

Chemistry and physiology of taste, flavouring compounds in foods, Separation, purification and identification of natural flavouring materials& Synthetic flavouring agents and their stability: Processing quality control of Savory, Thyme, Ajowan, Curry leaves, Asafoctida, Tea, Coffee, Cocoa, Vanilla and annatto. Flavours of soft drinks, Baking and confectionery industry.

Learning Outcomes: The students are expected to have learnt importance and production technology of spices and flavours.

Reference Books:

- Spices – vol. II Parry J. W.
- Spice and condiments Pruthi J. S.
- Herbs and spices by Rosemery Hemphill
- The book of spices by Rosen garten, F. and Livington Jr.
- Spices and herbs for the Food Inudstry by Lewies, Y.S.
- Spices Vol. I and II by Tropical Agril. Series. Purseglove, J. W. Brown E. G.,

- Green C. L. And Robbins SRJ. Food Flavourings P. R. Ashust.
- Food Flavouring composition,manafacture and uses. by J. Merrory

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Foundation Course: FFT 593 Communication Skills & Scientific Writing

Credits: (1-0-2-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Knowledge of basics of communication skills.

Objective:

To educate the students about kinds of communication, enhance their vocabulary and teach them types of formal writing used in academic research.

Course Content

Unit I 3 lectures

Advance Communication- Types of communication, Mass Communication, Levels of professional communication, Role of newspapers, radio, Cinema and TV, role of social media and networking

Unit II 2 lectures

Audio Visual Communication – Nature and scope of visual aids, use of Power Presentations in professional life

Unit III 3 lectures

Grammar usage and Word power – Phrase and Clauses, Idioms, Proverbs, Homophones, Homonyms, Reading and Comprehension.

Un**it IV** 2 lectures

Advance writing skills – Movie review, Book review

Unit V 5 lectures

Scientific Writing – Introduction to Technical writing, definition, types, characteristics, Report Writing, CV & Resume making, plagiarism

Practical:

- Sentence framing exercises - revision
- Writing descriptive paragraphs
- Dictionary consulting activities-Spell bee,
- Role Plays
- Movie viewing Sessions
- Book Reading sessions
- Impromptu Presentations
- Listening Practice
- Creating audio visual (AVs) using photographs
- Reading Scientific Texts
- Outlining a research

Learning Outcome: The course would have equipped the students with advance communication skills and basics of technical writing.

Reference Books

- Test your English Vocabulary in use, Michael McCarthy, Felicity O'Dell, Cambridge
- Wren &Martin, High School English Grammar and Composition, S.Chand, Paperback, 2005
- Oxford English Grammar Use, Micheal Swan & Catheirne Walter, Oxford University Press
- Using English in Science & Technology, Singh, R.K., Prakash Book Depot, Bareilly, 2000.

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SEMESTER III

Core Course FFT 601 : Processing of Cereals, Pulses and Oilseeds

Credits: (3-0-2-4)

Level: Post Graduate

Semester: Autumn

Pre-requisite: FFT 501 and FFT 502

Objective: To acquaint with production and consumption trends, structure, composition, quality evaluation, and processing technologies for product development and value addition of various cereals, pulses and oilseeds.

Course Contents:

UNIT I (8 lectures)
Wheat Technology: Composition of grain and environmental effects on its processing quality, enzymes of wheat and their role in the manufacture of wheat products; principles of wheat milling and its effect on composition of flour, aging of flour, byproducts, chemical improvers- bleaching and maturing agents, property of dough and its rheology, manufacture of wheat products bread, biscuits etc.; formulation of premixes for bakery products; pasta goods and processed cereal foods for infants.

UNIT II (10 lectures)
Rice Technology: Composition, type of proteins, starch content, amylose and amylopectin fractions; presence and effect of lipases; distribution of vitamins; minerals, and proteins in rice grain and its relation to milling; rice milling operations and its effect on nutritive value; cooking quality; byproducts of rice milling and their utilization; processed and prepared mixes based on rice.

UNIT III (8 lectures)
Legumes: Composition, anti-nutritional factors, processing methods, methods of cooking.

UNIT IV (10 lectures)
Corn Technology: Composition, processing of corn for manufacture of corn grits, meal and flour; manufacture of corn flakes, corn syrup, cornstarch, corn steep liquor, corn oil and canned corn.Composition and Processing of millets like barley, sorghum, oats etc.

UNIT V (9 lectures)
Oilseeds: Composition, processing of oilseeds as protein concentrations, properties and uses of oilseeds meals, technology vegetable protein isolates; Barrier compounds in the utilization of oil seed proteins. Low cost protein foods from oilseeds.

Practical

- Physico-chemical and rheological examination of wheat and its products test weight, kernel hardness, gluten content, milling tests.
- Evaluation of rice amylose and amylopectin determination, geletinization temperature, water absorption tests.
- Experimental parboiling and assessment of degree of polishing.
- Experimental baking of selected cereals products bread, biscuits.
- Preparation of protein concentrates and isolates and their evaluation for protein content and solubility.
- Determination of Yeast activity used in fermented cereal products.
- Quality test for wheat flour used in the baked products.
    - Maltose Number
    - Water Absorption
    - Sedimentation value
    - Alcohol Acidity
- Texture profile analysis of baked cereal food products by texture analyzer.

Learning Outcome: The students will have learnt about composition and processing of various cereals, pulses and oilseeds.

Reference Books

- Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.
- Dendy DAV & Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
- Hamilton RJ & Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.
- Hoseney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed. AACC.

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Core Course FFT 602 : Processing of Milk and Milk Products
Credits: (3-0-2-4)

Level: Post Graduate
Semester: Autumn

Pre-requisite: FFT 501

Objective: To acquaint with techniques and technologies of testing and processing of milk into various products and by products.

Course Contents:

UNIT I (12 lectures)

Introduction: Physicochemical properties of milk, Platform tests, Chemical composition and nutritive value of milk, Factors affecting composition of milk. Importance of milk industry in India: Collection, chilling, transportation, cream separation, standardization, pasteurization, sterilization, homogenization, packaging, storage and distribution of fluid milk, Ultrahigh temperature processed milk.

Preparation of various types of milks: Toned, homogenized, fortified, reconstituted and flavored milk.

UNIT II (12 lectures)

Technology of fermented milk products: Principles and practices of manufacture, packaging, storage and marketing of Dahi, cultured butter milk, acidophilus milk etc. Preparation of soft curd milk, vitaminized milk, standardized milk, filled milk and imitation milk.

Cheese: Manufacture of hard, semi hard, soft and processed cheeses. Storage, grading and marketing of cheese, cheese defects and their control. Butter: Manufacture, packaging, storage and marketing of butter; butter defects and their control, margarine.

UNIT III (8 lectures)

Technology of frozen milk products: Classification, manufacture, packaging, storage and marketing of ice cream, ices, sherbets etc. defects of frozen products and their control. Technology of evaporated and dried milk: Manufacture of evaporated milks and milk powders. Packaging storage defects and their control.

Technology of condensed milk: Manufacture of condensed milks, Packaging storage defects and their control.

UNIT IV (8 lectures)

Technology of dairy by products: Utilization of skim milk, buttermilk and whey for the manufacture of casein, lactose etc. Technology of indigenous milk products: Principles and practices of manufacture, packaging, storage and marketing of ghee, Khoa, Chhena, shrikhand, paneer, rasogulla, gulabjamun and Milk based foods.

UNIT V (5 lectures)

Sanitary aspects: of dairy plant building, equipment and their maintenance. Disposal of dairy plant waste. Application of membrane technology in dairy industry.

Practical

- Plat form test for raw milk
- Determination of moisture content in milk
- Determination of fat content in Milk powders and ice-cream products.
- Determination of Milk adulterants: Starch, Urea, Formaldehyde and Sugar,
- Hydrogen peroxide, salt and detergent
- Operation, cleaning and sterilizaiton of dairy plant machinery involved in fluid milk processing
- Preparation of toned, homogenized, fortified, reconstituted and flavored milks
- Manufacture of fermented milks.
- To study the kinetics of enzymes and manufacture of cheeses.
- Manufacture of butter
- Manufacture of ice- cream, ices, sherbets.
- Manufacture of casein, ghee, khoa, chhena.
- Sensory analysis of food products: Paired comparison test, Duo-trio test, Hedonic test, Triangle test, Ranking test, Single sample test, Composite scoring test,
- Analysis of water used in food industries i.e. Alkalinity, Acidity, Hardness, pH, TPC and Coliform count

Learning Outcomes: After completion of course students are expected to have an understanding of processing methods of milk in a dairy industry and manufacturing of dairy products.

Reference Books

- Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. Technology of Indian Milk Products. Dairy India Publ.
- De S.1980. Outlines of Dairy Technology. Oxford Univ. Press.
- Rathore NS et al. 2008. Fundamentals of Dairy Technology - Theory & Practices. Himanshu Publ.

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Core Course: FFT 603 Quality control Food Standards and Food Laws
Credits: (3-0-0-3)

Level: Post Graduate
Semester: Autumn

Pre-requisite: FFT 601

Objective: To acquaint with food quality parameters and control systems, food standards, regulations, specifications.

Course contents:

UNIT I (5 lectures)
Quality Assurance: Introduction, Importance and Difference. Food Quality and Food Safety: Scope and difference.

UNIT II (12 lectures)
Raw materials & Finished product quality: Quality parameters and evaluation procedures: Appearance, color, texture, viscosity, consistency, flavor.
Sensory evaluation: Selection of panel of judges, sensory characteristics of foods, types of tests.

UNIT III (12 lectures)
Food standards and laws: International – Concept of Codex alimentarius, HACCP, GMP, GHP, USFDA, ISO 9000, ISO 22000, ISO 14000. National – Introduction of BIS/IS, Food Safety and standards – 2006, Food Safety and standard regulation 2010, FPO, MPO, MMPO, Agmark. Prevention of food adulteration Act: Food Adulteration: definition, common adulterants in different foods, contamination, methods of detection. Food additives and legislation; coloring matter, preservatives, poisonous metals, antioxidants and emulsifying and stabilizing agents, insecticides and pesticides. PFA specification for food products, Nutritional labeling

UNIT IV (6 lectures)
Quality Certification & Accrediation: Introduction and procedure.

UNIT V (10 lectures)
Water Quality: Water standards and Analysis physical, chemical and microbiological characteristics of water analysis. Waste treatment: Fundamentals of Physical, Biological & Chemical waste treatments

Learning Outcome: The students must have an understanding about food laws and standards, quality parameters and sensory evaluation of food.

Reference Books

- Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Krammer A & Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ

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Elective Course FFT 651 : Entrepreneurship in Food Processing
Credits: (2-0-0-2)

Level: Post Graduate
Semester: Autumn

Pre-requisite: Completed basic course on Food Processing.

Objective: To enable the student to plan and prepare a project report for food processing unit and to provide capability to execute and evaluate the same and to introduce students to the methodology of project formulations and the implementation procedures and strategic planning of new projects.

Course contents:

UNIT I (6 lectures)
Aggregate Planning-: General design considerations, Financial Analysis, plant location and plant layout, Flowcharts and their design, equipment selection

UNIT II (4 lectures)

Design of service facilities

UNIT III (4 lectures)

Human resource planning: Planning and design of marketing system, worker's safety and plant hygiene

UNIT IV (6 lectures)

Introduction to Marketing and economics: Demand, Supply, Sample survey techniques, marketing information, consumer trends, consumer behavior.

UNIT V (10 lectures)

Introduction to Operations Research: Definition, applications. Inventory control, Linear Programming. Queuing Theory, Transportation and Assignment. Forecasting

Learning Outcome: The students would have been acquainted with designing and planning of food plant layout and operations research.

Reference Books

- Chandra P. 2005. Project Management. Tata McGraw Hill.
- Gopal Krishan P & Nagarajan K. 2005. Project Management. New Age.
- Hisrich RD & Peters MP. 2002. Entrepreneurship. Tata McGraw Hill.
- Kaplan JM. 2003. Patterns of Entrepreneurship. John Wiley & Sons.
- Nandan H. 2007. Fundamentals of Entrepreneurship Management. Prentice Hall.

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Elective Course: FFT 652 Food Fermentation and Microbial Technology

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Must have completed one course / paper on Microbiology / Food Microbiology.

Objective: To familiarize about the various microbial processes/systems/activities which have been used for the development of industrially important products/processes.

Course Content

Unit I (6 lectures)

Fermentation: History, definition and types. Study of a Bio fermentor – its design and operation, Down Stream Processing and Product recovery. Its measurement and control in fermentation, Aeration and agitation in fermentation: Oxygen requirement, sterilization of air and media; scale up in fermentation.

Unit II (6 lectures)

Recovery of particulate matter, product isolation, distillation, centrifugation, whole broth processing, filtration, aqueous two-phase separation, solvent extraction, chromatography and electrophoresis.

Unit III (8 lectures)

Production of alcoholic beverages, organic acids, enzymes and immobilization of enzymes. Biological waste treatment.

Unit IV (4 lectures)

Dairy Fermentations-starter cultures and their types, concept of probiotics.

Unit V (6 lectures)

Microbial enzymes, role in various industrial processes, Bio-transformations, Immobilized enzymes based bioreactors; production of antibiotics, vaccines, and biocides; Bioconversion of substrates, anti-nutritional factors present in feeds; Microbial detoxification of aflatoxins; Bioinsecticides; Biofertilizers.

Learning Outcome: The course will make the students learn about fermentation techniques and industrial microbiology.

Reference Books

- Huffnagle GB & Wernick S. 2007. The Probiotics Revolution: The Definitive Guide to Safe, Natural Health. Bantam Books.
- Nout RMJ, de Vos WM and Zwietering MH. 2005. Food fermentation. Wageningen Academic Publishers, Netherlands.

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Elective Course: FFT 653 Food Rheology
Credits: (2-0-0-2)

Level: Post Graduate
Semester: Autumn

Pre-requisite: FFT 508

Objective: To explain the basics of food rheology and to familiarize the students with rheological instruments and their use in relation to food products.

UNIT I (6 lectures)

Food rheology and structure: stress and strain tensors, viscometric properties, shear stress-shear rate relationships, units in rheological measurements, types of fluid flow behaviour, apparent viscosity, intrinsic viscosity, stress-strain behaviour of solid foods, linear viscoelasticity, phase transitions in foods.

UNIT II (6 lectures)

Flow and functional models for rheological properties of fluid foods: Time independent flow behaviour, Apparent viscosity- shear rate relationships of shear- thinning foods, models for timedependent flow behaviour, role of solids fraction in rheology of dispersions, affect of temperature on viscosity, treatment of rheological data using models.

UNIT III (6 lectures)

Tube viscometry, Rotational viscometry: introduction

UNIT IV (6 lectures)

Viscoelasticity: introduction, transient tests for viscoelasticity, oscillatory testing. Rheology of food gum and starch dispersions: effect of heating, effect of sugar and protein, rheological behaviour of starch, rheology of starch- gum dispersions.

UNIT V (6 lectures)

Rheological behaviour of processed fluid, semisolid foods and food gels: rheological tests to evaluate properties of gel systems, gel point and sol-gel transition by rheological measurements.
Application of rheology to fluid food handling and processing

Learning Outcome: It is expected that the students would have learnt concepts of rheology and structure of food systems.

Reference Books

- Bourne MC. 2002. Food Texture and Viscosity: Concept and Measurement. Academic Press
- Deman JM. et al. 1976. Rheology and Texture in Food Quality. AVI Publ.
- Mohsanin NN.1989. Physical Properties of Plant and Animal Material. Vol. I, II. Gordon and Breach Science Publ.
- Steffe JF. 1992. Rheology and Texture in Food Quality. AVI Publ.

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Elective course: FFT 654 Food Product Development
Credits: (2-0-0-2)

Level: Post Graduate
Semester: Autumn

Pre-requisite: Basic knowledge of Food Science.

Objective:

To acquaint the students about the need, types, basic technique and details of food product development to plan nutritious products.

Course Content

UNIT I (6 lectures)

Concept of product development - product success and failure, factors for success, process of product development, managing for product's success. Innovation strategy - possibilities for innovation, building up strategy, product development programme.

UNIT II (5 lectures)

The product development process - product strategy, product design and process development, product commercialization, product launch and evaluation.

UNIT III (6 lectures)

The knowledge base for product development technology - knowledge and the food system, knowledge management, knowledge for conversion of product concept to new product, technological knowledge (product qualities, raw material properties, processing, packaging requirement, distribution and marketing.

UNIT IV (5 lectures)

Role of consumers in product development - consumer behaviour, food preferences, avoiding acceptance, integration of consumer needs in product development and sensory needs.

UNIT V (8 lectures)

Managing the product development process, - principles of product development management, people in product development management, designing the product development process, key decision points, establishing outcomes, budgets and constraints, managing and organizing

product development process, innovative matrices, striving for continuous improvement, Improving success potential of new products, market exploration and acquisition, Legal aspects of new product launch.

Learning Outcome: The course must have acquainted the students with principles of food product design and development.

Reference Books:

- Clarke & Wright W. 1999. Managing New Product and Process Development. Free Press.
- Earle R, Earle R & Anderson A. 2001. Food Product Development. Woodhead Publ.
- Fuller 2004. New Food Product Development - from Concept to Market Place. CRC.

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Elective Course: FFT 655 Advanced Food Analysis

Credits: (1-0-1-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Must have completed one course / paper on Basic Food Analysis.

Objective: To develop an understanding of instrumental techniques in food analysis used for determination of food quality parameters.

Course Content

Unit I (2 lectures)

Concepts of food analysis. Rules and regulations of food analysis.Sample preparation for food analysis.Measurement of colour and water activity of raw and processed foods.

Unit II (3 lectures)

Determination of browning reaction in foods, food additives, residues and deleterious factors in raw and processed foods. Measurement of enzymatic changes in foods. Sugar profiling of foods through Bioscan.

Unit III (3 lectures)

Measurement of viscosity/texture in food products. Rheological techniques and instrumentation in food. Microscopic, Fluorimetric and polarimetric techniques in food analysis.

Unit IV (4 lectures)

Application and operating parameters of spectrophotometer, AAS (Atomic absorption spectroscopy), Inductively coupled plasma optical emission spectroscopy (ICP-OES), NMR (nuclear magnetic resonance), FTIR (Fourier transform infrared spectroscopy)

Unit V (3 lectures)

Application and operating parameters of GC (Gas chromatography), HPLC (high performance liquid chromatography),GC-MS (gas chromatography- mass spectroscopy), LC-MS (liquid chromatography-mass spectroscopy).

Practical

- Sample preparation of food analysis
- Measurement of enzymatic changes in foods
- Sugar profiling of foods through Bioscan.
- Determination of Rheological properties by using texture analyzer

- Pasting properties of foods through RVA
- Working and operation of UV Visible Spectrophotometer
- Determination of Minerals through AAS
- Determination of heavy metals through ICP-OES
- Working and operation of HPLC, GC
- Qualitative analysis of compounds by chromatography techniques: Thin layer Chromatography, Paper Chromatography

Learning Outcome: The students would have been acquainted with application and working of Advance food analysis techniques.

Reference Books:

1. Nielson S S(2017). Food Analysis.Fifth edition. Springer, New York.
2. Clifton M and Pomeranz Y (1988)Food Analysis - Laboratory Experiments. AVI Publ.
3. Leenheer AP, Lambert WE and van Bocxlaer JF (2000)Modern Chromatographic Analysis of Vitamins. 3rd Ed. Marcel Dekker, New York.
4. Nollet LML (2004) Handbook of Food Analysis. Vol. I. Marcel Dekker, Switzerland.
5. Handbook of Analytical Techniques by Helmut Gunzler and Alex Williams
6. The Chemical Analysis of Foods and Food products By Morris b. Jacobs

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Foundation Course: FFT 691 Workplace Skills
Credits: (1-0-2-2)

Level: Post Graduate
Semester: Autumn

Pre-requisite: Understanding of basics of communication skills.

Objective: To enable students to have firm grounding in English to be able to use it effectively in professional as well as social contexts and have good job seeking skills to work in the fiercely competitive job market.

Course Content:

Unit I 3 lectures

Business communication - Job Application, Business Letters, Cover letter, Writing Emails, Minutes writing, Project report

Unit II 2 lectures

Effective job seeking skills - Needed documentation, Application process, Preparing for the interview, Post interview process, Job interview question model,.

Unit III 3 lectures

Professional Practices and Ethical Codes- Work Ethics, Code of Conduct, Protocol, Motivation, Leadership, Formal writing

Unit IV 2 lectures

Presentation & public speaking skills – The art of listening, active listening**,** Presentation skills, public speaking

Unit V 5 lectures

Behavioral skills – Teamwork, Time management, Problem-solving Skills, Interpersonal & negotiation skills, building customer relations, Body language, Stress & Anger management

Practical:

- Oral presentations
- Using visual aids while presentations
- Critical Reading & Writing
- Mock interview
- Group discussions
- Team building exercises
- Proofreading and editing emails
- Cover letter drafting
- Resume-making
- Drafting reports

Learning Outcome: The course must have acquainted the students with communication and public speaking skills specially for interviews and group discussions.

Reference Books

- Barun K Mitra, Personality Development and Soft Skills, Oxford Higher Education
- Gopalawamy Ramesh and Mahadevan Ramesh, The Ace of Soft Skills, Pearson Education
- T. Anchukandam and J. Kuttainimathathil (Ed) Grow Free Live Free, Krisitu Jyoti Publications, Bangalore (1995)
- Mani Jacob (Ed) Resource Book for Value Education, Institute for Value Education, New Delhi 2002.
- T.N. & L.A. Olson Technical Writing & Professional Communication for Non-native speakers of English, McGraw-Hill, NY, 1991.

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Core Course FFT 604 Training and Workshop
Credits: (0-0-4-2)*

Level: Post Graduate
Semester: Autumn

Pre-requisite: Completed basic course in Food processing
*** Non Credit requirement**

FFT 641 Seminar (0-0-2-1)

SEMESTER IV

FFT 646 Thesis (0-0-40-20)

Revised

Syllabus

of

B. Voc.in Food Processing and Technology

Centre of Food Technology

Institute of Professional Studies

University of Allahabad

Revised November 2022

Revised Course Structure of B.Voc.in Food Processing & Technology

Semesters	Paper Code		Title of Paper	Skill/ General Education Courses	Credits			
					L	T	P	Total
Sem I	**FFT 121**		Introduction to Food Processing	Skill	3	0	2	5
	FFT 122		Food Science	Skill	3	0	2	5
	FFT 128		Food Quality and Analysis- I	Skill	3	0	2	5
	FFT 124		Food Hygiene and Sanitation	Skill	3	0	2	5
	FFT 101		Communication and Documentation Skills	Gen Ed.	3	0	1	5
	FFT 152		Introduction to Biosciences	Gen Ed.	3	1	0	5
	FFT 107		Basic Concepts in Laboratory Techniques	Gen Ed.	0	0	2	2
	QP-FIC/Q7601		**Assistant Lab Technician**	**NSQF-4**				*
			TOTAL		**18**	**1**	**11**	**30**
Sem II	**FFT 123**		Introduction to Food Microbiology	Skill	3	0	2	5
	FFT 125		Food Processing Equipment	Skill	3	0	2	5
	FFT 126		Technology of Processed and Preserved Foods	Skill	2	0	2	4
	FFT 127		Introduction to Food Quality Management	Skill	3	0	1	4
	FFT 102		Environmental Studies-I	Gen Ed.	2	0	1	3
	FFT 104		Introduction to Computer Application	Gen Ed.	2	0	1	3
	FFT 206		General Biochemistry	Gen Ed.	3	0	1	4
	FFT 130		Industrial Training-I for 15 days	Skill	0	0	2	2
	QP-FIC/Q7605		**Technical Lead - Food Analysis**	**NSQF-5**				*
			TOTAL		**18**	**0**	**12**	**30**
Sem III	**FFT 221**		Unit Operations in Food Processing	Skill	3	1	0	4
	FFT 222		Basic Food Chemistry	Skill	2	0	2	4
	FFT 223		Food Quality and Analysis- II	Skill	2	0	2	4
	FFT 224		Cereals, Pulses and Oilseed Technology	Skill	3	0	2	4
	FFT 229		Bakery and Confectionery Products	Skill	3	0	1	4
	FFT 203		Communication Skills and Technical Writing	Gen Ed.	3	2	0	4
	FFT 205		Environmental Studies - II	Gen Ed.	3	1	0	4
			TOTAL		**19**	**4**	**7**	**30**
Sem IV	**FFT 225**		Human Nutrition	Skill	3	1	0	4
	FFT 226		Fruits and Vegetable Technology	Skill	2	0	2	4
	FFT 227		Introduction to Food Packaging	Skill	2	0	1	3
	FFT 228		Dairy Technology	Skill	2	0	1	3
	ELECTIVE-II (Any One)	**FFT 251**	Technology of Meat, Fish and Poultry	Skill	3	0	1	4
		FFT 252	Flavour Technology					
		FFT 253	Fermentation Technology					
	FFT 201		Crop Production: Concepts and Practices	Gen Ed.	3	0	0	3
	FFT 202		Food Business Management	Gen Ed.	3	0	0	3
	FFT 207		Statistics and Data Analysis	Gen Ed.	3	1	0	4
	FFT 230		Industrial Training-II for 15 days	Skill	0	0	2	2
	QP-FIC/ Q7007		**Quality Assurance Manager**	**NSQF-6**				
			TOTAL		**21**	**2**	**7**	**30**
Sem V	**FFT 321**		Principles of Food Engineering	Skill	1	2	1	4
	ELECTIVE-III (Any One)	**FFT 351**	Post-Harvest Management of Fruits and Vegetables /	Skill	2	0	1	3
		FFT 352	Food Beverage Technology /	Skill				
		FFT 353	Technology of Indigenous milk Products	Skill				
		FFT 354	New Product Development and Sensory Science	Skill				
	FFT 322		Waste Management and Effluent Treatment	Skill	3	1	0	4
	FFT 323		Food Laws and Regulations	Skill	3	1	0	4
	FFT 324		Food Plant Design and Layout	Skill	3	1	0	4
	FFT 301		Disaster Management	Gen Ed.	3	2	0	5
	FFT 303		Introductory Biotechnology	Gen Ed.	3	0	1	4
	FFT 330		Seminar	Skill	0	0	2	2
			TOTAL		**18**	**7**	**5**	**30**
Sem VI	**FFT 325**		Quality Assurance and Certification	Skill	3	0	0	3
	FFT 306		Human Values and Ethics	Gen Ed.	4	0	0	4
	FFT 307		Project Management and Entrepreneurship	Gen Ed.	3	2	0	5
	FFT 340		Project Work for 3 months	Skill	0	0	18	18
	QP-FIC/ Q9002		**Food Regulatory Affairs Manager**	**NSQF-7**				
			TOTAL		**10**	**2**	**18**	**30**
			G. TOTAL		**103**	**16**	**61**	**180**

*** Non-credit requirement; Qualification Pack (QP) as recommended by Sector Skill Council (FICSI).**

SEM-I

Skill Course FFT 121:Introduction to Food Processing

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint with principles of different techniques used in processing and preservation of foods.

Course Content

UNIT I 5 lectures

Introduction: Definition and scope of Food Science and Technology, Sources of food, scope and benefit of industrial food preservation, perishable, non perishable food, causes of food spoilage.

UNIT II 15 lectures

Thermal processing methods of preservation: Principle: Canning, blanching, pasteurization, sterilization, evaporation.

Use of low temperature: Principle and effect on quality. Chilling, cold storage, freezing.

Preservation by drying dehydration and concentration: Principle, Methods and effect on quality.

Preservation by radiation: Definition, Methods of Irradiation, Direct & Indirect effect, measurement of radiation dose, dose distribution, effect on microorganisms.

UNIT III 5 lectures

Presentation of foods by Preservatives: chemicals, antioxidants, mould inhibiters, antibodies, acidulates etc.

Preservation by salt & sugar: Principle, Method and effect on food quality.

UNIT IV 5 lectures

Preservation by fermentation: Definition, Advantages, disadvantages.

UNIT V 15 lectures

Recent methods in preservation: Pulsed electric field processing, High pressure processing, processing using ultrasound, dielectric, ohmic and infrared heating.

Practical

- Introduction to food laboratory.
- To study the effect of enzymatic browning in fruits and vegetables.
- To study different types of blanching of fruits and vegetables.
- Preservation of food by canning.
- To perform cut out analysis of caned product.
- Preservation of food by high concentration of sugar i.e. jam.
- Preservation of food by high concentration of salt/acid i.e. pickle.
- Preservation of food by addition of chemicals i.e. tomato ketchup.
- Preservation of food by drying in a cabinet drier.
- Preservation of fruits & vegetables by freezing.
- Preservation of milk by pasteurization and sterilization.

Reference Books:

- Food Processing Technology by P.J.Fellows, Woodhead publishing ltd.
- Food Science by N.N. Potter, CBS publishing.
- Physical principles of Food Preservation. Vol. II by M. Karel, O.R. Fenema and D.B. Lurd,Maroel, Dekker Inc. New York.
- The technology of food preservation by N.W.Desrosier and J.N. Desrosier, CBS publishing.

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Skill Course FFT 122 : Food Science

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To impart knowledge of various areas related to Food science and technology.

Course Content

UNIT I 14 lectures

Introduction to Food Science*:* Historical development of food science and technology, Evolution of Food Processing from prehistoric times till date, Introduction to various branches of Food Science and Technology

Cereals and Millets: Wheat- structure and composition, types (hard, soft/ strong, weak). Process of malting, Gelatinization of starch, types of browning. Rice- Composition of rice obtained by different dehusking methods, parboiling of rice- advantages and disadvantages. Millets -Varieties, composition and uses of maize, sorghum, barley, rye, oats, triticale, pearl millet and finger millet.

Pulses: Introduction, common names and scientific names of different pulses. Chemical composition of pulses, processing of pulses- soaking, germination, decortications, cooking and fermentation.Toxic constituents in pulses and its detoxification processes.

UNIT II 6 lectures

Fats and Oils: Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids. Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, and hydrogenation. Rancidity - hydrolytic and oxidative rancidity and its prevention. Definition margarine, butter, hydrogenated vegetable oil, lard.

UNIT III 8 lectures

Fruits and Vegetables: Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments. Post harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes during the storage of fruits and vegetables.

UNIT IV 12 lectures

Flesh Foods - Meat, Fish, Poultry: Meat - Definition of carcass, composition of meat, concept of red meat and white meat. Fish - Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish, spoilage of fish. Poultry - Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality.

Milk and Milk Products: Definition of milk, typical chemical composition of milk of different species i.e. buffalo, cow, goat. Composition of milk, its constituents, various steps in processing of milk. An overview of types of market milk and milk products-cheese, paneer, ice cream, ghee, butter, flavoured milk, imitation milk.

Condiments and spices: Composition and importance of spices.

UNIT V 5 lectures

Sensory evaluation of food: Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duo-trio test, triangle test, hedonic scale, chemical dimension of basic tastes.

Practical

- To study the gelatinization temperature range and % sag of various cereal starches.
- To study the factors affecting gelatinization of cereal starches.
- To study germination of whole pulses and legumes.
- To study fermentation in cereals and pulses.
- To study non-enzymatic browning; caramelization in various sugars.
- To detect the adulteration in fats and oils by qualitative tests.
- To detect the presence of adulterants in milk.
- To perform the recognition test for the four basic tastes.
- To perform the sensitivity / threshold tests for four basic tastes.
- To recognize few odors and to learn to memorize them.

Reference Books:

- Food Science by B. Srilakshmi, publishing, New Age International (P) ltd. publications.
- Food Science by N.N. Potter, CBS publishing.
- Food Science by S. Manay, New Age International (P) ltd. publications.

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Skill Course FFT 128 : Food Quality and Analysis I

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Spring

Pre-requisite: Course in Food processing

Objective:

To learn about physical and chemical contaminants in foods.

Course Content:

UNIT I 5 lectures

Introduction to food quality: Definition, quality concepts, quality attributes (safety, sensory, shelf life, convenience, extrinsic attributes), factors affecting food behaviour.

Sampling techniques of food and water

UNIT II 15 lectures

Methods for food analysis: Estimation of carbohydrates, protein, fat, vitamins and minerals

Contamination in Food- : Physical, chemical (heavy metals, pesticide residues, antibiotics, veterinary drug residues, dioxins, environmental pollutants, radionucleocides, solvent residues, chemicals)

UNIT III 5 lectures

Natural toxins. Contaminants formed during processing – nitrosamines, acrylamide etc. natural food contaminants and contaminants form packaging materials.

UNIT IV 15 lectures

Food Additives: Introduction, need of food additives in food processing and preservation. Characteristics and classification of food additives.Safety and quality evaluation of additives and contaminants, Acute and chronic studies, NOEL, ADI, LD50.Colour:Introduction, importance, classification- artificial and natural. Use of plant tissue culture, polymeric colorsetc for color.

Sweeteners- Introduction, importance, classification- natural and artificial, chemistry, technology and toxicology, consideration for choosing sweetening agents.

Antimicrobial agents. -Nitrites, sulphides, sulphur-di-oxide, sodium chloride, hydrogen peroxide.

Antioxidants - Introduction, mechanism of action, natural and synthetic anti-oxidants, technological aspect of antioxidants.

UNITV 5 lectures

Food Adulteration: Definition, types of adulterants and their detection.

Practical

- Preparation of standard solutions for the chemical analysis i.e. HCl, H_2SO_4, $KMnO_4$, Sodium Thiosulphate and Iodine.
- Determination of proximate composition of food- moisture, protein, crude fat, crude fiber, ash, total carbohydrates and Calorific Value by standard AOAC procedures
- Determination of minerals in food products: Calcium by Titration, Phosphorus by Spectrophotometer, Iron by Spectrophotometer,
- Determination of pH and total acidity of various food samples.
- Determination of total sugars, reducing and non-reducing sugars in various food samples.
- Detection of adulterants in various food(turmeric, red chilli, coffee, honey, flour)etc.

Reference Books:

- Hand Book of Food Analysis by Nollet&Toldra, CRC publishing ltd.
- Hand Book of Analysis & Quality Control for Fruit & Vegetable Products by Rangana, Tata Mcgraw hill publishing.
- Introduction to the chemical analysis of foods by Nielson, CBS publishing.

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Skill Course: FFT 124Food Hygiene and Sanitation

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

The knowledge and skills required to produce healthy meals for the family with regard to safety, effective organisation and management of family resources, and the needs and lifestyles of family members

Course Content

UNIT I 5 lectures

Principles of hygiene and its relation to food preparation.

UNIT II 10 lectures

General hygienic and sanitary practices to be followed by different food business operators - fruits and vegetable, milk and milk product, meat and meat product, catering etc.

UNIT III 10 lectures

General hygienic and sanitary requirements for different areas - location and surroundings, layout and design of food establishment premises, equipment & containers, facilities, food operations and controls, management and supervision, food testing facilities, audit, documentation and records, sanitation and maintenance of establishment premises, personal hygiene, product information and consumer awareness, training.

UNIT IV 10 lectures

Water quality - water standards and analysis of physical, chemical and microbiological characteristics of water.

UNIT V 10 lectures

Waste treatment - fundamentals of physical, biological & chemical waste treatments.

Practical

- Analysis of water used in food industries
  - Determination of acidity of the given sample of water.
  - Determination of alkalinity of the given sample of water.
  - Determination of the total hardness of Water.
  - Determination of pH of the given sample of Water.
  - Determination of Conductivity of the given sample of Water.
  - Determination of Total Solids of the given sample of Water.
  - Determination of Total Dissolved Solids of the given sample of Water.
  - Determination of Turbidity of the given sample of Water.
- Assessment of surface sterilization using swab and rinse method.
- Case Study of food hygiene and sanitation (GMP/GHP) of a food industry.
- Preparation of HACCP Plan

Reference Books:

- Food plant sanitation – Packer and Litchfield (Reinhold Publ.)
- Handbook of analysis and quality control for fruits and vegetables products by S. Ranganna, Mcgraw Hill Pub. Co. New York.

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General Education Course FFT 101 :Communication and Documentation Skills

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: Basic knowledge of English

Objective

To equip the students with skills to write to communicate and articulate in English (verbal as well as writing) and to acquaint the students with the knowledge and use of computers and to introduce the basic principles, organization and operational aspects of computers.

Course Content

UNIT I 10 lectures

Introduction to Communication & Grammar : Consonant & Vowel Sounds, Indianism, Syllable & Syllable Stress, Determiners, Articles, Tense & Time, Preposition, Prepositional Phrases, Subject-Verb Agreement, Active – Passive Voice, Intonation & Modulation, Conjunctions

UNIT II 10 lectures

Formal Writing Skills: Composition Writing: Business Letters (Functions of a Business Letter, Layout of a Business Letter, Salient Features of a Business Letter, Kinds of Business Letter, Application Writing)

UNIT III 10lectures

Conversation Skills: Nature of Conversation, Purpose of Conversation, Guidelines for Effective Conversation Skills, Proverbs used in Everyday Conversation with their Meanings/Explanations

UNIT IV 5 lectures

Documentation Skills: Introduction to Documentation: Meaning, Purpose, Need.

UNIT V 10 lectures

A short introduction to Computers, digitalized era, global connection via net, Drafting of Text, Excel, E Mails, Making Presentations, MS Word

Practical

Communication Skills

- Verbal & Non Verbal Communication
  Verbal Communication - Extempore, Just a Minute, Declamation, Dialogue, Monologue
  Non verbal Communication - Guess the Mime, Dumb Charades, Formal & Informal Writing, Facial Expressions, Dressing & Clothing
- Oral Communication - Day to today talk, formal talk, informal talk, conversation
- Body Language
  Right body postures, Eye Contact, Pet Fiddles, how to walk, talk and present oneself.
- Group Discussion Skills(Meaning, Characteristic, Do's & Don'ts, Relevance, Moderating a group Discussion
- Presentation Skills - Confidence, Effective Delivery of ideas, Convincing the audience, basic courtesies
- Public Speaking - Oration, Debates
- English Movie Sessions

Documentation Skills

- Basics of Computers, usage of short cut keys, taking out print outs, page set ups.
- Making of Power point Presentation
- E- Mail (Subject line, salutation, subscription, how to mark cc, drafting, sending of mails, reverts, forwarding of mails, attaching pictures and documents, attaching ppts
- Differentiation between hardware and software and practical usage of both.
- Diagrammatic representation of pie-charts, tabular presentation of data/info, Etc
- Basic use of MS Excel/Spread Sheets

Reference Books:

- High School English Grammar and Composition - Wren & Martin, Publisher - Churchill Livingstone
- Anthology of English Language and Communication Skills - Sharma S R, Jacob, Mark Publications
- Language and Communication Skills - Shastri, Rameshchandra, ABD Publications
- A Course in Academic Writing - Renu Gupta, Orient Blackswan Publications.

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General Education Course FFT 152 : Introduction to Biosciences

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Restrictions: The course is compulsory only for students with maths background

Objective:

Fundamentals of Bioscience is based on the structural organisation of the human body and the general functions of the body systems, emphasizing the relationship between structure and function.

Course Content:

UNIT I 10 lectures

Level of organization in life (water to protein).

UNIT II 10 lectures

Cytology - cell composition, structure and function.

UNIT III 10 lectures

Animal systems and plant physiology with introductory food biochemistry.

Plant and animal taxonomy - With reference to edible groups and their identification.

Domestication, improvement and disease control of animal and plants species.

UNIT IV 15 lectures

Economic biology - Cereals, pulses, fruits, Vegetables, Beverages, Meat, Dairy, Piggery, aquaculture, and other edible animal and plant product.

Introduction of Ecology and environment of edible species of plant and animals.

UNIT V 15 lectures

Brief introduction of genetics and evolution of Taxa with human interaction.

Plant and animal breeding, genetic engineering and GM Food (a brief introduction).

Reference Books:

- Biosciences by Taylor, Cambridge University Press.
- Biology by Storer, Viva publishing.

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General Education Course FFT 107 : Basic Concepts in Laboratory Techniques Practical

Credits: (0-0-2-2)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with handling and analyzing the high end euipments and to learn the concept and principles of food analysis euipments.

Course Content

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware

Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution, Handling techniques of solutions; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values.

Preparation of different agro-chemical doses in field and pot applications

Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability

Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

General Laboratory Safety: Preparing for laboratory work, during laboratory work andcleaningupbefore leaving, General Characteristics & procedure for handling & storage of hazardous materials and control of hazards.

Reference Books

- Furr A.K. 2000. CRC Hand Book of Laboratory Safety. CRC Press.
- Gabb M.H. &Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co

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SEMESTER-II

Skill Course FFT 123 :Introduction to Food Microbiology

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food.

Course Content

UNIT I 10 lectures

Introduction of microbiology, History and significance of food microbiology.

Classification of microbes, Structure of microbes, Metabolism of microbes.

UNIT II 5 lectures

Environmental microbiology: microbiology of air and water.

UNIT III 5 lectures

Food contamination and public health: food poisoning

UNIT IV 15 lectures

Food microbiology and spoilage of fruits and vegetables, milk and milk products, cereals and cereal products.

Industrial microbiology: Industrial application of microbes.

UNIT V 10 lectures

Thermal inactivation of microbes: pasteurization, sterilization etc. concept of TDT, F, Z and D values. Factors affecting heat resistance.

Antimicrobial agents: mechanism and action

Practical

- An introduction to microbiology, aseptic technique and safety.
- Preparation of culture media.
- To sterilize the media and equipment.
- To prepare serial dilutions.
- Plating techniques
- Culturing the bacteria on a solid media by using serial dilution method and determining the number of viable cells in the culture (standard plate count).
- Introduction to microscopy and to study cell morphology with simple staining.
- To study cell morphology and cell arrangement with negative stain.
- To stain bacteria with gram stain.
- To stain bacterial cells by wet-mount technique to check the mobility (flagellin) in bacterial cell.
- To stain bacterial cells with malachite green stain to check the presence of endospore.

Reference Books:

- Food microbiology by V. Ramesh, MJP publishing.
- Food microbiology by W.C. Frazier, Ist Edition by Mcgraw Hill Pub. Co. New York.
- Modern Food Microbiology, J.M. Jay. CBS publisher.

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Skill Course FFT 125 : Food Processing Equipments

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Spring

Pre-requisite: Course in Food processing (FFT 321)

Objective

Plan and carry out a course of action demonstrating the ability to manage time, money, energy/effort, energy/fuel, ingredients and equipment, according to a given situation

Course Content

UNIT I 5 lectures

Principle considerations of agricultural and food Processing Equipments.

UNIT II 15 lectures

Food Processingequipments:Types and Principle of dryers.

Types of heat exchanger, Principle of heat Exchangers and Evaporators, pasteurizer, Blancher, Retorts and boilers.

Low Temperature processing equipment: Refrigeration system and freezer.

UNIT III 5 lectures

Material handling equipments like belt conveyor, screw conveyor, bucket elevator and pneumatic conveyors.

UNIT IV 10 lectures

Mechanical separation: filtration, sieving, centrifugation sedimentation;

UNIT V 10 lectures

Equipments for size reduction, Mixing, and Extrusion etc.

Practical:

- Study of dryers, and its efficiency ;
- To study elevating and conveying equipment's,
- Sieve analysis and determination of its efficiency.
- To study extrusion technology and pasta making.
- Mixing index determination for solid mixing
- Visit to food processing plants.

Reference Books

- S. K. Sharma, S.J.Mulvaney, and S.S.H.Rizvi, Food Process Engineering: Theory and Laboratory Experiments, Wiley and Sons, 2000
- H. Pandey, H.K. Sharma, R.C.Chouhan, B.C. Sarkar and M.C. Bera, Experiments in Food Process Engineering, CBS Publishers and Distributors, 2004
- M.A. Rao, S.S. H.Rizvi and A.K.Dutta, Engineering properties of Foods, 3rd ed., Marcel Dekker, 2005.

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Skill Course FFT 126 :Technology of Processed and Preserved Foods

Credits: (2-0-2-4)

Level: Undergraduate food products, operating& maintenance the modern equipment's& machineries, Make different processed food products with quality assurance, and Process of Packaging, Storing & marketing.

Course Content

UNIT I 5 lectures

An overview of types of processed fruit and vegetable Products: juice, squashes, RTS, sauce, ketchup, jam, jelly, marmalade etc.

UNIT II 5 lectures

Pickles and chutneys: Preparation of various types of pickles- theory and practice; preparation of sauces and chutneys.

UNIT III 5 lectures

Pectin: Raw materials; processes and uses of pectin.

Vinegar: Types, General methods of preparation.

UNIT IV 5 lectures

Cereal products: Wheat, Rice, Legumes and Oil seeds: Composition, general processing and their products etc.

UNIT V 10 lectures

Definition of milk, colostrums, factors affecting composition of milk. Constituents of milk.Transportation, reception, grading and general processing of milk.An overview of types of market milk and milk products.

Meat - post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat.

Practical

- Dehydration of fruits & Vegetables
- Preparation of Jelly, Marmalades, Sauce and Squash
- Pectin estimation
- Milling of rice with emphasis on quality and recovery.
- Gluten content estimation
- To conduct the platform tests of milk sampling of dairy products.
- Determination of moisture and protein of milk.
- Study of processed food samples available in market pasteurized milk, ketchup, squash, jelly, biscuit, soybean oil.

Reference Books

- Food Science by N.N. Potter, CBS publishing.
- Food Science by Srilakshmi, New Age International Publishing Ltd.
- Food Science by Manay, New Age International Publishing Ltd.

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Skill Course: FFT 127 :Introduction to Food Quality Management

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: Course in Food hygiene and Food plant sanitation

Objective

To learn about quality management in food production chain and understand the significance of safe processing of foods.

Course Content

UNIT I 5 lectures

Quality Management System- ISO 9000

UNIT II 10 lectures

Management Principles, Process Model, ISO 9000 Family, principles and requirements of ISO 9001

UNIT III 10 lectures

Food Safety Management System- Key role, Principles of FSMS, ISO-22000.

UNIT IV 10 lectures

HACCP- Prerequisites; GMP/GHP, Cleaning and Sanitation, Pest Control, Recall Procedures.

UNIT V 10 lectures

Principles and steps of HACCP Plan, Hazard Identification, Risk assessment Risk communication with communication agencies and Hazard analysis, CCP Decision Tree, HACCP Plan.

Practical:

- To conduct Hazard Analysis & Risk Assessment of identified hazards
- Determination of CCP through CCP Decision Tree
- Formation of CCP Monitoring Checklist
- Identification of PRP's (GHP & GMP) of food plant
- Preparation of detail flow diagram of manufacturing process & identification of potential hazards of food at each step/process
- Preparation of sample pages of Quality Manual
- Preparation of sample pages of Management System Procedure (MSP)
- Preparation of sample pages of Standard Operating Procedure (SOP)
- Preparation of sample pages of Formats for Quality Management System
- Preparation of on-site audit plan
- Preparation of an Audit CheckList /Observation Sheet
- To conduct Document Review (Adequacy Audit) before Audit
- To conduct opening meeting of audit
- To conduct Closing Meeting

- Preparation of Audit Plan Schedule before an Internal Audit
- To conduct an Audit Meeting before conducting Internal/External Audit
- Preparation of Corrective /Preventive Action Recommendation for the organization after Audit (Report Writing)
- Preparation of report by auditee after correction of non-conformities
- To conduct audit Follow-up

Reference Books

- Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Krammer A &Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ.

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General Education Course FFT 102 :Environmental Studies I

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the natural resources and the ecosystem, and ecology.

Course Content

UNIT I 5 lectures

The Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance.

Natural Resources: Renewable and Non-Renewable Resources, Natural Resources and Associated Problems, Renewable Resources

UNIT II 15 lectures

Ecosystems: Concept of an Ecosystem, Structure and Functions of an Ecosystem, Energy Flow in the Ecosystem: The Water Cycle, The Carbon Cycle, The Oxygen Cycle, The Nitrogen Cycle, The Phosphorus Cycle, The Sulphur Cycle, The Energy Flow, Integration of Cycles in Nature, Food Chains, Food Webs and Ecological Pyramids, Introduction, Types, Characteristic Features, Structure and Functions.

UNIT III 3 lectures

Biodiversity: Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation, Conservation of Biodiversity: In Situ and Ex Situ.

UNIT IV 15 lectures

Pollution: Definition, Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards, Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Waste, Pollution Case Studies, Social Issues and the Environment From Unsustainable to Sustainable Development, Urban Problems Related to Energy, Water Conservation, Rainwater Harvesting, Watershed Management, Consumerism and Waster Products

Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents an Holocaust.

UNIT V 7 lectures

The Environmental (Protection) Act- The Air (Prevention and Control of Pollution) Act, TheWater(Preventionand Control of Pollution) Act

Value Education: Environmental Values, Valuing Nature, Valuing Cultures, Social Justice, Human Heritage, Equitable Use of Resources, Common Property Resources, Ecological Degradation.

Practical:

- Visit to a local area to document environmental assets, river/forest/grasslands
  - Visit to gangatic plain to document environmental diversification in river and grass land.
  - Documenting the environmental assets and comparing with local gazettes
- visit to a local polluted site
  - Enlisting the types of pollutants/wastes visible in allahabad, sangam area before kumbh.
  - Enlisting and comparing the types of pollutants/wastes visible in allahabad, sangam area after kumbh.
  - Observing the anthropogenic change at gangatic river coast near sangam area during kumbh.
- Study of common plants, insects, birds
  - Documenting the special resource features of individual ecosystems. (river/ forest)

- Study of simple ecosystems
  - observing the water cycle- observing how rain recharges ground water like wells and rivers.
  - Observing the energy cycle – by looking different types of insects and birds in the trees.
  - Observing food chains and interpret the food web.
  - Observing water from a pond under the microscopefor measuring flora, fauna and turbidity. There are a large number of algae and zooplankton that form the basic food chains of the aquatic ecosystem

Reference Books

- Kumarasamy, K., A.Alagappa Moses And M.Vasanthy, 2004. Environmental Studies, Bharathidsan University Pub, 1, Trichy
- Rajamannar, 2004, Environemntal Studies, Evr College Pub, Trichy
- Kalavathy,S. (Ed.) 2004, Environmental Studies, Bishop Heber College Pub., Trichy

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General Education Course FFT 104 :Introduction to Computer Application

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the knowledge and use of computers and to introduce the basic principles, organization and operational aspects of computers.

Course Content

UNIT I 10 lectures

Microsoft Word and its applications (in relation with Food Industry)

Font formatting, Paragraph formatting, Inserting images, auto shapes symbols, diagrams, header & footer, References, watermarks and Hyperlinks, Style & Formatting, Mail Merge through word, Excel, Access database, Page setup, Printing a document

UNIT II 10 lectures

MS Excel and its applications (in relation with Food Industry)

Making column chart & pie chart and chart formatting, Use of general functions & formula (autosum, using basic arithmetic operators: +,-,*,/), Use of filter & sorting, Cell references, header & footer, age setup, use of page break preview, printing worksheets.

UNIT III 15 lectures

MS PowerPoint and its applications (in relation with Food Industry)

Creating own design, formatting objects on a slide, Use of Slide Master to control the design & formatting of a presentation, Use of Image, audio, video in the presentation, Slide show setup, slide transition, use of animation, Use of narration in presentation, Print setup & Printing handouts of a presentation.

UNIT IV 5 lectures

Internet & Web Applications (in relation with Food Industry)

UNIT V 5 lectures

Websites, Internet applications, Google Applications (G mail, Google search, G Drive, Google Docs) and other Email Services, Industry customer approach.

Practical

- Applications of MS Excel to solve the problems of food technology
- Statistical quality control, Sensory evaluation of food, and Chemical kinetics in food processing;
- Use of word processing software for creating reports and presentation;
- Familiarization with the application of computer in food industries -Milk plant, Bakery Units, Fruit & Vegetable processing Unit;
- Familiarization with software related to food industry;
- Ergonomics application in the same; Visit to Industry and case study problems on computer.
- Visit to Industry and case study problems on computer.

Reference Books

- Fundamentals of Computers by E. Balagurusamy (Author) Publisher: McGraw Hill Education (India) Private Limited
- Ms Office 2007 in a Nutshell by S. Saxena (Author) Publisher: S.Chand (G/L) & Company Ltd
- Computer Fundamentals Paperback – by P. K. Sinha (Author) Publisher: BPP

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General Education Course FFT 110 : General Biochemistry

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A basic course in Food Chemistry (FFT 329)

Objective

To acquaint the students with scope and importance of biochemistry and the pathways of metabolism of nutrients in human body.

Course Content

UNIT I 3 lectures

Scope and importance of biochemistry in Food Technology.

Aqueous solutions - properties of water - hydrogen ion concentration - acids, bases and their concept - buffers and electrolytes and their functions - acidity, alkalinity and pH determination.

UNIT II 10 lectures

Classification, structure and function of carbohydrates, lipids, proteins, and nucleic acids.

Structure and biological functions of vitamins, Vitamins as co-enzymes.

Classification and biological functions of minerals, Minerals as co-factors.

UNIT III 13 lectures

Enzymes: Classification and nomenclature of enzymes, Physico- chemical nature of enzymes, Enzyme kinetics, Mechanism of enzyme action, Factors affecting enzyme activity.

UNIT IV 14 lectures

Pathways of metabolism of carbohydrates, proteins, lipids.

UNIT V 5 lectures

Hormones as regulators of biochemical pathways- Introductory concept.

A brief account on the biochemistry of the secondary plant products: Alkaloids, flavonoids, anthocyanins, terpenes

Practical

- Qualitative and quantitative estimation of carbohydrates and proteins.
- Measurement of blood Pressure.
- Estimation of haemoglobin in blood.
- Estimation of glucose in blood.
- Qualitative urine analysis for normal and abnormal constituents.

Reference books

- Biochemistry by A. Satyanarayan
- Biochemistry by KeshavTrehan
- A textbook of Biochemistry by A. K. Berry
- L. Stryer, Biochemistry, 1999, IV Edition. Freeman Company, New York.
- Lehninger, Biochemistry, 1982. Worth Publications Inc., CBS Publication, New Delhi.
- H.S. Srivastava, Elements of Biochemistry, Rostogi Publications.
- Outline of Biochemistry, Corn & Stump.

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Skill Course FFT 130 :Industrial Training-I for 15 days

Credits: (0-0-2-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course in Food processing

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SEMESTER-III

Skill Course FFT 221 : Unit Operations in Food Processing

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on food processing equipments

Objective

To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I 5 lectures

Introduction: Basic principles of food processing, Conservation of mass and energy, Units and dimensions of engineering parameters, dimensionless ratios, and calculations involving various physical parameters.

UNIT II 10 lectures

Distillation: Distillation, Steam distillation, applications and equipment – determination of height equivalent of theoretical plate (HETP) – McCabe-Thiele method – reflux ratio. Molecular distillation, theory and examples. Mass transfer phenomenon applied to food systems

UNIT III 10 lectures

Evaporation: Needs, basic principles, Calculations, Single and multiple effect evaporation, Heat economy – enthalpy balances for evaporators, Vapour recompression, Thermo and mechanical systems, boiling point elevation, Falling film, climbing film tubular evaporators, plate evaporators, thin film and scraped surface evaporators.

UNIT IV 10 lectures

Contact Equilibrium Separation Processes: Concentrations, Gas-liquid equilibria, Solid liquid equilibria, Equilibrium concentration relationships, operating conditions; Basics of Solid-liquid extraction processes, liquid-liquid extraction, with food application examples, Crystallization

UNIT V 10 lectures

Leaching and Extraction: Leaching – Leaching equipments – principles of continuous and countercurrent leaching. Liquid extraction – extraction equipment – principles of extraction.Special extraction techniques – supercritical fluid extraction.Applications; extraction of Fatty acids, oleoresins and essential oils; Relative advantages, limitations and economics.Mechanical extraction – Expellers, screw press, filter press.

Reference Books

- Albert Ibarz, Cannovas, G.V. Unit Operations in Food Engineering. CRC Press. 2003.
- J.M. Coulson, J.F. Richardson, J.H. Harker - Coulson & Richardson's Chemical Engineering - Vol 2 Particle Technology and Separation Processes, Fifth Edition, 2002. Butterworth & Heinemann - Elsevier science Ltd.

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Skill Course FFT 222 : Basic Food Chemistry

Credits: (2-0-2-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint with properties and role of various constituents in foods, interaction and changes during processing.

Course Content

UNIT I 2 lectures

Food Constituents: Proximate composition of foods, water in foods,

UNIT II 6 lectures

Carbohydrate: Introduction, Definition nomenclature, classification. General properties of sugar (physical and chemical) identification of common mono saccharides, disaccharides and polysaccharides, determination of the amount of reducing and non – reducing sugars.Chemistry of starch, glycogen, cellulose, gums and mucilage, crude fibre.

UNIT III 7 lectures

Protein: Physical and Chemical properties of amino acids. Classification of proteins, amino acid sequence in proteins, pleated sheet and helix structure of protein tertiary structure and conformation of proteins.Physical and chemical properties of proteins, molecular weight of proteins, protein denaturation.

UNIT IV 7 lectures

Lipids: Classification of lipids, fatty acid, soap and detergent, essential fatty acids, fats and oils saponification number, acid numbers, iodine value, acetyl value, Reichart – Meissl number, Oxidative and hydrolytic rancidity, reversion.

UNIT V 8 lectures

Vitamins & minerals: Occurrence, chemistry, food sources, deficiency, loss during storage and processing of foods

Natural Pigments and Flavouring Agents: Chlorophyll, carotonoids, anthocyannics, anthoxanthins, flavonoids, tannins. Natural flavour constituents.

Practicals

- Qualitative test for proteins and fats/oils and their identification in unknown mixtures - Free fatty acid, Peroxide value, Saponification value, RM Number, TBA test, Iodine value.
- Quantitative estimation of proteins by Lowry and Bradford methods
- Estimation of vitamins - ascorbic acid..
- Analysis of edible common salt for MC, iodine and total chlorides.
- Estimation of ammonia in water.
- Estimation of plant pigments - carotenoids, flavonoids
- To determine alcohol soluble and insoluble solids in peas.
- Effect of heat on proteins
- Determination of smoking points of fat and oils

Reference Books

- Belitz HD.1999. Food Chemistry. Springer Verlag.
- DeMan JM. 1976. Principles of Food Chemistry. AVI.
- Fennema OR.1996. Food Chemistry. Marcel Dekker.
- Meyer LH. 1987. Food Chemistry. CBS

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Skill Course FFT 223 : Food Quality and Analysis-II

Credits: (2-0-2-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A basic course in Food quality and analysis (FFT 327)

Objective

To develop an understanding and methodologies of instrumental techniques in food analysis used for objective methods of food quality parameters.

Course Content

UNIT I 2 lectures

Concept of quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation

UNIT II 6 lectures

Colour:Importanceandneedofcolourdetermination,methodsofcolourdeterminationwithHunter Colour lab, CIE systemand their applications.

Flavour: Importance offlavour, foodflavours, factorsaffectingfoodproductflavours, measurementof

foodflavours.

Texture:Food texture,Physical characteristicsoffood, workingoftexture measuringinstrumentssuchasTextureAnalyser, Texture Profile Analysis (TPA).

UNIT III 7 lectures

Chromatography:PrincipleandworkingofGas chromatography(GC),Highpressureliquid chromatography (HPLC), Thin layer chromatography (TLC), Column Chromatography, chromatographic methods applied as qualitycontrol.

UNIT IV 8 lectures

Spectroscopy: Beers and Lambert's Law. General principles of colorimeters and spectrophotometers, Atomic absorption spectroscopy, IR spectroscopy, Flouremetry.

Special Techniques: Electrophoresis, Immuno assay techniques.

UNIT V 7 lectures

Introduction to quality attributes: Appearance, flavour, textural factors and additional quality factors.

Sensory Analysis: Introduction to sensory analysis; general testing conditions, Requirements of sensory laboratory; organizing sensory evaluation programme. Factors influencing sensory measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and gloss; Detection, threshold and dilution tests, discrimination, descriptive, affective; Ranking tests; Methods of sensory evaluation of different food products.

Practical

- Demonstration of HPLC and GC for analysis of bioactive compounds,antioxidant, pesticides, fatty acids etc.
- Qualitative analysis of compounds by chromatography techniques- a) Thin layer Chromatography, b) Paper Chromatography: Descending, Ascending and Circular Paper chromatography.
- Estimation of metals - Fe, Ca, Cu, Cu, Pb, Zn, Sn and Cr- by atomic absorption spectrometer and flame photometer. Demonstration of AAS for estimation of metals.
- Colour measurement (L a b values) by X Rite.
- Use of electrophoresis in the determination of proteins.
- Determination of pesticide residue in water and cauliflower by HPLC.
- To conduct sensory evaluation of the given samples using descriptive method.
- To perform the difference testes (Paired comparison test, Duo trio test and Triangle test) in the given sample
- To study and conduct sensory evaluation of different pairs of sugar with lemon samples using 'paired test' and prepare score card for the same.
- Texture analysis of raw and processed foods.

Reference Books

- Clifton M &Pomeranz Y. 1988. Food Analysis - Laboratory Experiments. AVI Publ.
- Gruenwedel DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. I. Physical Characterization. Marcel Dekker.
- Nollet LML. 1986. Handbook of Food Analysis. Vol. I. Marcel Dekker.

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Skill Course: FFT 224 : Cereal Pulses and Oil Seed Technology

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course in Food Science (FFT 322)

Objective

To acquaint with production and consumption trends, structure, composition, quality evaluation, and processing technologies for product development and value addition of various cereals, pulses and oilseeds.

Course Content

UNIT I 5 lectures

Status, production and major growing areas of cereals, in India and world.

Coarse Cereals Products: Maize- Dry and wet milling of corn, corn products, sorghum, pearl millet and small millets processing.

UNIT II 10 lectures

Wheat Processing: Wheat classification, Functionality of wheat flour components.

Rice Processing: Classification, paddy Processing, Parboiling and treatment for quality improvement, Milling, rice products.

UNIT III 10 lectures

Pulses: Pre-treatment of pulses for milling, milling of major pulses. Methods to improve recovery, Nutrition and anti- nutritional factors in pulses.

UNIT IV 10 lectures

Oil seeds Processing: Groundnut, Mustard, Soybean, Sunflower, Safflower, Sesame and other oil seeds processing.

UNIT V 10 lectures

Special Topics: Processing & Utilization of Soya bean for value added products, Innovative products from cereals, pulses and oilseeds. Extrusion technology for cereals

Practical:

- Physico-chemical examination of wheat and its products test weight, kernal hardness, gluten content.
- Millingof rice with emphasis on quality and recovery.
- Physicochemical tests of rice and flour quality of wheat- geletinization temperature, water absorption tests.
- Determination of Yeast activity used in fermented cereal products.
- Quality test for wheat flour used in the baked products. Maltose Number, Water Absorption, Sedimentation value, Alcohol Acidity
- Quality tests for oils.
- Texture profile analysis of baked cereal food products by texture analyzer.
- Products of Soybean- tofu, soya milk,
- Estimation of antinutritional factors in pulses- Trypsin inhibitors and tannins.
- Visit to dhal mills

Reference Books

- Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.
- Dendy DAV &Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
- Hamilton RJ &Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.
- Hoseney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed. AACC.

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Elective Course FFT 229 : Bakery and Confectionery Products

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course on processing of cereals (FFT 331)

Objective

To familiarize the students with different form of bakery confectionary and the analysis equipment involved, and to acquire the knowledge of manufacturing process of bakery and confectionary products in range.

Course Content

UNIT I (3 lectures)

Bakery and Confectionery industry; raw materials and quality parameters; dough development; dough chemistry;

UNIT II (10 lectures)

Rheological testing of dough-principles of Farinograph, Mixograph, Extensograph, Amylograph / Rapid ViscoAnalyzer, Falling number, Hosney's dough stickiness tester.

UNIT III (10 lectures)

Technology for the manufacture of bakery products- detailed description of unit operations for the manufacturing of bread, biscuits, cakes and the effect of variations in formulation.

UNIT IV (10 lectures)

Manufacturing of confectionary products: Characteristics and processing of raw material; Technology of manufacturing of toffee, chocolate, hard boiled candies, bars, chewing gums, bubble gums and Characteristics of finished products.

UNITV (10 lectures)

Equipment used in bakery and confectionary industry: Construction and working of various equipments like Mixers, proofing chambers, dough dividers, moulder and sheeter, baking ovens, cooling chamber, sealing and packaging machines, Rolling and cutting machines.

Practical

- Quality test for wheat flour used in the baked products. Maltose Number, Water Absorption, Sedimentation value, Alcohol Acidity
- Preparation and quality evaluation of cakes
- Preparation and quality evaluation of biscuits
- Preparation and quality evaluation of nan khatai
- Preparation and quality evaluation of cookies
- Effect of syrup consistency and temperature on the quality characteristics of hardboiled sweets
- Preparation and quality evaluation of chocolate
- Visit to bakery and confectionery industries.

Reference Books

- Dubey SC. 2002. Basic Baking. The Society of Indian Bakers, New Delhi.
- Francis FJ. 2000. Wiley Encyclopedia of Food Science & Technology. John Wiley & Sons.
- Manley D. 2000. Technology of Biscuits, Crackers & Cookies. 2nd Ed. CRC Press.

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General Education Course FFT 203 :Communication Skills and Technical Writing

Credits: (3-2-0-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A basic course on Communication and Documentation skills (FFT 301)

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. and equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Course Content

UNIT I 15 lectures

Grammar: Expressions, Modals & Moods, Word Stress, Fluency, Voice, Enhancing VocabularyPunctuations

UNIT II 20 lectures

Technical Writing:

Introduction to Technical writing – Definition, types, characteristics, Report Writing, CV & Resume making, Research paper

UNIT III 10 lectures

Effective Communication Skills: Power Point Presentations (Subject-Oriented), Soft Skills - Proper Body Postures, Right/Positive Body Language, Eye Contact, Public speaking, Interactive Communication Skills -Group Discussions, Debates, Conversations, Telephonic Etiquettes, Facing an interview

UNIT IV Tutorial 15 lectures

Communication Skills: How to make Delivery of Content Effective, Proper Articulation, Modulation, Voice Throw, Proper Stress on Words, Presenting PPT's, Confidence Building, Motivation, Writing Covering Letters , Filling Application Forms

UNIT V Tutorial 15 lectures

Technical Writing : Documentation of Academic credentials, Writing of Introduction, Acknowledgement, Abstract & Conclusion, Commonly used Abbreviations in the Thesis & Research Communication, Structuring the Presentation, Learning how to make PPT's, number of Slides, font, font size, Table Insertions, Picture, Clip Art, Chart, Grammatical Accuracy

Reference Books

- Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek, Chandigarh.
- Shelton James H. 1994. Handbook for Technical Writing. NTC Business Books, Chicago.
- Wren PC & Martin H.2006. High School English Grammar and Composition. S. Chand, New Delhi.

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General Education Course FFT205 : Environmental Studies – II

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: An introductory course on environmental studies (FFT 305)

Objective

To acquaint the students with environmental aspect like natural resources and biodiversity, and different techniques involved in preserving the environment

Course Content

UNIT I (10Lectures)

Natural Resources: forest resources, water resources, mineral resources, food resources, energy resources, land resources. Role of an individual in conservation of natural resources.Equitable use of resources for sustainable life style.

UNIT II (15 Lectures)

Biodiversity and its conservation: Introduction, definition, genetic, species and ecosystem diversity. Bio geographical classification of India, Value of diversity, consumptive use, productive use, social, ethical aesthete and option values.

UNIT III (15 Lectures)

Biodiversity at global, national and local levels.India as mega-diversity nation.Hot-spot of biodiversity. Threat to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts. Endangered and endemic species of India.Updated list of red data book ,Conservation of biodiversity, In-situ conservation of biodiversity.

UNIT IV (10 Lectures)

Environmental Pollution: definition, Causes effect and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards.

UNIT V (10 Lectures)

Solid waste management: causes effect and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.Pollution case studies. Disaster Management : flood, earthquake, cyclone and landslides.

Reference Books

- Kumarasamy, K., A.Alagappa Moses AndM.Vasanthy, 2004. Environmental Studies, Bharathidsan University Pub, 1, Trichy
- Rajamannar, 2004, Environemntal Studies, Evr College Pub, Trichy
- Kalavathy,S. (Ed.) 2004, Environmental Studies, Bishop Heber College Pub., Trichy

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SEM IV

Skill Course FFT 225: Human Nutrition

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students about importance of nutrition, balanced diets, therapeutic diets for health and role of food and nutraceuticals in health.

Course Content

UNIT I 8 lectures

Introduction to human nutrition.
Macronutrients and micronutrients- Classification and functions.
Digestion, absorption and assimilation of nutrients.

UNIT II 15 lectures

Energy metabolism- Components of energy expenditure, Basal Metabolic Requirements and Activity, Recommended Dietary Allowances, Food Groups, Concept of a balanced diet, Methods of evaluation of nutritive value of foods.
Nutritional assessment and nutritional policies- Salient features, concept of community nutrition

UNIT III 15 lectures

Carbohydrates- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Proteins- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT IV 10 lectures

Fat- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT V 12 lectures

Vitamin- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Minerals- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Water and electrolytes- Concept and importance

Reference books

- Nutrition Science by B. Srilakshmi
- Fundamentals of Foods & Nutrition by Sumati R. Mudambi
- Textbook of Nutrition : A Life cycle approach by RavinderChadha

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Skill Course FFT 226 : Fruits and Vegetable Technology

Credits: (2-0-2-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course on processed and preserved foods (FFT 325)

Objective

To acquaint with the proper handling technologies of fruits and vegetables to reduce post harvest losses and acquaint with principles and methods of preservation of fruits and vegetables into various products.

Course Content

UNIT I 2 lectures

Pre-packaging of fresh fruits and vegetables.Storage techniques for fresh fruits and vegetables.

UNIT II 6 lectures

Primary processing: grading, sorting, cleaning, washing, peeling, slicing and blanching

UNIT III 6 lectures

Dehydration of fruits and vegetables using various drying technologies like sun drying, solar drying, osmotic, tunnel drying, fluidized fed drying, freeze drying.

UNIT IV 8 lectures

Processing of juices: Processing of vegetable juice, Processing of fruit juice

Manufacturing of fruit juices concentrates, puree and pastes, Preparation of jam, jellies and marmalades.

UNIT V 8 lectures

Preparation of preserve and candied fruits, Pickling of fruits and vegetables.,Waste management in fruits and vegetable processing units

Practical

- Determination of ascorbic acid, acidity, total soluble soild.
- Evaluation of pectin content.
- Preparation and quality evaluation of fruit jam, fruit jelly, fruit marmalade; squash
- Processing of tomato products; Ketchup
- Preparation of dehydrated vegetables.
- Determination of chemical preservatives- benzoic acid, KMS
- Visit to commercial storage, and canning unit.

Reference Books

- Lal G, Siddapa GS &Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.
- Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.
- Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.
- Verma LR. & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

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Skill Course FFT 227 : Introduction to Food Packaging

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: A basic course on food processing

Objective

To acquaint the students with packaging methods, packaging materials, packaging machineries, modern packaging techniques etc.

Course Content

UNIT I 7 lectures

Packaging–Concepts, definition, Significance, classification. Deteriorative changes in food and packaging methods for prevention.

UNIT II 7 lectures

Primary packaging media – Properties and application of Paper, paper boards, metals, plastics, glass. Food containers-rigid containers and flexible packaging materials.Application of different packaging materials in food industry.eg. bags, pouches, wrappers, cartons etc.

UNIT III 8 lectures

Factors determining the packaging requirements of various foods, Packaging of perishable and processed foods.

UNIT IV 4 lectures

Advancements in packaging: Biodegradable packaging, Edible packaging,

UNITV 4

lecturesActive packaging, Modified atmosphere packaging, Vacuum packaging, Aseptic packaging

Practical

- Familiarization of different types of packaging materials.
- To perform vacuum packaging of food sample and carry out its storage study.
- To perform modified atmospheric packaging of food sample and carry out its storage study.
- Cut out analysis of canned food
- Determination of wax absorptiveness of paper

Reference Books

- Robertson, G.L. "Food Packaging: Principles and Practice". 2nd Edition. Taylor & Francis, 2006.
- Ahvenainen, Raija. "Novel Food Packaging Techniques". Wood Head Publishing, 2003.
- Mathlouthi, M. "Food packaging and Preservation". Aspen Publications, 1999.
- Paine, F.A. and Paine, H.Y. 1983. A Handbook of Food Packaging. Leonard Hill, Glasgow, UK.

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Skill Course FFT 228 : Dairy Technology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course in food science (FFT 322)

Objective

To acquaint with techniques and technologies of testing and processing of milk into various products and by products.

Course Content

UNIT I 4 lectures

Physical properties of milk: Color, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing,boiling point, specific heat, OR, electrical conductivity.

UNIT II 9 lectures

Lactose: Lactose (alpha and beta forms). Significances of lactose in dairy industry.

Milk fat: Composition and structure, and physical properties, crystallization, structure of fat granules, lipolysis, autoxidation, fat constants (saponification value, iodine value, RM value, Polenske value, peroxide value).

Protein and Enzymes: General structure, amphoteric nature, difference between casein and serum protein, differenttypes of casein (acid and rennet), uses of casein, fractionation of protein. Enzymes- catalase, alkaline phosphatase, lipases and proteases.

UNIT III 7 lectures

Market milk industry and milk products: Systems of collection of milk, Reception, Platform testing, Various stages of processing: Filtration, Clarification, Standardization,Homogenization, Pasteurization, Sterilization, Packaging and Storage, Cleaning and Sanitation

UNIT IV 5 lectures

Description and working of clarifier, cream separator, homogenizer and plate heat exchanger.

UNIT V 5 lectures

Flow diagram for manufacture of following milk products: Flavoured milk, Butter, ice-cream, milk powder.

Practical

- To perform platform tests in milk. (Acidity and COB).
- To estimate moisture content in milk.
- To estimate skim milk protein by titration method.
- To estimate milk fat by Gerber method, SNF and specific gravity of milk.
- To check the efficiency of sterilization of milk by Turbidity test.
- To prepare casein and calculate its yield.
- Preparation of flavoured milk
- Preparation of butter
- Visit to a milk industry

Reference Books

- Aneja RP, Mathur BN, Chandhan RC & Banerjee AK. 2002. *Technology of Indian Milk Products*. Dairy India Publ., Delhi.
- De S. 1980. *Outlines of Dairy Technology*. Oxford Univ. Press Publ., New Delhi.
- Smit G. 2003. *Dairy Processing – Improving Quality*. CRC-Woodhead Publ.
- Walstra P, Geurts TJ, Noomen A, Jellema A & Van Boekel MAJS. 1999. *Dairy Technology – Principles of Milk Properties and Processes*. Marcel Dekker.

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General Education Course FFT 201 : Crop Production: Concepts and Practices

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the basics of agriculture and crop farming so as to learn the related field of food processing such as farm machinery, land & water resources, and horticulture.

Course Content

UNIT I 5 lectures

Agriculture and its role in national development, food security; General features of climate - India; Crop environment, weather and significance of various weather elements;

Crop production - definition and scope, crop classification based on season, life cycle, taxonomy and economic use; Growth and yield of crops, growth parameters, yield attributes and factors affecting them

UNIT II 10 lectures

Quality of good seed, ideal condition for germination, seed treatment, hybrid and composite seeds, categories of seeds (certified, foundation and breeder seed); Importance of sowing time, seed rate, sowing methods, plant population; Tillage and Inter-culture operations.

UNIT III 10 lectures

Irrigation - scheduling, methods and water use efficiency; Harvesting, threshing, winnowing, storage and processing.

UNIT IV 10 lectures

Crop rotations, mixed cropping, inter cropping, its objectives and importance; Definitions of mono-cropping, double cropping, multiple/intensive cropping, relay cropping.

Soil as a three phase disperse system, its physical chemical and biological properties; Soil fertility and soil productivity, manures and fertilizers,

UNIT V 10 lectures

Classification of vegetable crops; Types of vegetable farming; Principles of vegetable production; Raising of vegetable seedlings under different environmental conditions

Concepts in Horticulture - methods of propagation, systems of planting and layout, fruit growth and development, fruit maturity and ripening, Post harvest management of fruits.

Reference Books

- Batnakar S &Schware R. 2000. Information and Communication Technology in Development- Cases from India. Sage Publ.
- Meera SN. 2008. ICTs in Agricultural Extension: Tactical to Practical. Ganga- Kaveri Publ. House. JangamWadiMath, Varanasi.
- Willem Zip. 1994. Improving the Transfer and Use of Agricultural Information – A Guide to Information Technology. The World Bank, Washington.

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General Education Course FFT 202 : Food Business Management

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To give basic fundamentals to students for managing the food processing operations starting for raw material procurement to the end consumer and familiarizing them with international trade.

Course Content

UNIT I 5 lectures

Business Management: introduction, theories and functions, food industry management, marketing management and human resource development, personal management. Sectors in food industry and scale of operations in India.

UNIT II 5 lectures

Human Resource Management: Study the basics about HR and related policies and capacity mapping approaches for better management.

UNIT III 10 lectures

Consumer behavior towards food consumption, Consumer Surveys by various Institutes and Agencies, various journals on consumer behavior and market research, internet based data search.

UNIT IV 15 lectures

International trade: basics, classical theory, theory of absolute advantage, theory of comparative modern theory, free trade- protection, methods of protection, quotas, bounties, exchange control, devaluation, commercial treaties, terms of trade, balance of payments, Exim policy, foreign exchange, mechanics of foreign exchange, GATT, WTO, role of WTO. International trade in agriculture. World trade agreements related with food business, export trends and prospects of food products in India.

UNIT V 10 lectures

World consumption of Food: patterns and types of food consumption across the globe. Ethnic food habits of different regions. Govet. Institutions related to international ad trade; APEDA, Tea board, spice board, wine board, MoFPI etc. management of export import organization, regristration, documentation, export import logistics, case studies. Export and import policies relevant to horticultural sector.

Reference Books

- Chhabra TN &Suria RK. 2001. Management Process and Perspectives. KitabMahal.
- Jhingan ML. 2005. International Economics. 5th Ed. Virnda Publ.
- Kotler P. 2000. Marketing Management. Prentice Hall.
- Reddy SS, Ram PR, Sastry TVN &Bhavani ID. 2004. Agricultural Economics. Oxford & IBH.

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General Education Course FFT 207 :Statistics and Data Analysis

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

The students will be exposed to various research methods and statistical tools required to analyze the experimental data in food research and industry. The focus will be on providing knowledge related to research process, data collection and data analysis etc.

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

The students will be exposed to various research methods and statistical tools required to analyze the experimental data in food research and industry. The focus will be on providing knowledge related to research process, data collection and data analysis etc.

Course Content

UNIT I 10 lectures

Scientific Approach to Research: Meaning, significance, variables

Research Process: Formulating the problem, objectives, hypothesis, Experimental design, sample design, collecting data, analysis of data, interpretation, preparation of report.

UNIT II 10 lectures

Sampling Techniques: Probability and non probability sampling.

Experimental designs: Randomized Block design

UNIT III 10 lectures

Measurements: measurement scale, Frequency distribution, graphical presentation of data.

Measures of Central Tendency: Mean, median and mode, their uses.

UNIT IV 15 lectures

Measures of variability: Mean deviations, Quartile deviation, standard deviation, their uses.

Correlation: Spearman and Pearson's techniques of correlation, Linear regression

UNIT V 15 lectures

Tests of significance of difference between means: t-test, F-test, One way ANOVA.

Applications to food quality assessments

Reference Books

- Aggarwal BL. 2003. Basic Statistics. New Age.
- Kothari CR. 1989. *Research Methodology*. Wiley Eastern.
- Gupta SP. 2004. *Statistical Methods*. S. Chand & Sons

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Elective Course: FFT 251: Technology of Meat, Fish and Poultry

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course on Food Science (FFT 322)

Objective

To provide an understanding of the technology for handling, processing, preservation and bi-product utilization of meat, poultry and fish products processing.

Course Content

UNIT I 5 lectures

Development of meat and poultry industries in India.Ante-mortem examination of animals and poultry birds.Slaughter and dressing, post-mortem examination. Post-mortem changes in meat and factors affecting them.

UNIT II 5 lectures

Nutritive value of meat. Whole sale and retail cuts. Meat tenderization methods.

UNIT III 15 lectures

Canning of meat and meat products, Restructured meat products, sausages, curing and smoking of meat. Disposal and utilization of meat industry by- products

Chilling and freezing of carcass and meat; canning, cooking, drying, pickling, curing and smoking; prepared meat products like salami, kebabs, sausages, sliced, minced, corned; intermediate moisture and dried meat products; meat plant hygiene – GMP and HACCP; Packaging of meat products.

UNIT IV 10 lectures

Structure, composition and nutritive value of poultry eggs.Poultry dressing, Functional properties of eggs, internal quality of eggs and its preservation.

Eggs spoilage, Spray dried and frozen egg products.

UNIT V 10 lectures

Fish structure and composition.Cold storage, freezing preservation and canning of fish. Picking of fish, fish protein concentrates, fish meal and by products of fish processing industry

Practical:

- Slaughtering and dressing of meat animals
- Study of post-mortem changes; meat cutting and handling
- Evaluation of meat quality
- Evaluation of quality of eggs
- Preparation of meat products
- Visit to meat processing plants.

Reference Books

- Forrest JC. 1975. Principles of Meat Science. Freeman.
- Govindan TK. 1985. Fish Processing Technology. Oxford & IBH.
- Hui YH. 2001. Meat Science and Applications. Marcel Dekker. 32
- Kerry J. et al. 2002. Meat Processing. Woodhead Publ. CRC Press.
- Pearson AM & Gillett TA. 1996. Processed Meat. 3rd Ed. Chapman & Hall.

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Elective Course FFT 252 :Flavour Technology

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A basic course of Food Chemistry (FFT 329)

Objective

To equip the students with the knowledge of flavor science, extraction of pigment and safe storage and nutritional retention principles.

Course Content

UNIT I 65 lectures

Sources of flavours (natural, processed and added), Flavour composites (natural, semi-synthetic and synthetic).

UNIT II 12 lectures

Biogenesis of flavours in food – natural and processed foods (Maillard Reaction and Lipid Oxidation).

UNIT III 3 lectures

Analysis of flavours (Subjective and objective); Formulations of flavours, adulteration, Flavour emulsions, Flavours production in fermented foods, Off-flavours in foods.

UNIT IV 3 lectures

Spices and spice-based products as flavours, Plantation crops as flavours tea, coffee, cocoa and vanilla.

UNIT IV 6 lectures

Sensory evaluation of flavours, selection of flavourist, flavours and legal issues.

Ppractical

- Odour recognition and thresholds tests
- Analysis of different types of flavours such as whole and powdered spices, essential oils, oleoresins, synthetic flavours, plated and dispersed spices-general tests.
- Sensory analysis of flavours; monitoring flavours during food processing
- Preparation of flavour emulsions and their stability
- Study of off-flavours in different foods.

Reference Books

- Ashurst PR. 1994. Food Flavorings. 2nd Ed. Blackie.
- Burdock GA. 2004. Fenaroli's Handbook of Flavor Ingredients.5th Ed. CRC Press.
- Deibler D &Delwiche J. 2004. Handbook of Flavor, Characterization: Sensory Analysis, Chemistry and Physiology. Marcel Dekker.

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Elective Course FFT 253 : Fermentation Technology

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: An introductory course of Food Microbiology (FFT 323)

Objective

To familiarize about the various microbial processes/systems/activities which have been used for the development of industrially important products/processes.

Course Content

UNIT I 6 lectures

History of fermentation. Introduction to fermentation processes, Media formulation and process optimization.

UNIT II 8 lectures

Microorganisms used in food fermentation, Types of cultures, starter cultures: maintenance, propagation and activation of cultures.

UNIT III 5 lectures

Types of fermentation sub-merged/solid state, Batch /continuous fermentation, Fermenter design and operation.

UNIT IV 5 lectures

Fermented Foods-types, methods of manufacture for vinegar, saurkraut, tempeh, miso, soya sauce, bakery foods and traditional Indian foods.

UNIT V 6 lectures

Food related fermentations: Microbial biomass, Single cell protein, baker's yeast and enzyme production

Practical

- Media formulation and sterilization
- Study of fermentation of pulses and millets
- Maintenance and activation of lyophilised starter cultures.
- Study of dough raising power of yeasts
- Production of fermented products viz. saurkraut, idli, curd etc.

Reference Books

- Stanburry P.P. and Whitaker, A. 1984. Principles of Fermentation Technology. Pergamon
- Press, Oxford UK.
- Steinkraus, K.H. 1983. Handbook of Indigenous Fermented Foods. Marcel Dekker, New York.
- Biely, J.E. and Ollis D.F. Bio Chemical Engineering Fundamentals (1986) McGraw Hills.
- Moo-young M. Comprehensive Biotechnology Vol. 1-4 Pergamon Press Oxford.

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Skill Course FFT 230 : Industrial Training-II for 15 days

Credits: (0-0-2-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: Any course in Food Processing

SEMESTER V

Skill Course FFT 321 :Principles of Food Engineering

Credits: (1-2-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on unit operations in food processing (FFT 328)

Objective

To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I 10 lectures

Process time calculations; Sterilizers and accessories used in canning industries; Engineering aspects of pasteurizer; homogenizer, evaporators (basic principle and single-effect evaporator) and concentrators used in food industries; Seaming machine.

UNIT II 8 lectures

Construction of cold storage; Different types of freezers including plate contact freezer, air blast freezer, cryogenic freezing and refrigerated vans.

UNIT III 9 lectures

Various types of driers (basic principle and drying time) – Tray drier, roller drier, spray drier, fluidized bed drier, freeze drier and solar drier.

UNIT IV 9 lectures

Heat exchangers (including paraflow HEs); Extruders – Basic principles and types, Difference between single- and twin-screw extruders; Kneader; Oil expeller

UNIT V 9 lectures

Advanced separation processes: Dialysis, ultrafiltration, reverse osmosis, electro dialysis and membrane separation.

Practical:

- Determination of viscosity of Newtonian fluid, Non Newtonian fluids;
- Determination of conductivity, calorific value and filtration properties of food& water.
- Calculation of freezing time for some typical foods
- Determination of Textural characteristics TPA of food product
- Evaluation of Bulk density and basics of true and bulk density

Reference books

- Fundamentals of Food Engineering by Stanley Charm.
- Introduction to Food Engineering - R.Paul Singh, Dennis R.
- Fundamentals of Food Process Engineering; Toledo RT; 2nd ed, 2000, CBS Publishers.
- Food process engineering, D.R.Heldman and R.P.Singh

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ElectiveCourse FFT 351 :Post Harvest Management of Fruits and Vegetables

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: An introductory course on fruits and vegetables (FFT 333)

Objective

To acquaint with the proper handling technologies of fruits and vegetables to reduce post harvest losses and acquaint with principles and methods of preservation of fruits and vegetables into various products.

Course Content

UNIT I 6 lectures

Morphology, structure and composition of fruits and vegetables; maturity indices and standards for selected fruits and vegetables; methods of maturity determinations

UNIT II 8 lectures

Harvesting and handling of important fruits and vegetables, Field heat of fruits and vegetables and primary processing for sorting and grading; factors affecting post harvest losses; Standards and specifications for fresh fruits and vegetable.

UNIT III 8 lectures

Post-harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits; Storage practices: CA and MA, hypobaric storage, pre-cooling and cold storage; Commodity pretreatments - chemicals, wax coating, prepackaging and irradiation.

UNIT IV 4 lectures

Physiological post harvest disorders - chilling injury, freeze injury and disease.

UNIT V 4 lectures

Prevention of post harvest diseases and infestation; Handling and packaging of fruits and vegetables.

Practical

- Quality evaluation of raw vegetables
- MAP of fruits, Preparation of Products- Lemon Squash, Mango Soup
- Waxing of fruits
- Preservation of vegetables- Low Temperature, Determination of Preservative(KMS)

Reference Books

- Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.
- Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.
- Verma LR. & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

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Elective Course FFT 352 : Food Beverage Technology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A basic course in Food Science (FFT 322)

Objective

In this the students will be exposed to the knowledge of beverage types and manufacturing process involved in different beverage manufacturing industries.

Course Content

UNIT I 6 lectures

Types of beverages and their importance; status of beverage industry in India;

UNIT II 4 lectures

Manufacturing technology for juice-based beverages; synthetic beverages; technology of still, carbonated, low-calorie and dry beverages; isotonic and sports drinks;

UNIT III 4 lectures

Specialty beverages based on tea, coffee, cocoa, spices, plant extracts etc.

UNIT IV 8 lectures

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, , wine and related beverages, distilled spirits.

UNIT V 8 lectures

Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, carbonated water.

FFT 422 Food Beverage Technology Practical

- Chemical and microbiological analysis of raw water quality;
- Preparation of regional fruit juices;
- Preparation of whey-based beverages;
- preparation of crush, nectar, blended juice
- Preparation of soy milk, fruit milkshakes, herbal beverages;
- Visit to relevant processing units.

Reference Books

- Srivastava RP & Kumar S. 2003. Fruit and Vegetable Preservation - Principles and Practices. International Book Distributors.
- Hardwick WA. 1995. Handbook of Brewing. Marcel Dekker.
- Hui YH. et al 2004. Handbook of Food and Beverage Fermentation Technology. Marcel Dekker.
- Priest FG & Stewart GG. 2006. Handbook of Brewing. 2nd Ed. CRC.
- Richard P Vine. 1981. Commercial Wine Making - Processing and Controls. AVI Publ.

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Elective Course: FFT 353 :Technology of Indigenous Milk Products

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on Dairy Technology/Food Science

Objective

To acquaint the students with the milk and milk based product preparations and the nutritional composition and health effect (good/bad).

Course Content

UNIT I 2 lectures

Status and significance of traditional milk products in India.

UNIT II 6 lectures

Khoa: Classification of types, standards methods of manufacture and preservation factors affecting yield of khoa. Physico-chemical changes during manufacture and storage of khoa. Confectioneries made from Khoa-Burfi, peda, Milkcake, Kalakhand, Gulabjaman and their compositional profile and manufacture practices.
Rabri and Basundhi: Product identification, process description, factors affecting yield physico-chemical changes during manufacture.

UNIT III 6 lectures

Channa: Product description, Standards method of manufacture, packaging and preservation.
Chhana-based sweets, Mechanization of manufacturing process.
Paneer: Product description standards method of manufacture packaging and preservation. Physico-chemical changes during manufacture and storage.

UNIT IV 7 lectures

Srikhand: Chakka product description, standards method of manufacture, small scale and industrial, packaging and preservation aspects. Physico-chemical changes and quality assurance during manufacture and storage.
Sandesh, Mistidahi: Product description method of manufacture and packaging process.
Kheer and Payasam: Product description methods of manufacture, innovations in manufacturing and packaging processes.

UNIT V 9 lectures

Microbiology of indigenous milk products: predominance of spoilage & pathogenic organisms in Curd, Khoa, Channa, Paneer, Shrikhand, control measures & legal specifications.
Biopreservative principles in enhancing the shelf-life ofindigenous milk products including active packaging.

FFT 366 Technology of Indigenous Milk Products Practical:

- Preparation of khoa from cow and buffalo milk.
- Preparation of chhana from buffalo milk.
- Preparation of paneer from buffalo milk.
- Analysis of khoa, chhanna and paneer for total solids, moisture, fat and acidity.

- Preparation of mistidahi, chhaka and srikhand.
- Microbiological examinations of traditional dairy products: Khoa, paneer, coliform counts, yeast and molds counts etc.

Reference Books

- Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. *Technology of Indian Milk Products*. Dairy India Publ.
- De S.1980*. Outlines of Dairy Technology*. Oxford Univ. Press.
- Rathore NS *et al.* 2008. *Fundamentals of Dairy Technology - Theory & Practices*. Himanshu Publ.

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Elective Course FFT 354: New Product Development and Sensory Science

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: An introductory course on Food quality and analysis (FFT 327)

Objective

To acquaint the students with the Sensory evaluation techniques and steps for the development of new food products.

Course Content

UNIT I (5 lectures)

Introduction to sensory analysis.Background and importance of Sensory Analysis, Definition of Sensory Analysis, Fields of Application of Sensory Analysis, Legislation on Sensory Analysis, Sensory perception and the organs of senses

UNIT II (6 lectures)

Methodology of sensory analysis, Preparation of trial, Location of test and tasting Rooms, Sensory evaluation techniques, Types of tests Differentiation sensory tests, Variables and scales, Descriptive sensory tests Affective sensory tests

UNIT III (7 lectures)

Assessors: Selection, training and monitoring, Assessors, Types of assessors, Factors influencing sensory evaluations, Features of assessors, Selection, training and monitoring of assessors: Recruitment, Selection, Training,Monitoring

UNIT IV (6 lectures)

Concept of product development - product success and failure, factors for success, process of product development, managing for product's success. Innovation strategy - possibilities for innovation, building up strategy, product development programme.

UNIT V (5 lectures)

The product development process - product strategy, product design and process development, product commercialization, product launch and evaluation.

Practical

- Selection and training of sensory panel
- Detection and threshold tests
- Ranking tests for taste, aroma colour and texture
- Sensory evaluation of various food products using different scales, score cards and tests
- Estimation of color and texture,Relationship between objective and subjective methods
- Idea and Concept generation for development of new product

Reference Books

- Meilgaard Morten; Sensory evaluation techniques Stone Herbert; Sensory evaluation practices. ISBN: 0-12-672690-6
- Schaffner, D. J., W. R. Schroeder e M. D. Earle; Food Marketing: An International Perspective - 2nd ed, McGraw Hill, 2003. ISBN: 978-0072952889
- Varela, P. e G. Ares; Novel Techniques in Sensory Characterization and Consumer Profiling, CRC Press , 2014. ISBN: ISBN 9781466566293

Skill Course FFT 322 :Waste Management and Effluent Treatment

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on hygiene and plant sanitation (FFT 320)

Objective

To acquaint the students with the major source of living ie water, its treatment, analysis and how to make it potable.

Course Content

UNIT I 10 lectures

Selection of sanitizing agents for cleaning, packaging sanitation, food storage sanitation, transport sanitation and water sanitation.

UNIT II 10 lectures

By-products obtained from cereals, pulses, legumes, oil seeds, fruit and vegetables, dairy plant, sugar and bakery, plantation crops and spices egg and poultry processing industry and meat, Fermentation industry.

UNIT III 10 lectures

Characterization of food industry wastes e.g., BOD, COD and total organic content, floatable and suspended solids in water.

UNIT IV 15 lectures

Pretreatment, secondary treatments of solid waste, sludge volume index, advanced techniques activated bio-filtration, biological fluidized bed reactor, dried bacteria culture process

UNIT V 15 lectures

tertiary treatments or advanced waste water treatment system (AWT); polishing ponds, DAF Techniques, micro trainers treatment and disposal of sludge, sand filters, removal of nitrogen, phosphorus, sulphur, physical chemical treatment process.

Reference Books

- Energy Conservation through Waste Utilization, American Society of Mechanical Engineers, New York.
- Kreit F &Goswami DY. 2008. Energy Management and Conservation Handbook. CRC Press.
- Murphy WR &Mckay G. 1982. Energy Management. BS Publ. Patrick DR. 1982.. Energy Management and Conservation. Elsevier Publ.
- Patrick DR., Fardo SW, Richardson RE & Steven 2006. Energy Conservation Guidebook. The Fairmont Press.
- Wulfinghoff DR. Energy Efficiency Manual. Energy Institute Press

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Skill Course FFT 323 :Food Laws and Regulations

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on Food science/processing

Objective

To acquaint with food quality parameters and control systems, food standards, regulations, specifications.

Course Content

UNIT I 5 lectures

Introduction and Need of enforcing to Food Laws.

UNIT II 20 lectures

Mandatory food laws; The food safety and standards Act 2006, Establishment of the authority, composition of authoring functions of chief executive officer, scientific part, General principles to be followed in administration of act, General provisions as to articles of food, special responsibility as to safety of food, analysis of food offences of penalties.

UNIT III 15 lectures

Edible Oils Packaging (Regulation) Order, 1998, Environment (Protection) Act, 1986, Fruit Products Order, 1955 (FPO), Meat Food Products Order, 1973 (MFPO), Milk and Milk Product Order, 1992 (MMPO), Solvent Extracted Oil, De-oiled Meal and Edible Flour (Control) Order, 1967.

UNIT IV 10 lectures

Standards of Weights and Measures Act, 1976, The Essential Commodities Act, 1955, The Export (Quality Control and Inspection) Act, 1963, The Insecticides Act, 1968, Vegetables Oil Products(Control) Order, 1998, Prevention of Food Adulteration Act & Rules (PFA Act), 1954 , Agmark Standards (AGMARK), Codex Alimentarius Standards, BIS Standards and Specifications, Consumer Protection Act, 1986.

UNIT V 10 lectures

Recommended international code of hygiene for various products.

Reference Books

- Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Krammer A &Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ

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Skill Course FFT 324 :Food Plant Design and Layout

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course of food processing unit operations (FFT 328)

Objective

To acquaint the students with the plant layout operation which is required by all industries to check their comparative factors as equipment position raw material handling and end product delivery

Course Content

UNIT I 10 lectures

Introduction : Plant design concepts - situations giving rise to plant design problems - differences in design of food processing and non-food processing plants

UNIT II 20 lectures

General design considerations, Food Processing Unit Operations, Prevention of Contamination, Sanitation, Deterioration, Seasonal Production, Flow Chart for Plant Design, Identification Stage, Looking for a need, Finding a product, Preliminary Screening of ideas, Comparative rating of product ideas: Present Market, Market Growth potential, Costs, Risks,

UNIT III 15 lectures

Plant location: Introduction, Location Decision Process, Factors involved in the plant location decision, Subjective, Qualitative and Semi-Quantitative Techniques

UNIT IV 5 lectures

Food Plant Utilities: Process Water, Steam, Electricity, Plant Effluents.

UNIT V 10 lectures

Plant layout : Importance, Flow Patterns, Basic Types of plant layouts, Product or line layout, Process or functional layout, Cellular or group layout, and Fixed position layout, Plant Layout factors, Layout design Procedure., Maintenance of Food Plant Building

Reference Books

- Peters, M.s and Timmerhaus, K.D, Plant Designs and Economics for Chemical Engineers, 4th Edition McGraw Hill,1991
- Biegler L.,grossmannI.E.andWesteberg A.W., Systematic Methods of Chemical Engineering and Process Designs, prentice Hall ,1997.
- Z. B. Maroulis and G. D. Saravacos, Food Process Design, Marcel Dekker 2003.

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General Education Course FFT 301 : Disaster Management

Credits: (3-2-0-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To familiarize the students with the concept of disaster, how to response to disaster and field work to access the cause.

Course Content

UNIT I 15 lectures

Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and Local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

UNIT II 15 lectures

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT III 10 lectures

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction.

UNIT IV 15 lectures

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion.

UNIT V 15 lectures

Field work / Case studies Hazard mapping of vulnerable areas, Vulnerability assessment (physical, social, organizational, economical, technological) Risk mitigation planning for vulnerable areas.

Reference Books

- Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan.
- Hodgkinson PE & Stewart M. 1991. Coping with Catastrophe: A Handbook of Disaster Management. Routledge.
- Sharma VK. 2001. Disaster Management. National Centre for Disaster Management, India.

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General Education Course FFT 303 :Introductory Biotechnology

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on basic microbiology (FFT 323)

Objective

To acquaint the students with the fundamental of bio-technology, industrial microbiology and fermentation processes.

Course Content

UNIT I 5 lectures

Prospectus of biotechnology- definition, scope and importance, DNA structure, function and metabolism.

UNIT II 10 lectures

GMO, genetic recombination mechanisms and technique used for improvement in microbial strains; Methods of recombinant DNA technology; Nucleic acid hybridization; Plant and animal cell and tissue culture techniques and their applications.

UNIT III 10 lectures

Molecular markers and their applications; DNA sequencing; Genetic engineering and transgenics; Genomics, transcriptomics and proteomics.

UNIT IV 10 lectures

General application of biotechnology in food industry, pharmaceuticals and agriculture Public perception of biotechnology; Bio-safety and bioethics issues.

UNIT V 10 lectures

Introduction to nanotechnology, history and recent developments, sources of nanoparticles, microbial production of nanoparticles, advantages of microbial nanoparticles and their applications.

FFT 303 Introductory Biotechnology Practical

- Isolation of genomic DNA from different sources
- Gel electrophoresis techniques
- Restriction enzyme digestion, ligation, transformation and screening of transformants
- Demonstration of PCR

Reference Books

- Becker JM, Coldwell GA &Zachgo EA. 2007. Biotechnology – a Laboratory Course. Academic Press.
- Brown CM, Campbell I & Priest FG. 2005. Introduction to Biotechnology. Panima Pub.
- Gupta PK. 2004. Biotechnology and Genomics. Rastogi Publications.
- Sambrook J, Fritsch T &Maniatis T. 2001. Molecular Cloning – a Laboratory Manual. 2nd Ed. Cold Spring Harbour Laboratory Press.
- Singh BD. 2007. Biotechnology Expanding Horiozon. Kalyani Publishers
- Fundamentals of Biotechnology, Prave. P. Faust, V. Sitih. W., Sukatsh, DA, 1987. ASM press.

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FFT 330: Seminar(0-0-4-2)

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SEMESTER-VI

Skill Course FFT 325 :Quality Assurance and Certification

Credits: (3-0-0-3)

Level: Undergraduate
Semester: Spring
Pre-requisite: A course of food Quality and Analysis (FFT 327)

Objective

To acquaint the students with the certifications involved in raw material food and industries and different organizational system such as HACCP, GMP/GHP and auditing and surveillance.

Course Content

UNIT I 5 lectures

Quality inspection, quality control, quality management and Quality Assurance.

UNIT II 10 lectures

Total quality management; Good Manufacturing Practices, Good Agricultural Practices, Good Laboratory Practices, Quality Management systems QSS. Quality Circles, SQC.,

UNIT III 10 lectures

ISO System. HACCP, Principles, Implementation.

UNIT IV 5 lectures

Plan of Documentation, types of records.

UNIT V 15 lectures

Auditing, Surveillance; Audit, Mock audit, third party quality certifying audit, Auditors and Lead auditors. Certification, Certification procedures, Certifying bodies, Accrediting bodies, International bodies.

Reference Books

- Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Krammer A &Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ

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General Education Course FFT 306 :Human Values and Ethics

Credits: (4-0-0-4)

Level: Undergraduate
Semester: Spring
Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the ethics involve in environmental protection, IPR and safe guarding heatlh of consumer.

Course Content

UNIT I 10 lectures

The importance and the needs of ethics; Ethical business practices; Laws and ethics; Environmental protection;

UNIT II 10 lectures

Creating awareness and safeguarding health of consumers; Fair trade practices.

UNIT III 10 lectures

Concept of property, rights, duties and their correlation; History and evaluation of IPR; Copyrights and related rights.Distinction among various forms of IPR.

UNIT IV 15 lectures

Patent rights/protection and procedure; Infringement or violation; Remedies against infringement; Indian Patent Act 1970 and TRIPS; Geographical indication and Industrial design.

UNIT V 15 lectures

International Registration systems; WIPO treaties; Unfair competition; Protection of new plant varieties; Legal implications and public concerns in genetic modification of foods; National policies on food security.

Reference Books

- Daniel and Selvamony - Value Education Today, (Madras Christian College, Tambaram and ALACHE, New Delhi, 1990)
- S. Ignacimuthu - Values for Life - Better Yourself Books, Mumbai, 1991.
- M.M.M.Mascaronhas Centre for Research Education Science and Training for Family Life Promotion - Family Life Education, Bangalore, 1993.
- Agochiya D. 2002. Every Trainer's Handbook. Sage Publ.
- David Gross. 1997. Human Resource Management - The Basics. TR Publ.
- Davis Keth&Newston W John 1989. Human Behaviour at Work. 8th Ed. McGraw-Hill.
- Lynton RP &Pareek U. 1993. Training for Development. DB. Taraporewale Sons & Co.

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General Education Course FFT 307 :Project Management and Entrepreneurship

Credits: (3-2-0-5)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course on business management (FFT 309/FFT 317)

Objective

To acquaint the students with the performance evaluation and review techniques and critical path method to solve the industrial problems.

Course Content

UNIT I 15 lectures

Definition of Entrepreneurship given by various economists, the conceptual model of Entrepreneurship.Entrepreneur and Manager, Enterprise and Entrepreneur. Managing Creativity Issues to be addressed in working the definition of creativity, Attributes of a creative person, Creative Thinking and Motivation.

UNIT II 15 lectures

Composition of Small Business, Economic Contribution of Small Business. Strategic Planning for Small Business, Steps in Strategic Planning -Conduct a thorough Market Segment Analysis, Formulate Strategic Options and Select appropriate Strategies (Focus, Cost leadership & Differentiation), Why Strategic Planning fails in Small Business.

UNIT III 8 lectures

Forms of Ownership: Sole Proprietorship, Partnership &Corporation form of Organisation -Advantages and Disadvantages, Franchising- What is Franchising -Advantages and Disadvantages to Franchising - Franchise Evaluation Checklist –Franchise contracts -Types of Franchise arrangements.

UNIT IV 20 lectures

Project creation, significance of infrastructure in economic development, Project Identification, Idea generation, Project screening, Feasibility study. The advantages and disadvantages of starting your business, Financial Record Keeping – Profit Planning & Cost Control, Project costing : Breakdown structure of the project, cost estimation of the project, factor affecting the cost of the project, Costing with alternative configurations/specifications.

UNIT V 17 lectures

Traditional sources of financing, Equity shares, preference, shares, Debentures/bonds, loan from financial institutions- Loan syndication and consortium finance; Alternative sources of financing, Franchising etc; Role played by various Financial Institutions like IDBl, ICICI and IFCI etc. Project insurance, Human resource management, network analysis.

Reference Books

- Chandra P. 2005. Project Management. Tata McGraw Hill.
- GopalKrishan P &Nagarajan K. 2005. Project Management. New Age.

- Hisrich RD & Peters MP. 2002. Entrepreneurship. Tata McGraw Hill.
- Kaplan JM. 2003. Patterns of Entrepreneurship. John Wiley & Sons.
- Nandan H. 2007. Fundamentals of Entrepreneurship Management. Prentice Hall

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FFT 340 : Project Work for 3 months (0-0-18-18)

Course Curriculum

SEMESTER I: Core Courses (4x5=20 Credits)

This semester has four core papers which are as under (Each paper is compulsory)

- MLS501: Introduction to Social Sciences/Liberal Studies
- MLS502: Social Ecology and Ecological Economics
- MLS503: Fundamentals of Sociology
- MLS504: Indian Political System

SEMESTER II: Creative Bucket (4x5=20 Credits)

This semester has two core papers and two elective papers (out of four options) which are as under

GROUP – A (Core Papers: Each paper is compulsory)

- MLS505: Contemporary Social Theory
- MLS506: Performance and Literary Theories

GROUP – B (Elective Papers: Choose any one out of two papers)

- MLS551: Cultures and Migration
- MLS552: Civil Society and Human Rights

GROUP – C (Elective Papers: Choose any one out of two papers)

- MLS553: Gender: The Invisible Dynamics
- MLS554: Introducing the Theories of Art and Aesthetics

SEMESTER III: Research Methods in Liberal Studies (4x5=20 Credits)

This semester has four core papers which are as under (Each paper is compulsory)

- MLS507. Quantitative Research Techniques in Social Science Research
- MLS508: Qualitative Research Methodology
- MLS509: Soft Skills: Communication and Computer Skills
- MLS510. Intervention in Social Settings: Participatory/Action Research

SEMESTER IV: Specialization (4x5=20 Credits)

This semester has one core paper termed ‘Dissertation’ which is equivalent to two papers i.e. 10 credits and two elective papers can be chosen out of six papers which are as under

GROUP – A (Core Paper: Dissertation which is compulsory)

- MLS511: Dissertation (2x5=10 Credits)

GROUP – B (Elective Papers: Choose any one out of three papers)

- MLS555: Economics of Development
- MLS556: Public Health
- MLS557: Anthropology of Indian Civilization

GROUP –C (Elective Papers: Choose any one out of three papers)

- MLS558: Gender, Culture and Identity
- MLS559: Fundamentals of Cultural Studies
- MLS560: Democracy and Subaltern Politics

Category

- Highlight of the course
- Aims and Objectives
- Career Opportunities
- Course Curriculum
- Syllabus
- Coordinator

G.B. Pant Social Science Institute, Jhusi, Prayagraj-211019, Uttar Pradesh, INDIA

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PROGRAMME STRUCTURE: B.Voc. Degree Programme in Software Development

SEMESTER – I

General Education				Skill Component			
No.	Title	Credit	Hrs/week	No.	Title	Credit	Hrs/week
BSG-101	Communication Skills	4	4	BSS-101	Introduction to IT	4	4
BSG-102	Aptitude & Logical Reasoning	4	4	BSS-102	Fundamentals of Programming	4	4
BSG-103	Managerial Economics	4	4	BSS-103	Word Processing & Image editing	4	4
				BSL-231	Photoshop Lab	3	6
				BSL-232	LaTex Lab	3	6
	TOTAL	12	12		TOTAL	18	24

SEMESTER – II

General Education				Skill Component			
No.	Title	Credit	Hrs/week	No.	Title	Credit	Hrs/week
BSG-104	Documentation & Presentation methods	4	4	BSS-104	Multimedia & Animation	4	4
BSG-105	Environmental Studies	4	4	BSS-105	Network & Internet Applications	4	4
BSG-106	Mathematics-I	4	4	BSS-106	C Programming	4	4
				BSL-233	C Programming Lab	3	6
				BSL-234	Animation Lab	3	6
	TOTAL	12	12		TOTAL	18	24

SEMESTER – III

General Education				Skill Component			
No.	Title	Credit	Hrs/week	No.	Title	Credit	Hrs/week
BSG-107	Business Statistics	4	4	BSS-107	Web Programming	4	4
BSG-108	System Analysis & Design	4	4	BSS-108	Computer Hardware & Maintenance	4	4
BSG-109	Management Information Systems	4	4	BSS-109	Operating Systems	4	4
				BSL-235	Web Development Lab	3	6
				BSL-236	Computer Hardware Lab	3	6
	TOTAL	12	12		TOTAL	18	24

SEMESTER – IV

General Education	Skill Component

Centre for Women's Studies

Syllabus for Masters Programme in Women's Studies

Semester –I

5 Papers each having 4 units & 4 credits in Semester I & II (Credits-20)
5 Papers each having 4 units & 4 credits in Semester III & IV, with Practical Work and Viva-voce each having 4 Credits

Total number of Credits for each paper - 20
Each Credit is equal to 10 contact teaching hours

Course Code: CWS 501
Core Paper -1
Introduction to Women's Studies

Objectives: The purpose of this paper is to introduce the student to the subject of Women's Studies, its radical nature and its significance and scope. The paper also acquaints the student with the history of the subject, tracing its development to the present time**.**

Unit-1: Genesis and history**,** scope and significance of Women's Studies**,** Its relation others subject- History, Sociology, Political Science, & Philosophy, History of Women's Movements.

Unit-2: The Status of Women's-Equality Report**,** The development of Women's Studies, Role of academic bodies-SNDT, UGC, MHRD, ICSSR.

Unit-3: National Organizations- MHRD, Ministry of Women & Child Development, Government Agencies, National Commissions and State Commissions

Unit-4: International Organizations, Role of United Nations, UN Declarations, World Conferences**,** CEDAW

Unit-5: Research Paper/Project/PPT

Suggested readings:

- Neera Desai and Maithreyi Krishnaraj**, Women and Society in India,** Bombay: Ajanta,1987
- Government of India, Department of Social Welfare ***Towards Equality***, New Delhi,1974 **Millennium Development Goals**, UNIFEM

- Devaki Jain and Pam Rajput, eds. ***Narratives from the Women's Studies Family,*** New Delhi : Sage, 2003
- Malashri Lal and Sukrita Paul Kurnar (ed.), **Women's Studies in India: Contours of Change,** IIAS, Shimla, 2002 (selected articles).
- Stevi Jackson et al, (ed.), **Women's Studies: A Reader** Harvester, 1993.
- Vidyut Bhagwat, **Women's Studies: Interdisciplinary Themes and Perspectives,** Diamond publications, Pune, 2012
- Anne Cranny-Francis and others, **Gender Studies; Terms and Debates,** Macmillan, 2003,New York, USA
- Gloria Bowles & Renate Duelli Klein (eds.),**Theories of Women's Studies,** London: Routledge and Kegan Paul,1983
- Gandhi, Nandita and Nandita Shah, ***The Issues at Stake : Theory and Practice in the Women's Movement in India***, New Delhi: Kali for Women, 1992
- Mary E. John , Editor, **Women's Studies in India : A Reader**, New Delhi **:** Penguin Publishers, 2008
- Neera Desai and Usha Thakkar, **Women in Indian Society**, New Delhi *:* National Book Trust India,1999

Course Code: CWS 502
Core Paper-2
Feminism

Objectives: This paper will acquaint the student with the beginnings and growth of Feminism as a world movement, the reasons for its genesis and its various international contexts. It will focus on the indigenous roots of the movement in India and its social, economic, political and cultural framework.

Unit-1: Feminisms- meanings and definitions**,** History-Suffragette movement-The three waves of Feminism**,** Women's participation in **S**ocial Movements.

Unit-2: Pre-Independence and post-independence feminist movement, History and diversity of Indian feminism**,** Issues and challenges.

Unit-3: Reformers & Thinkers in the nineteenth and twentieth century's- Raja Ram Mohan Roy, Ishwar Chand Vidyasagar, Annie Besant, Phule, Periyar, Gandhi, Nehru, Ambedkar, Beauvoir, Millet, Woolf, Greer, Friedan**,** Walker**,** Morraga, Andalzua (Western Thinker)

Unit-4: Pioneering Indian women in the areas of political and social reform, their achievements and contributions- Sarojini Naidu, Durga Bai Deshmukh, Pandita Ramabai and others. (Indian Thinker)

Unit-5: Research Paper/ Field work /Project/PPT

Suggested Readings:

- M. Chaudhuri, (ed.) **Feminism in India**, Kali for Women, New Delhi,2004.
- Krishnaraj, Maithreyi (ed**), Feminist Concepts: Part l, 2, and 3,** Contribution to Women's Studies Series-7, Research Centre for Women's Studies, SNDT University, Bombay, 1990.
- Sushila Singh, **Feminism**, Pencraft International, Delhi, 2004
- Phillips, Anne (ed.) **Feminism and Equality**, Oxford : Blackwell, 1987
- Betty Frieden, **The Feminine Mystique,** New York **:** Dell, 1964
- Chandra V. **Gender Relations in Early India**. Jaipur : Rawat Publishers, 2010
- Jill M. B. & Joti Sekhon, (eds), **Democratization and Women's Grassroots Movements.** Indiana : Indiana University,1999
- Forbes, G. **Women in Modern India**. Cambridge: Cambridge University Press,1999
- Phillips, Anne (ed.) **Engendering Democracy**, Oxford: Polity Press,1991
- Devaki and Pam Rajput,eds, **The Tyranny of the Household: Essays on Women and Work,** New Delhi ; Shakti, 1985
- Mala Khullar, (ed.), **Writing the Women's Movement: A Reader,** New Delhi: Zubaan, Kali for Women, 2005.
- Bharathi Ray (ed.), **Women of India: Colonial and Post Colonial Periods in History of Sciences and Philosophy in Indian Civilization**, Vol. IX Part 3, New Delhi :Sage, New Delhi,2005
- Clara Zetkin, **Movements for the Emancipation of Women**, New Delhi : Kamgar Prakashan,1988
- Joanna Kerr Ellen Sprenger & Alison Symington(eds),**The Future of Women's Rights: Global Visions and Strategies** Zed Books London/ New York: Zed Books,2005
- Chandra Talpade Mohabty, Ann Russo, Lourdes Torres, (eds), **Third World Women and the Politics of Feminism,** Bloomington and Indianapolis : Indiana University Press, 1991
- Germaine Greer, **The Female Eunuch,** UK : Harper Collins, 1970
- Simone de Beauvoir, **the Second Sex**, New York : Knopf, 1950,
- Judith Butler, **Feminism and the Subversion of Identity**.New York : Routledge. 1999
- Jasbir Jain, **Indigenous Roots of Feminism: Culture, Subjectivity and Agency**, New Delhi, Sage Publications, 2011.

Course Code: CWS 503
Core Paper-3
Core concepts of Women's Studies

Objectives: The aim of this paper is to introduce to the students the core concepts of Women's studies, with a focus on Patriarchy, and its mutually supportive social institutions like caste, religion and marriage.

Unit-1: The dynamics of patriarchy**,** status of women in patriarchy & sexist stereotypes of women**,** concepts of purity & honour, personal is political, Sex & Gender.

Unit-2: Intersectionality- Engendering Caste, Caste & Patriarchy, Class & Gender, Caste and Gender, Race & Gender

Unit-3: Social construction of society, Gramsci's concept of Hegemony**,** Femininity, Masculinities & Sexuality

Unit-4: Sociology of religion, Women in Religious Traditions- Hinduism, Islam, Christianity and others. Patriarchy & Gender, Issues of minority women & marginalization,

Unit-5: Research Paper/field work /Project/PPT

Suggested Readings:

- Butler, Judith, **Gender Trouble: Feminism and the Subversion of Identity**, London: Routledge,1990
- Judith M. Bennett, **History Matters: Patriarchy & the Challenge of Woman,** Manchester University Press, 2006
- Pateman, Carole**, The Sexual Contract**, Oxford : Polity Press,1988
- Pateman, Carole, **The Disorder of Women**, Oxford : Polity Press,1989
- Maria Mies, **Patriarchy and Accumulation on a World Scale: Women & the International Division of Labour,New Delhi :** Zed Books, 1986.
- National Population Policy, Govt. of India, 2000.
- Padmini Swaminathan, (ed) **Women and Work**, New Delhi: Orient Longman, 2012
- Gerder Lerner, **The Creation of Patriarchy**, OUP, 1986.
- V. Geetha , **Gender**, Kolkata : Stree, 2002.
- V.Geetha, **Patriarchy**, Kolkata : Stree, 2007
- Jasbir Jain, **Women in Patriarchy: Cross Cultural Readings**, Jaipur :Rawat Publication, 2005
- Manoranjan Mohanty, **Class, Caste, Gender** (ed.) , New Delhi: Sage, 2004
- Aggarwal, B. **Patriarchy and the "Modernising" State**, in Agarwal, B. (ed.), **Structures of Patriarchy: The State, the Community and the Household,** London: Zed Press, 1988.
- Bhasin, Kamla. **What is Patriarchy**? New Delhi: Kali for Women, 1993
- Kum Kum Sangari & Uma Charkravarty (eds) **From Myth to Market: Essays on Gender**, New Delhi: Manohar, 1999.
- Sarkar, S. & Sarkar, T. **Women and Social Reforms in Modern India**, Vol. 2, Bloomington, Indian University Press, 2008.
- Maithreyi Krishna Raj, **Women Studies in India – Some Perspectives**, Bombay : Popular Prakashan, 1986.
- Germaine Greer, **The Female Eunuch**, UK : Harper Collins, 1970.

Course Code: CWS 504
Core Paper-4
Women's Writing & Literature

Objectives: This paper aims to show the students how the earliest feminist articulations were made and how, with time, the volume of literature written from the subject position has grown and constitutes a respected part of world literature**.** The Academic Programme

Committee will choose suitable selected texts for in-depth study from some of the regions given below.

Unit-1: Feminist reading of Literary Text, Locating women in historical context of epics like Mahabharata and Ramayana. Different genres – Diaries, Letters & Essays, Introducing Literary Feminist Criticism, female traditions in literary production, do women write differently? Feminist writing, The Female Voices in the Sufi Traditions

Unit-2: Selections from 19th and 20th century & contemporary writings from the Asian sub-continent including Dalit writings (Possible writers - Shashi Deshpande, Kamala Das, Shobha De, Kamila Shamsie, Taslima Nasreen, Bama, Ismat Chughtai, among others) mapping of changes in contents, tone and approaches towards writing.

Unit-3: Relationship of the Novel and women writers, Selected texts of the 19th & 20th centuries, Contemporary texts, American, African-American, South American, Mexican & European writers (Possible Writers- Jane Austen, Virginia Woolf, Anais Nin, Adrienne Rich, Tillie Olsen, Alice Walker, Morraga), Women in Modern Hindi Literature, Story, Novels, Poetry and Autobiographies.

Unit-4: Selections from Literatures of the world**,** Middle East**,** African**,** Chinese/Japanese**, (**Possible Writers- Zhang Ling (Chinese) Nawal El Saadawi (Egyptian) Huda Bakarat (Lebanese) Chimamanda Ngozi Adichie (African) among others)

Unit-5: **Research Paper/field work /Project/PPT**

Suggested Readings:

- Tharu and K.Lalitha (eds.) **Women Writing in India: 600BC to the Present**. 2vols. Delhi: OUP 1991 & 1993
- Sangari, Kumkum and Suresh Vaid (eds.). **Recasting Women: Essays in Colonial India,** New Delhi: OUP, **2003**
- Walker, Alice, **In Search of Our Mothers' Gardens**, London:The Women's Press, 1984
- Tutun Mukherjee, **Staging Resistance: Plays by Women in Translation.** (ed.), New Delhi: Oxford, 2005.
- Urvashi Butalia,**The Other Side of Silence: Voices from the Partition of India**, New Delhi: Kali for India, 1998
- Ritu Menon and Kamla Bhasin, **Borders and Boundaries**,New Delhi: Kali for Women, 1997
- Cherries Moraga and Gloria Anzaldua(eds) **This Bridge Called My Back,** Goodreads, 1981.
- Sandra M.Gilbert and Susan Gubar, **The Madwoman in the Attic,** Yale Press, 1979.
- Anees Jung, **Unveiling India : A Woman's Journey**, New Delhi : Penguin, 2000
- Bama, **Vanman**, **Vendetta,** New Delhi : Oxford University Press, 2008
- Virginia Woolf, **A Room of One's own and Three Guineas**, New York : Oxford University Press, 1992
- Women Writers, **Five Novellas**, New Delhi : Oxford University Press,2008 (Nabaneeta Dev Sen, Mrinal Pande, Vaidehi, B.M.Zuhara and Saniya)

- Geetanjali Singh Chanda, **Indian Women in the House of Fiction**, New Delhi : Zubaan, 2008
- **Toril Moi, Sexual/Textual Politics: Feminist Literary Theory,** London: Routledge, 1985.
- Ashcroft, Bill, Gareth Griffith and Helen Tiffin, **The Empire Writes Back: Theory and Practice in Post- Colonial Literature**, London: Routledge, 1989
- Kate Millet, **Sexual Politics,** University of Illinois Press,1970
- Elaine Showalter, **A Literature of their Own: British Women Novelists from Bronte to Lessing**, Princeton N.J.: Princeton University Press, 1977
- Ellen Moers, **Literary Women**, UK: Doubleday, 1976
- Juliet Mitchell, **Women, The longest Revolution, London** : Virago Press Ltd.,1984
- Mahasweta, Devi, **Imaginary Maps: Three Stories**. Translated by Gayatri Chakravarty Spivak, Calcutta: **Thema,** 1984; New York; Routledge.1995
- Eunice de Souza, ed. **Nine Indian Women Poets**, New Delhi, O.U.P., 1997.
- Annie Zaidi, **Unbound: 2000 years of Indian Women's Writing**, New Delhi, Aleph Book Company, 2015.

Course Code: CWS 505
Core Paper-5
Fundamentals of Research Core

Objectives: The paper aims to introduce the student to the concept of research, what it is and what are its methodologies. It will highlight the features of computer packages and statistical methods.

Unit-1: Meaning of Research, Objectives of Research, and Types of Research, Research Approaches, Use of Empirical and Scientific Methods.

Unit-2: Research Methods in Social Sciences, Types of Research Methods: Quantitative and Qualitative, Collections of Primary Data through Questionnaire, Interview, Observation, Schedule, Case Study. Secondary Data: Major sources, Journals, Books, Government Records and Reports etc

Unit-3: Statistical Methods- Uni-variate, Bi-variate, Computer analysis- Introduction to computer packages.

Unit-4: Interpreting Data, Technique of Interpretation, Significance of Report Writing, Different Steps in Writing Report, Mechanics of Writing a Research Report- Literature review, footnotes, endnotes bibliography.

Unit-5: **Research Paper/field work /Project/PPT**

Suggested Readings:

- Joseph F. Healey, **Statistics: A tool for Social Research**, Belmont : Wadsworth Publishing Company,C.A., 1999
- Using Statistical data base – NFHS data, Census etc.

Semester -2

Course Code: CWS 506
Core paper-6
Feminist Theories

Objectives: Theory occupies an important place in the study of any discipline. The aim of the paper will be to familiarize the student with the broad features of existing schools of feminist criticism in Women's Studies and the contemporary debates and issues regarding them.

Unit-1: Liberal feminism**,** Radical Feminism, Post-Modernism & Feminism,

Unit-2: Socialist Feminism**,** Marxist Feminism

Unit-3: Post-Colonial Feminist Theory, Subaltern Feminisms: Black Feminist Criticism**,** Ethnic Voices in America**,**

Unit-4: Psychoanalysis and Feminist Theory**,** French Feminist theory, Contemporary Issues in Feminist Thought

Unit-5: Research Paper/Project/PPT

Suggested Readings:

- Stevi Jackson and Jackie Jones (eds) ***Contemporary Feminist Theories***, Rawat Publications, Hyderabad, Indian Reprint, 2011
- Spivak, Gayatri Chakravorty, "Three Women's Texts and a critique of Imperialism", in ***Critical Inquiry***,12, Autumn: 243-62.
- Spivak, Gayatri Chakravorty 'Can the subaltern Speak?' reprinted in Patrick Williams and Laura Chrisman(eds***) Colonial Discourse and Post-Colonial Theory***, Hemel Hempstead : Harvester Wheatsheaf, 1993
- Chaudhuri, Nupur and Margaret Strobel (eds) ***Western Women and Imperialism: Complicity and Resistance,*** Bloomington and Indianapolis: Indiana University Press,1992
- Rajan, Rajeshwari Sunder**,** ***Real and Imagined Women: Gender, Culture and Postcolonialism***, London: Routledge, 1993
- Said, Edward, ***Culture and Imperialism***, London: Chatto and Windus,1993
- Sangari, Kumkum and Sudesh Vaid (eds) ***Recasting Women: Essays in Colonial History,*** New Delhi: Kali for Women, 1986
- Mary Eagleton (ed.), **Feminist Literary Theory**, New York: Basil Blackwell, 1986.
- Sangari, Kumkum and Sudesh Vaid (eds)***Women and Culture***, Bombay Research Unit for Women's Studies, SNDT University, 1985
- Spivak, Gayatri Chakravorty**,** ***In Other Worlds: Essays in Cultural Politics,*** London: Routledge,1987
- Trinh T.Minh-ha, ***Woman Native Other: Writing Postcoloniality and Feminism,*** Bloomington and Indianapolis :Indiana University Press, 1989

- Spender, Dale (ed.) ***Feminists Theorists : Three Centuries of Women's Intellectual Traditions***, London: Women's Press, 1983
- Elaine Showalter, **Towards a Feminist Poetics: Women's Writing and Writing About Women**, London: Croom Helm, 1979
- Chandra Talpade Mohanty, **Feminism Without Borders - Decolonizing Theory, Practising Solidarity**, New Delhi ; Zubaan, 2006
- Collins, Patricia Hill, **Black Feminist Thought: Knowledge, Consciousness and the Politics of Empowerment,** London: Unwin Hymen,1990
- Hooks, Bell, ***Feminist Theory: From Margin to Centre***, Boston: South End Press, 1984
- Hooks, Bell, ***Black Looks: Race and Representation***, Boston: South End Press,1993
- Barbara Smith, **Writings on Race, Gender and Freedom: The Truth that Never Hurts**. New Jersey: Rutgers University Press, 1998.
- Trinh T.Minh-ha, **Woman Native Other: Writing Postcoloniality and Feminism,** Bloomington and Indianapolis :Indiana University Press, 1989
- Toril Moi, **Sexual/Textual Politics: Feminist Literary Theory**, London : Routledge, 1985

Course Code: CWS 507
Core Paper-7
Women & Education

Objectives: The aim of this paper is to acquaint students with the history of the education of women during different periods in history, the causes of the improvement or decline in their status, their relationship with education, the nature of education provided to women and the current positions.

Unit-1: Status of women in the Ancient, Medieval Times**,** Education of the minority women- Muslim, Christian, Parsi, History of the education of women in the colonial period

Unit-2: British Reforms, History of Indian Reformers & Social reforms**,** Women's education in the post-Independence period.

Unit-3: Thinkers and contributions to the education of women, Women's roles in Social Movements & Independence Movement.

Unit-4: Issues in contemporary education of women**,** Engendering the curriculum, Gender gaps in accessibility to education, Government schemes & interventions, Socialization processes through education, Gender stereotyping in the curriculums, Urban rural divide.

Unit-5: Research Paper/project /PPT

Suggested Readings:

- B.M Sharma, & U. Sharma, **Women and Higher Education**, Common Wealth Publisher, 1995

- M. Bhargava, & K.Dutta K, **Women, Education and Politics**, Oxford University Press, 2005
- Roopa Vohra, Arun K.Sen, **Status, Education and Problems of Indian Women**, Akshat Publications, Delhi, 1986
- J.Bharat , J Madhu , **Indian Approaches to Women's Empowerment**, Rawat, Jaipur, 2004
- Sharmila Rege ,(Ed.), **Sociology of Gender – The Challenge of Feminist Sociological Knowledge,** Sage, New Delhi, 2003
- Bharathi Ray, (Ed.), **Women of India: Colonial and Post Colonial Periods in History of Sciences and Philosophy in Indian Civilization**, Vol. IX Part 3, Sage, New Delhi, 2005
- Mala Khullar, (Ed.), **Writing the Women's Movement: A Reader**, Zubaan, Kali for Women, New Delhi 5, 2005
- Sabanna Talwar, **Women Education Employment and Gender Discrimination**, Serials publication, 2007
- Raj Kumar, Lord Kames, Manot Kumar Singh, **Women and Education**, Anmol publication, 2000
- Nirmala Sharma, **Women And Education : Issues & Approaches,** Alfa Publication, 2006
- Malala Yousafzai, Lamb Christina**, I Am Malala : The Girl who Stood Up for Education and was Shot by the Taliban**, Hachette Book, 2013
- Margaret Grogan, Sakeshaft Charol, **Women and Educational Leadership**, Jossey-Bass, 2010
- M. Diane Dunlap (Editor), A. Patrica ,Patricia Schmuck (Series Editor), **Women Leading in Education**, State University of New York Press, 1994
- C. Cryss Burner, Grogan Margaret, **Women Leading School Systems: Uncommon Roads to Fulfillment**, R&L Education, 2007

Course Code: CWS 508
Core Paper-8
Economics, Politics & Women

Objectives: The main objective of this paper is to help students gain an understanding of economic and political processes and policies and their impact on women and their lives. The paper will also focus on the consequences and benefits of economic and political empowerment of women.

Unit-1: Capability and entitlement approach of Amartya Sen's theory, Theories of Development, Empowerment, Alternative Approaches – WID (Women in Development), WAD (Women and Development), GAD (Gender and Development), Five year Plans and policies, Welfare perspectives 1 to 5th Plan, Development Perspective, 6th & 7th Plans, Empowerment perspectives 8th Plan onwards, Feminization of poverty**,** Development Measures - Human development Index – Gender Related Development Index, Gender Empowerment Measures, Gender Budgeting

Unit-2: Women in various sectors, (Organised/Unorganised) Entrepreneurship**,** Wage discrimination, Labour laws & it's implementation Self-employment**,** Self -help groups, and income generation, Micro Finance, Trade Unions**,** Women and technology and empowerment, Women and agriculture, status of rural women, Globalization, Globalization effect on Women (Rural/Urban), Millennium Development Goals (MDG) & Sustainable Development Goals (SDG).

Unit-3: Nature of participation of women in Politics**,** Women and Politics, Criminalization of Politics and its impact on women's political participation, Women & Governance**,** Women in Parliament, 73rd and 74th Constitution Amendments

Unit-4: Politics of political representation**,** Panchayati Raj**,** Reservation Bill- significance and Debates**,** Women's presence in Political Manifestoes

Unit-5: Research Paper/project/PPT

Suggested Readings:

- Amartya Sen, **Development As Freedom**, (selection),New Delhi :OUP, 2011.
- Bina Agarwal, ed. **Capabilities and Equality, Amartya Sen's Work from a Gender Perspective**, Oxford University Press, New Delhi, 2006. Readings
- Krishna Gupta, (ed.), **Empowerment of Women, Emerging Dimensions**, S Chand Publishing, New Delhi, 2010.
- Manmohan Kaur, **Women in Indian Freedom Struggle**, Sterling Publications, New Delhi, 1985
- Reports of Center for Budget and Governance and Accountability, National Commission for Women, **Gender Equity-Making it Happen – Strategies and Schemes of Government of India**, NCW, New Delhi, 2001
- S. Maria John, R. Jeyabalan, and S. Krishnamurthy, **Rural Women Entrepreneurship, Discovery Pub House, 2004**
- Soundrapandian (ed), **Women Entrepreneurship- Issues and Challenges**, Ashish Publishing House, New Delhi, 2000.
- Sheela Varghese, **Employment of Women in the Unorganized Manufacturing Sector**, University Book House Private limited, Jaipur, 2003
- Leela Kasthuri, **Development, Patriarchy, and Politics: Indian Women in the Political Process 1947-1992**, Occasional Paper NO 25, Centre for Women"s Development Studies, New Delhi, 1995
- L Sharma, **Empowering Women through Panchayati Raj Institutions in India**, Prateeksha Publication, Jaipur, 2009
- P Singh, **Women's Participation in Panchayati Raj : Nature and Effectiveness**, Rawat Publisher, 2007
- M Dhanda, Series Editor- Rajeshwari Sunder Rajan, **Reservation for Women**, Kali for Women, 2008
- S.Sarkar & T. Sarkar, **Women and Social Reforms in Modern India, Vol. 1**, Bloomington Indian University Press, 2008

- Mala Khullar (ed), **Writing the Women's Movement, A Reader**, Zubaan, New Delhi, 2005
- Mary Wollstonecraft, **A Vindication of the Rights of Women**, Penguin Books, 2005
- Nivedita Menon , **Gender and Politics in India**, OUP, New Delhi, 1999
- A.K Sinha, **Panchayati Raj and Empowerment of women**, Northern Book Centre, Delhi, 2004
- Jojanna Brennen, **Women and the Politics of Class**, Aakar Books, Delhi, 2006
- Maithreyi Krishna Raj, **Women's Studies in India – Some Perspectives**, Popular Prakasham, Bombay, 1986
- Pam Rajput and Hemlata Swaroop (eds),**Women and Globalisation**, New Delhi: APH, 1994
- Ellen, J Springer & A. Symington, Editors, **The Future of Women's Rights: Global Visions and Strategies**, 2005

Course Code: CWS 509
Core Paper-9
Women & Law

Objectives: A crucial aspect of empowerment is the awareness and knowledge of the Law and the ability to access it when and if required. The aim of this paper is to educate students in the ways of the Law.

Unit-1: Feminist Jurisprudence, Legal Concepts & Women, Women in the Indian Constitution, Engendering the Law

Unit-2: Colonial Rule and Women's laws, Personal Laws and Women, Marriage, Divorce & related issues, contextualizing the Uniform Civil Code

Unit-3: Laws for women- Domestic violence, Immoral Trafficking Sexual violence & sexual harassment, Indecent representation of women,

Unit-4: Laws pertaining to women and family- Dowry, Family Courts, Maternity Benefits, Universal Declaration of Human Rights & Women's Rights.

Unit-5: Research Paper/ field work/project/PPT

Suggested Readings:

- Bina Agarwal, **A Field of One's Own; Gender and Land Rights in South Asia**, Cambridge, Cambridge University Press, 1994
- Brenda Crossman and Ratna Kapoor, **Subversive Sites: Feminist engagements with Law in India**, 1996
- Anita Dhanda and Archana Parashar (Ed), **Engendering Law: Essays in Honour of Lotika Sarkar**,139-160, 1999
- Indira Jaisingh, **Women's Law, Women's Lives: A Constitutional Perspective on Religion, Consumer Law and Culture in South Asia**, Delhi :Women Unlimited, 2005

- Lotika Sarkar, **Women's Movement and the Legal Process**, Occasional Paper No. 24 Centre for Women's Development Studies, New Delhi, 1995
- Lotika Sarkar and B. Sivaramayya, **Women and Law: Contemporary Problems**, New Delhi: Vikas,1994.272p., 346.0134 WOM 6073
- Ratna Kapur, **Subversive Sites: Feminist Engagements with Law in India** edited by Ratna Kapur and Brenda Crossman.- New Delhi: Sage, 352p., 346.0134 KAP.S 7069, 1996
- Ratna Kapur, ed. **Feminist Terrains in Legal Domains: Interdisciplinary Essays on Women and Law in India**, New Delhi: Kali for Women, 280p., 346.0134 FEM 7344, 1996
- Krishna Gupta, **Women, Law and Public Opinion**.- Jaipur: Rawat, 228 p., 346.0134 GUP.W 9873, 2001
- Wadia, Pouruchisti, **Victim and Witness Protection: A Women's Right**, From the Lawyers Collective. 20(6); June 2005
- Madhu Bright, **Women and Law, Women's Link**. 14(4); p. 43-45, 2008
- A. Dhanda & A . Parashar (Ed.), **Redefining Family Law in India**. Routledge India. 2008
- National Commission for Women, **Gender Equity-Making it Happen – Strategies and Schemes of Government of India**, NCW, New Delhi, 2001
- Madhu Bright, **Women and Law, Women's Link**. 14(4); p. 43- 45 October-December 2008

Course Code: CWS 510
Core Paper-10
Feminist Research

Objectives: The paper aims to introduce the student to the concept of feminist research, what it is and what are its methodologies and how is it different from researches in other social and physical sciences. It will interrogate the epistemology of feminist research and how it is more inclined towards interpretive and critical approaches.

Unit-1: Meaning of Feminist Research, Mainstream research, Problems of doing feminist research**,** Significance of research methods

Unit-2: Epistemology and research**,** Feminist Research Methodology**,** Interrogating methodology**,** The Philosophy of feminist research, feminist empiricists.

Unit-3: The new methods of data collection generated by feminist scholars, Questionnaires**,** Interviews**,** Case study, narrative & conversational analysis, Oral history/ documentaries, Oral Literature

Unit-4: Data Analysis manually and using SPSS**,** Research Reports

Unit-5: Research Paper/ Sample Project/PPT

Suggested Readings:

- Ramazanoglu, Caroline. **Feminist Methodology: Challenges and Choices** , Sage Publications: London,2002
- Harding, Sandra, ed. **Feminist Standpoint Theory Reader: Intellectual and Political Controversies**, Routledge,2004.
- C.Weedon, **Feminism, Theory and the Politics of Difference**, Oxford : Blackwell,1999
- K.Weiler, **Women Teaching for Change : Gender Class and Power**, South Hadley, MA : Bergin & Harvey, 1988
- E.Grosz, Jacques **Lacan : A feminist Introduction**, London : Routledge, 1990
- Judith Butler, **Gender Trouble and the Subversion of Identity**, London : Routledge,1999
- A.Cavarero, **Relating Narratives : Storytelling and Selfhood**, London : Routledge,2000
- Mary Daly, **Gynecology : The Metaethics of Radical Feminism**, Boston MA :Beacon Press,1978
- Joseph F. Healey, **Statistics: A tool for Social Research**, Belmont : Wadsworth Publishing Company,C.A., 1999
- Using Statistical data base – NFHS data, Census etc.
- Agarwal, 1980, ***Basic Statistics***, Wiley Eastern.
- S. P. Gupta, 1969, **Statistical Method**, Sultan Chand & Son

Semester -3

Course Code: CWS 511
Core Paper- 11
Women and Health

Objective- The objective of this paper is to develop a holistic understanding of health for women. This paper will enlighten students with the status, attitudes, and behaviour and health needs of women in society. Moreover, major physical and mental illnesses, their causes and treatments are also emphasized.

Unit-1: Concept of health, Social construction of health by woman - familial, social and cultural factors effecting women's health, reasons for primacy of reproductive health over other health concerns of women such as nutritional, physical, and mental health needs. HIV and AIDS, Reproductive health issues, Maternal and child health, gender in contraception and family planning, reproductive technologies- female amniocentesis, PNDT and PNCDT Acts, MTP Acts, Surrogacy Acts.

Unit-2: Mental illness among women, Principles of mental Health, Psychosomatic Indicators, Menopause and Pre menstrual Syndrome, Issues of old age- Alzheimer and depression, Anxiety Disorders, Anxiety Disorders- Major depressive disorders, phobia, eating disorders – causes, symptoms and treatment, Madness and Women

Unit-3: Status and statistics of Woman's health in India- NFHS, ICRW Reports, sex ratio, mortality, morbidity, National health and Population Policies and Programmes in India. Linkages between women's health and family welfare, Issues of menstruation, ailments related to pregnancy, work related health problems of women, Men's participation in health concerns of women.

Unit-4: International & National Initiatives: Cairo Conference - International Conference on Population and Development 1994 – Role of International Organizations - World Health Organization, NMHP, UN International Children's Emergency Fund, United Nations Educational, Scientific and Cultural Organization - CARE and Others

Unit-5: Research Paper/ Sample Project/PPT

Suggested readings:

- Nancy Chodorow, **The Reproduction of Mothering**, Berkeley: UC Press, 1978.
- Koenig M.A., Jejeebhoy S., Cleland C.J. & Ganatra, B. **Reproductive Health in India : New Evidence** Editors Rawat Publishers, 2008.
- Kumar R.S. **Marketing Reproduction,** Zubaan, New Delhi, 2006.
- Jhansi S.C. **Women and Reproductive Health- An Educational Insight in the new Millennium,** Shipra Publication, New Delhi ,2010.
- Gunasekaran, S. **Women, Autonomy and Reproductive Behavior**, Kalpaz Publication, New Delhi, 2010
- Amita Dhanda **Legal Order and Mental disorder**. Sage Publisher 2000
- Shukla A. (Ed.)**Psyche of Indian Women** Concept Publishing company, New Delhi 2013

- Tulsi Patel, (Ed.), **Sex selective Abortion in India – Gender, Society and New Reproductive Technologies,** Sage, New Delhi, 2007
- World Health Organisation, **Women of South East Asia-A health profile,** WHO, Regional Office for South East Asia, New Delhi , 2000
- United Nations Development Organisation, **Human Development Report,** UNDP, Delhi , 1995
- Sakshi, 1999, **Sexual Harassment at the Work Place, A guide**, ILO, New Delhi
- A.Kumar, **Women and Family Welfare**, Ammol Publications Pvt Ltd, New Delhi , 2006
- Sigmund Freud **New Introductory Lectures**, Standard Edition 12: 112-135.1933
- Sigmund Freud. **Studies in Hysteria**. London: Penguin, 1984.
- D.Sinha, **The Concept of Psycho-social Well Being: Western and Indian Perspectives,** National Institute of Mental Health and Neurosciences Journal, 8, 1-11. 1990
- Kakar, S. **The Inner world: A Psychoanalytic Study of Childhood and Society in India.** Delhi: Oxford University Press, 1981
- S.Kakar, **Shamans, Mystics and Doctors**. New York: Alfred A. Knopf, 1982
- S.Kakar, The **Colours of Violence**. New Delhi: Viking, 1995
- Marsha Pravder Mirkin, Karen S. Suyemoto, Okun, B.F. **Psychotherapy with Women: Exploring Diverse Contexts and Identities, Guilford Press.**, 2005

Course Code: CWS 512
Core Paper -12
Women & Society

Objectives-The purpose of this paper is to develop an understanding of the sociological, psychological and anthropological construction of social norms and understanding women's issues within these contexts. A special emphasis has been given to analysing and interrogating the role and status of women in society.

Unit-1: Feminist approaches to the study of Society, nature of family and kinship, marriage: patterns of exchange and presentation (dowry), Honour, Shame and Violence, Religion in India: Ideology, Social Organization, religious movements, women and religion

Unit-2: Contribution of Cultural anthropologist Margaret Mead, Women and Society in Continuity and Change: Tradition and Modernity, Contemporary India: Nationalism, Secularism, Communalism and Regionalism, Objectification of women and the patriarchal construction of beauty

Unit-3: Psychological principles - definition, methods, branches, and the nature of scientific enquiry, Psychoanalytical and psychosocial theories of development and personality- Sigmund Freud, Carl Jung, Karen Horney, Eric Erikson, Albert Bandura, Feminist psychologists-Juliet Mitchell, Carol Gilligan, Naomi Weisstein

Unit-4: Difference between Sex and Gender- A Psychological Enquiry. Mind Body issue, Socialization, Types of parenting, Theories of Gender role development, development of Stereotypes, breaking stereotypes- mechanism

Unit-5: Research Paper/ Sample Project/PPT

Suggested Readings:

- Sharmila Rege, (ed.), ***Sociology of Gender – The Challenge of Feminist Sociological Knowledge***, New Delhi : Sage, 2003
- Sara Delamont, 2003, ***Feminist Sociology***, Sage, New Delhi,
- Maragaret Mead, **The Coming of Age in Samoa**, New York: William Morrow and Company, 1928
- Lena Dominelli, 2002, **Feminist Social work Theory and Practice,** Palgrave, New York
- R.A. Nisbet, **The Sociological Tradition**. London: Heinemann, 1967
- K.Marx, **Pre-capitalist Economic Formations**, London: Lawrence and Wishart. 1964
- M.Weber, **The Protestant Ethic and the Spirit of Capital.** Los Angeles: Blackwell Publishers, 2002
- E Durkheim, **The Division of Labour in Society**. Glencoe: The Free Press, 1933
- G.H.Mead, **Social Psychology**. Chicago: University of Chicago Press.1964
- A. Schutz, **On Phenomenology and Social Relation** (72-78). Chicago: University of Chicago Press.1970
- H.Garfinkel,. **Studies in Ethnomethodology**. Cambridge: Polity Press (Chapter 1,2).1984
- G.Simmel,. **On Individuality and Social Forms**. Chicago: University of Chicago Press. (Chapters 3, 4, 5).1971
- Parkin, R. and L. Stone (eds.), **Kinship and Family: An Anthropological Reader,** U.S.A.: Blackwell.2000
- Carsten, J. (ed.). **Cultures of relatedness: New approaches to the study of Kinship.**Cambridge: Cambridge University Press. 2000
- C.Levi-Strauss, .**The Elementary Structures of Kinship**. London: Eyre and Spottiswoode, 1969
- P.Uberoi, P, **Family, Kinship and Marriage in India**. New Delhi: Oxford University, Press.1994
- Srinivas, M.N. and M.N. Panini. 1973. '**The Development of Sociology and Social Anthropology in India',** Sociological Bulletin, 22(2): 179-215.
- Cohn, B.S, **An Anthropologist among Historians**. Delhi: Oxford University Press. 1987
- N.K.Bose, **The Structure of Hindu Society**. Delhi: Orient Longman.1975
- M.N.Srinivas, **Social Change in Modern India**. Bombay: Allied Publishers,1966
- M.N.Srinivas, **The Cohesive Role of Sanskritisation and Other Essays**. Delhi: Oxford University Press. 1989.
- Y.Singh, **Modernization of Indian Tradition**. Delhi: Thomson Press.1973
- T.S.Saraswathi,.(ed**). Cross Cultural Perspectives in Human Development: Theory, Research and Applications**. New Delhi: Sage.2003
- Robert M. Baron, **Psychology, 5th edition,** Pearson Education, 2011

- Anne V. Gormly, **Life Span Human Development, 6th Edition,** 1997
- A.Agarwal &A.K. Saxena, (eds). **Psychological Perspectives in Environmental and Developmental Issues**. New Delhi: Concept.2003

Semester-3
Two electives: Papers: 13 & 14
Students to choose any one

Course Code: CWS 513
Elective Paper 13
Women & Development

Objectives: The main objectives of this paper to provide students an understandings of the basic concepts of development and the significance of women's role in development, the contributions of women in productive and non- productive work and women representation and situation in the organised and unorganised sectors.

Unit-1: Understanding of development: Theories of Development, Role of women in economic development, Empowerment – Alternative Approaches – WID (Women in Development) - WAD (Women and Development) – GAD (Gender and Development), Human development Index, Gender Related Development Index.

Unit-2: Concept of Work , Productive and non-productive work, value and measurement of women's work, female labour force in India, main workers and marginal workers in rural & urban areas Problems in measurement of women's work, , role of Government, mainstreaming Gender development , role of development policies- Recent trends.

Unit-3: Gender division in labour, Women in organized and unorganized sector, skilled and unskilled labour, wage discrimination, reasons for discrimination , labour laws, sexual harassment , sectoral distribution of male and female workers, factors affecting women's entry into labour market, perspectives of empowerment.

Unit-4: Women and employment, conditions of women's, employment generation schemes(for women) , National and State levels approaches to women's employment, Micro finance Revolution, SHGs(self help groups) and economic empowerment, women banks, theoretical perspectives of empowerment

Unit-5: Research Paper/ Project/PPT

Suggested Readings:

- IAWS, **Feminist Approaches to Economic Theories A Report**, IAWS, New Delhi, 1995
- Promilla Kapur (ed.), **Empowering Indian Women**, Publication Division, Government of India, New Delhi, 2000

- Kaila H.L**, Women, Work and the Family**, Rawat Publications, Jaipur, 2005
- Malcom Harper, **Profit for the Poor - Cases in Micro Finance**, Oxford and IBH publishing House, New Delhi, 1998
- Bhaskar A Shukla, **Women Entrepreneurship and Economic Development**, Sarup and Sons publication, New Delhi, 2014
- Leela Kasthuri, "**Development, Patriarchy, and Politics: Indian Women in the Political Process, 1947-1992**", Occasional Paper No 25, Centre for Women's Development Studies, New Delhi, 1995
- Agarwal, Bina et.al (ed.), **Capabilities and Equality**, Amartya Sen's Work from a Gender Perspectives, Oxford University Press, New Delhi, 2006
- Gopalan Sarla, **Towards Equality. The Unfinished Agenda: Status of Women in India.2001**. National Commission for Women, New Delhi: Government of India, 2002
- Gopalan, Sarla and Mira Shiva, **National Profile on Women, Health and Development**,New Delhi: Voluntary Health Association of India (compiled for WHO), 2000
- Government of India, **1974. Towards Equality. Report of the Committee on the Status of Women in India**, New Delhi: Ministry of Education and Social Welfare, 1975
- Shramshakti.Report of the National Commission on **Self-Employed Women and Women in the Informal Sector**, Delhi: Government of India, 1998
- Central Statistical Organisation, **Report of the Time Use Survey. New Delhi: Ministry of Statistics and Programme Implementation** , 2000
- Gurumurthy Anita, **Women's Rights and Status Questions of Analysis and Measurement. Gender in Development**, Monograph Series No.7,.New Delhi: UNDP, 1998
- John Mary E, **Democracy, Patriarchies and Reservations for Women: A Note**, Indian Journal of Gender Studies,1991
- Kabeer Naila, **Reversed Realities, Gender Hierarchies in Development Thought**, New Delhi: Kali for Women 1994
- Promilla Kapur, **Empowering Indian Women**, Publication Division, Government of India, New Delhi, 2000
- Malcom Harper, **Profit for the Poor - Cases in Micro Finance**, Oxford and IBH publishing House, New Delhi, 1998
- Sheela Varghese, **Employment of Women in the Unorganized Manufacturing Sector**, University Book House Private limited, Jaipur, 2003

Course Code: CWS 514
Elective Paper-14
Women, Science & Technology

Objectives: History posits marginalization of women in scientific professions. Participation of women in science has either been marginalized or has been dominated by their male competitors. The aim of this paper is to help students understand the nature of scientific enquiry and women's relationship with it and exploring ways of reducing gender bias in the area of science and technology

Unit-1: The Philosophical roots, Sociological perspectives of science (groups and status), Presence of women in science- historical perspective , Marginalization issues

Unit-2: Feminists critiques of science, Women's way of doing science, ethics and Social responsibility, Access to and status of girls and women in science education and scientific work – National and International perspectives.

Unit-3: Women in/and Science- A common agenda, experiences of women in science- Autobiographies, Indian Academy of Science, Ministry of Science & Technology efforts by National educational bodies for encouraging women in scientific education- UGC, CSIR, ICMR

Unit-4: Women scientists- Socially defined roles and their implication for women's scientific careers, their contributions and recognitions, some noted Indian Women Scientists

Unit-5: Research Paper/ Project/PPT

Suggested Readings:

- N. Kumar, **Women and Science in India: A Reader** ,OUP, 2008
- M.I. Bartsch Lederman, **The Gender and science Reader**, Routledge London, 2001
- M.J Bystydzienski, R.Bird Sharon, **Removing Barriers: Women in Academic Science, Technology, Engineering & Mathematics**, 2006
- V.Gornick , **Women in Science: Then and Now**, The Feminist Press, New York, 1992
- S.Mayle Sheffield, **Women and Science: Social Impact and Interaction**, ABC-CLIO USA, 2004
- M.Morse, **Women Changing Science**, Perseus Publications, 2008
- Bharathi Ray, (Ed.), **Women of India: Colonial and Post Colonial Periods in History of Sciences and Philosophy in Indian Civilization**, Vol. IX Part 3, Sage, New Delhi, 2005
- **Science Career for Indian Women: An Examination of Indian Women's Access to and Retention in scientific careers**, A Report, October 2004, Indian National Science Academy, Bahadurshah Zafar Marg, New Delhi, 2004
- G.Kirkup , **Inventing Women: Science, Technology and Gender**, Wiley, 1992
- G. Sandra Harding Sandra, **The Science Question in Feminism**, Cornell University Press1986
- **Role of Women in Science- Society Interaction Proceedings (1996), VII All India Meeting of Women in Science**, Roorkee, U.P. India, Ajay Printers and Publishers, 1996
- **Missing Links: Gender Equity in Science and Technology for Development (1995). Gender Working group**, United Nations Commission on science and Technology for Development. International development Research Centre, Canada, 1995
- K.Kahle Scantlebury, B.J., N.M Sonya, **Revisioning Science, Education from Feminist Perspectives: Challenges, Choices and Careers**, Sense Publishers

- A.B Ginorio, **Warming the Climate for Women in Academic Science**, Washington, D.C.: Association of American Colleges & Universities, 1995
- S.Harding, **Whose Science? Whose Knowledge? Thinking from Women's Lives**, Ithaca, NY: Cornell UP, 1991
- S.Bertsch McGrayne, **Nobel Prize Women in Science: Their lives, Struggles and Momentous Discoveries**, Secaucaus, NJ: Birch Lane Press Book, 1993

Course Code: CWS 515
Core Paper-15
Internship with NGO

Course Code: CWS 531
Practical
Viva-voce

Semester -4

Course Code: CWS 516
Core Paper-16
Women & Environment

Objectives: The objective of this course is to highlight the crucial relationship that women have with the environment, their involvement in environmental issues from sustenance to degradation, and their participation in decision making processes. The course will also enlighten the students with the various theoretical historical movements in the realm of environment.

Unit-1: Feminist Geography ,Natural environment - Land, water, air and its degradation - impact on women The politics of Water Women and natural resources, Defining ecology - Women's connection with the environment, and the development debate, women's attitudes, Gender and perception of the environment. Masculization of the Mother Land, Women and Migration, Women and Livelihoods Women & Conservation, Tribal women and conservation Consumerism & Capital Patriarchy, Issues and debates

Unit-2: Theoretical Perspectives- Nature as a Feminine principle, Eco feminism- A Social Movement, Environmental or ecological feminism, Eco-feminism & Globalization Possible problems environmental feminism, feminist political ecology. Some prominent women environmentalists- MeiNg, Vandana Shiva, Wangari Muta Marathai, Maria Cherkasova, Rachel Carson

Unit-3: Management of Natural resources- women's role, role of panchayats, Industrialism, biotechnology, forest and water management, National Policy on Protecting Environment – Role of Pollution Control Boards - Central and State initiatives for environment protection - Ministry of Environment and Forest- Recent trends Ecological Movements initiated by Women- Chipko Movement, Green Belt, NavDanya, Kenyan Land takeover, Narmada Bachao Aandolan.

Unit-4: The Private Sphere: Housing and Gender Roles in a Cross Cultural Contexts, Gender and Space, Spatial Constraints, Private meets public: The Material Feminist Movement, Contemporary Feminist Housing, Housing and Disability, Gender and Household Technology ,The Public Sphere - Gender and Transportation (Cars and Public Transportation), the Built Environment and Personal Safety

Unit-5: Research Paper/ Project/PPT

Suggested Readings:

- Vandana Shiva, **The Impoverishment of the Environment: Women and Children Last**. **Environmental Philosophy: From Animal Rights to Radical Ecology** (Fourth Edition). Pearson Education Inc. Upper Saddle River, NJ. 2005

- N. Rao, & Rurup, **A Just Right: Women's Ownership of Natural Resources and Livelihood Security,** New Delhi: Freidrich Ebert Stiftung 1997
- Vandana Shiva, & Meis**, Ecofeminism,** Rawat Publishers, Jaipur,2010
- C. Datar, **Ecofeminism Revisited- Introduction to the Discourse,** Jaipur **:**Rawat Publishers, 2011
- B. Agarwal, **The gender and environment debate: lessons from India. Feminist Studies**, Vol. 18, No.1, Spring. 1992
- B. Agarwal, **Gender and Green Governance: The Political Economy of Women's Presence within and beyond Community Forestry**, OUP ,2010
- Nightingale, **The nature of gender: work, gender, and environment" Environment and Planning,** D: Society and Space 24(2) 165 – 185, 2006
- P. Panda, & B. Agarwal, **Marital violence, human development and women's property status in India, World** Development. Vol. 33, No 5. pp. 823-850. 2005
- Annabel Rodda, **Women and the Environment,** New Jersey: Zed Books Ltd. 1991
- Mary J. Breton, **Women pioneers for the environment**, Boston: North Eastern University Press. 1998
- M.S Swaminathan, **Gender Dimensions in Biodiversity Management**, New Delhi: Konark publishers pvt ltd, 1998
- Promilla Kapur (ed), **Empowering Indian Women**, New Delhi: Publication Government of India Division, 2000
- Vernooy, Ronnie (Ed.), **Social and Gender Analysis in Natural Resource Management – Learning Studies and Lessons from Asia**, New Delhi: Sage, 2006
- P.K. Rao, **Sustainable Development-Economics and Policy**, New Delhi: Blackwell 2000
- S. Benhabib, **Feminist theory and Hannah Arendt's concept of public space. History of the human sciences**, May 93 v.6 is.2 pp.97-114 ,1993
- E. Blimlinger, **Feminist perspectives on technology, work and ecology**, European Journal of Women's Studies, Feb 95 v.2 is.1,1995
- M. Zwarteveen, S.Ahmed & Sr Gautam, **Diverting the Flow: Gender Equity and Water in South Asia**, New Delhi: Zubaan, 2012
- Roberts Marion, **Living in a Manmade World**, London ; New York, Routledge, 1991
- L. Weisman, **Discrimination by Design : A Feminist Critique of the Man-made Environment**, Urbana : University of Illinois Press,1992
- Vandana Shiva, **Stolen Harvest: The Hijacking of the Global Food Supply**, Cambridge, MA: South End Press, 2000
- Williams, Terry Tempest, **Refuge: An Unnatural History of Family and Place**, New York: Random House, 1991
- S. Ahmed, **Empowering Women through Water Management Initiatives in India**, New Foundations books private limited 2005

Course Code: CWS 517
Core Paper -17
Women & Modes of Representation

Objectives: The aim of this paper is to make the students aware of the role of the media both print and electronic, the crucial role it plays in the reporting of facts and the formation of public opinion and the positive role it can play in the betterment of society. The paper also aims to educate students about the exploitation and manipulation of the media by vested interests.

Unit-1: Genesis and types of media, new media, new communication technologies and their merits and demerits , Women Pioneers in the world of media, portrayal of women in media, gender stereotyping, Co modification of women, how media and mass media effects women, indecent representation of women in media(Prohibition act-1986)

Unit-2: Women in films, Cultural stereotypes, Contemporary cinema-Indian and International, analysis of specific films and programmes, new approaches/feminist directors in Cinema,

Unit-3: Electronic media, types of electronic media, its power and impact, radio, community radio, Television, Feminist voices in the small screen, history of television programmes, programmes for women and children, cinema and women, reinforcing cultural values, breaking stereotypes in media, Censor Board.

Unit-4: The world of advertising and women, Media and consumerism, Capitalist and profit based media, gender stereotyping in advertisements, violence and media, women as consumers in media, women objectification in the media, media and culture, recent trends, role of government in media.

Unit-5: Research paper/ project/PPT

Suggested Readings:

- P. K. Kar and P.P Panda, 2005, **Awareness of Women's Rights – Projection in Mass Media,** New Delhi: Dominant Publishers and Distributors, 2005
- Saksena, A. **Gender and Human Rights**, New Delhi : Shipra publications, 2004
- Tony Thwaites, Lloyd Davis and Warwick Mules, **Introducing Cultural and Media Studies – A Semiotic Approach,** London: Palgrave,2005
- B.Bose, **Gender and Censorship**, New Delhi: Women Unlimited, New Delhi. 2006.
- Aunal Goel, **Organisation and Structure of Women Development and Empowerment**, New Delhi : Deep and Deep Publications,2004
- Jaya Chakravarty, **Media and Women's Development: Women in Journalism** 2 New Delhi : Swaroop & Sons, 2014
- Barbara Stallings, **Globalization and Liberalization: A View from the Developing Countries-** UN Economic Commission for Latin Aneries and the Caribbean
- BN Ahuja & Shakti Batra **Mass Communications with Special Reference to Indian Conditions**, Varma Brothers, New Delhi, 1978

- Bathla Sonia, **Women, Democracy and the Media**. Sage Publications, 1998
- Joseph, A & Sharma K, **Whose News: The Media & Women's Issues**. Sage Publications, 2006
- Allan Stuart and Thorsen Einar, **Citizen Journalism-Global Perspectives**. Peter Lang, NY, 2009
- Barns Margarita, **The Indian Press: A History of the Growth of Public opinion in India**, Allen and Unwin. London,1940
- Cameron James, **Point of Departure**. Oriel Press, London, 1978
- Karkhanis Sharad, **Indian Politics and the Role of the Press**. Vikas Publishing House, New Delhi, 1981
- Kumar, Keval J, **Mass Communication in India**. .Jaico Books, Mumbai, 2004
- Ninan Sevanti, **Through the Magic Window: Television and Change in India**, Penguin Books New Delhi, 1995
- Ninan Sevanti, **Headlines from the Heartland-Reinventing the Hindi Public Sphere.** Sage publication, 2007
- Pawar Nisha, **Theoretical Dimension: Women in Indian Print Media**, Sapana Publication, Bangalore, 2009.
- Ram N, **Foreword to Journalism in India-From the Earliest Times to the Present Day.** Sterling Publishes Private Limited. New Delhi, 2001
- **Second Press Commission Report**, Vol 1.Government of India. New Delhi, 1982
- Sunanda K D R, **India-Country Report in Media and Democracy in Asia.** An AMIC compilation.AMIC publication, 2000
- Vinod P and Mallik K, **Other Voices: The Study of Community Radio in India**. Sage publication, 2007
- B. Axford & R. Huggins, **New Media and Politics**, 2001, Sage Publication, London
- Partha Chatterjee, **The Nationalist Resolution of Women's Question** in Kumkum Sangari & Sudesh Vaid(eds.**) Recasting Women: Essays in Colonial History**, Kali for Women, New Delhi, 1989
- D.C.Hallin and P. Mancini, **Comparing Media Systems :Three Models of Media and Politics**, Cambridge University Press, Cambridge, 2004

Semester-4
Two electives: Papers 18, & 19
Students to choose any one

Course Code: CWS 518
Elective Paper-18
Women, Conflict & Conflict Resolution

Objectives: War and Conflict has become a reality of our times. The outcome of this is disastrous for all human, but for women added dimensions come into play. This paper aims to familiarise students with the consequences of war and conflict for women and what are the measures that are taken to counter these.

Unit-1: Twentieth century wars, Women in the military, Women in Conflict, conflict and post conflict situations, post-conflict reconstruction and resolutions, women's role in the peace making process, gender relations during and after conflict, Case studies— The Holocaust, Vietnam, Afghanistan, Barundi, Syria, Partition— Pakistan and Bangladesh

Unit-2: The U.N. and war, Security Council Resolution 1325, hurdles in implementation, Collaboration with other UN agencies, The Barcelona Process, Violence of the Right to life, Role of Human Rights Networks.

Unit-3: Bodies of Women and rape in war, Sexual violence/crimes against women in war, Sexual violence as a weapon in war, Rape and Torture, Rape, International Laws against these crimes, Rape inside prisons, kidnapping and use of women as hostages, War Tribunals, Preventing gender based violence

Unit-4: Women as refugees, fears consequences of isolation, stigmatization and exclusion from communities, intersections with concepts of honour and "purity", HIV Infections, pregnancies, and other health complications.

Unit-5: **Research Paper/ Project/PPT**

Suggested Readings:

- Mushirul Hasan ed, **India Partitioned : The Other Face of Freedom,** 2 volumes New Delhi ; Roli Books, 1995
- Luciana Ricciuteli et all (eds.) **Women Power and Justice: Global Feminist Perspectives,** vol. I, London : Zed Publishers, 2005
- R.Chopra et al (eds.) **South Asian Masculinities**, New Delhi : Kali for Women, 2004
- Nadera Shalhoub-Kevorkian, **Militarization and Violence against Women in Conflict Zones in the Middle East,** Cambridge: Cambridge University Press, 2009
- B.Allen, **Rape Warfare : The Hidden Genocide in Bosnia-Herzegovina and Croatia,** Minneapolis : University of Minnesota Press,1996
- H.Arendt, **The Origins of Totalitarianism**, New York : Harcourt, Brace Jovanovich,1951
- E. Augustin, (ed.) **Palestinian Women : Identity and Experience**, London : Zed Books, 1994
- R.Ronit (ed.) **Gender and Catastrophe**, London : Zed Books, 1997
- Yasmin Saikia, **Women, War and the Making of Bangladesh**, New Delhi: Women Unlimited, 2011
- Ishrat Firdousi,**The Year that Was,** Dhaka : Bastu Prakashan,1996
- S.Dasgupta, **The Midnight Massacre in Dacca**, New Delhi: Vikas Publishing House, 1978
- Gyanendra Pandey, **Remembering Partition,** New Delhi : Cambridge University Press, 2003
- Isabella Bruschi, **Partition in Fiction**,New Delhi : Atlantic, 2010
- Nonica Datta, **Violence, Martyrdom and Partition**, Delhi : Oxford University OPress, 2009

- Roshmi Goswami et al, **Women in Armed Conflict**, Guwahati : North East Network, 2005
- Alok Bhalla (ed.) **Stories about the Partition of India**, Vols. 1, 2 & 3,New Delhi :Manohar Publishers, 2013

Course Code: CWS 519
Elective Paper-19
The Stories the Indian States Tell

Objectives: The purpose of this paper is to acquaint the students of the tremendous differences within the country among the various states. Thus the paper will cover the complexities and diversities existing in different regions and their intersections with different religions, castes languages etc.

Unit-1: The issues in the Northern States and Central States—possible topics -- declining sex-ratio and its co-existence with material prosperity. The scenario in the hills and the relative higher status of women there, Women and terrorism in Kashmir, Caste class nexus and communalism in Uttar Pradesh.

Unit-2: The States of the West—possible topics--child marriage issues, culture and the issue of Sati in Rajasthan, nexus of poverty and prostitution in Rajasthan, Ground realities in Gujarat and Maharashtra

Unit-3: The Southern States—possible topics--the issues of alcohol in Kerala, intersection of high literacy and declining sex ratio in Kerala, the caste class divide in Tamil Nadu, farmers deaths in Andhra and the impact on women

Unit-4: The Eastern States –possible topics---– the problem of terrorism and the question of Gender, intersections of regional minorities and politics, Maoism and women, the Seven sisters and matrilineal societies.

Unit-5: Research Paper/ Sample project/PPT

Suggested Readings:

- Reardon, Asha Hans (Ed.), **The Gender Imperative: Human Security VS State Security**, Routledge Taylor & Francis Group, New Delhi, 2010
- Tamsin Bardley,(Ed.), **Women, Violence and Tradition: Taking FGM and Other Practices to a Secular State**, Zed Books, London & New York, 2011
- Priya Chatterjee, Manali Desai, Parma Roy,(Ed.), **States of Trauma: Gender and Violence in South Asia**, Zubaan, kali for Women, New Delhi, 2009
- Alok Bhalla,(Ed.), **Stories About The Partition of India**, Manohar publisher, New Delhi, 2012
- Vakulabharanam Lalitha, **Women, Religion and Tradition: The Cult of Jogin, Matangis and Basvis**, Rawat Publications, New Delhi, 2011
- Badri Narayan, **Women Heroes and Dalit Assertion in North India: Culture Identity and Politics**, Sage Publication, New Delhi, 2009

- Salima Jan, Forgotten Identities: **Women Artisans of Kashmir**, Decent Books, New Delhi, 2004
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Course Code: CWS 520
Core Paper-20
Research Paper

Course Code: CWS 532
Practical
Viva-voce

Revised

Syllabus

of

B. Voc.in Food Processing and Technology

Centre of Food Technology

Institute of Professional Studies

University of Allahabad

Revised November 2022

Revised Course Structure of B.Voc.in Food Processing & Technology

Semesters	Paper Code		Title of Paper	Skill/ General Education Courses	Credits			
					L	T	P	Total
Sem I	**FFT 121**		Introduction to Food Processing	Skill	3	0	2	5
	FFT 122		Food Science	Skill	3	0	2	5
	FFT 128		Food Quality and Analysis- I	Skill	3	0	2	5
	FFT 124		Food Hygiene and Sanitation	Skill	3	0	2	5
	FFT 101		Communication and Documentation Skills	Gen Ed.	3	0	1	5
	FFT 152		Introduction to Biosciences	Gen Ed.	3	1	0	5
	FFT 107		Basic Concepts in Laboratory Techniques	Gen Ed.	0	0	2	2
	QP-FIC/Q7601		**Assistant Lab Technician**	**NSQF-4**				*
			TOTAL		**18**	**1**	**11**	**30**
Sem II	**FFT 123**		Introduction to Food Microbiology	Skill	3	0	2	5
	FFT 125		Food Processing Equipment	Skill	3	0	2	5
	FFT 126		Technology of Processed and Preserved Foods	Skill	2	0	2	4
	FFT 127		Introduction to Food Quality Management	Skill	3	0	1	4
	FFT 102		Environmental Studies-I	Gen Ed.	2	0	1	3
	FFT 104		Introduction to Computer Application	Gen Ed.	2	0	1	3
	FFT 206		General Biochemistry	Gen Ed.	3	0	1	4
	FFT 130		Industrial Training-I for 15 days	Skill	0	0	2	2
	QP-FIC/Q7605		**Technical Lead - Food Analysis**	**NSQF-5**				*
			TOTAL		**18**	**0**	**12**	**30**
Sem III	**FFT 221**		Unit Operations in Food Processing	Skill	3	1	0	4
	FFT 222		Basic Food Chemistry	Skill	2	0	2	4
	FFT 223		Food Quality and Analysis- II	Skill	2	0	2	4
	FFT 224		Cereals, Pulses and Oilseed Technology	Skill	3	0	2	4
	FFT 229		Bakery and Confectionery Products	Skill	3	0	1	4
	FFT 203		Communication Skills and Technical Writing	Gen Ed.	3	2	0	4
	FFT 205		Environmental Studies - II	Gen Ed.	3	1	0	4
			TOTAL		**19**	**4**	**7**	**30**
Sem IV	**FFT 225**		Human Nutrition	Skill	3	1	0	4
	FFT 226		Fruits and Vegetable Technology	Skill	2	0	2	4
	FFT 227		Introduction to Food Packaging	Skill	2	0	1	3
	FFT 228		Dairy Technology	Skill	2	0	1	3
	ELECTIVE-II (Any One)	**FFT 251**	Technology of Meat, Fish and Poultry	Skill	3	0	1	4
		FFT 252	Flavour Technology					
		FFT 253	Fermentation Technology					
	FFT 201		Crop Production: Concepts and Practices	Gen Ed.	3	0	0	3
	FFT 202		Food Business Management	Gen Ed.	3	0	0	3
	FFT 207		Statistics and Data Analysis	Gen Ed.	3	1	0	4
	FFT 230		Industrial Training-II for 15 days	Skill	0	0	2	2
	QP-FIC/ Q7007		**Quality Assurance Manager**	**NSQF-6**				
			TOTAL		**21**	**2**	**7**	**30**
Sem V	**FFT 321**		Principles of Food Engineering	Skill	1	2	1	4
	ELECTIVE-III (Any One)	**FFT 351**	Post-Harvest Management of Fruits and Vegetables /	Skill	2	0	1	3
		FFT 352	Food Beverage Technology /	Skill				
		FFT 353	Technology of Indigenous milk Products	Skill				
		FFT 354	New Product Development and Sensory Science	Skill				
	FFT 322		Waste Management and Effluent Treatment	Skill	3	1	0	4
	FFT 323		Food Laws and Regulations	Skill	3	1	0	4
	FFT 324		Food Plant Design and Layout	Skill	3	1	0	4
	FFT 301		Disaster Management	Gen Ed.	3	2	0	5
	FFT 303		Introductory Biotechnology	Gen Ed.	3	0	1	4
	FFT 330		Seminar	Skill	0	0	2	2
			TOTAL		**18**	**7**	**5**	**30**
Sem VI	**FFT 325**		Quality Assurance and Certification	Skill	3	0	0	3
	FFT 306		Human Values and Ethics	Gen Ed.	4	0	0	4
	FFT 307		Project Management and Entrepreneurship	Gen Ed.	3	2	0	5
	FFT 340		Project Work for 3 months	Skill	0	0	18	18
	QP-FIC/ Q9002		**Food Regulatory Affairs Manager**	**NSQF-7**				
			TOTAL		**10**	**2**	**18**	**30**
			G. TOTAL		**103**	**16**	**61**	**180**

*** Non-credit requirement; Qualification Pack (QP) as recommended by Sector Skill Council (FICSI).**

Regulations, Course Structure & Syllabus

of

5-year Integrated UG and PG Food Technology Programme

Centre of Food Technology
Institute of Professional Studies
University of Allahabad

Revised Course Structure
5-year Integrated UG and PG Food Technology Programme

Sem I	Title	Credits	Course Type	Exit Qualification
FFT 131	Fundamentals of Food Processing	2-0-1-3	Core Course (CC)	
FFT 132	Concepts of Food Science	3-0-1-4	Core Course (CC)	
FFT 133	Basic Food Chemistry-I	3-0-1-4	Core Course (CC)	
FFT 105	General Bioscience	2-0-0-2	Generic Elective (GE)	
FFT 106	Conversation and Documentation Skills	2-0-1-3	Ability Enhancement Course (AEC)/Foundation course	
FFT 107	Concepts of Laboratory Techniques	0-0-2-2	Skill Enhancement Course (SEC)	
Total		**18**		**Certificate(Food Technology)**
Sem II	**Title**	**Credits**	**Course Type**	
FFT 134	Introduction to Food Hygiene and Sanitation	2-0-1-3	Core Course (CC)	
FFT 135	Principles of Food Microbiology	2-0-1-3	Core Course (CC)	
FFT 136	Food Packaging	2-0-1-3	Core Course (CC)	
FFT 137	Fruits and Vegetable Processing	2-0-1-3	Skill Enhancement Course (SEC)	
FFT 108	Environmental Studies*	3-0-0-3	Foundation / Ability Enhancement Course (AEC)	
FFT 104	Introduction to Computer Application*	2-0-1-3	Foundation / Ability Enhancement Course (AEC)	
Total		**18**		
Grand Total		**36**		
Sem III	**Title**	**Credits**	**Course Type**	**Exit Qualification**
FFT 231	Basic Food Chemistry-II	2-0-1-3	Core Course (CC)	
FFT 232	Food Quality and Analysis	3-0-1-4	Core Course (CC)	
FFT 233	Food Processing Operations	3-0-0-3	Core Course (CC)	
FFT 234	Technology of Cereals, Pulses and Oilseed	3-0-1-4	Core Course (CC)	
FFT 208	Disaster and Risk Management	2-0-0-2	Generic Elective (GE)	
ELECTIVE-I (Any Two)				
FFT 255	Bakery and Confectionery Products Technology	2-0-1-3	Discipline Specific Elective (DSE)	
FFT 256	Beverage Technology		Discipline Specific Elective (DSE)	
FFT 257	**Basics of Nutrition**	**3-0-0-3**	**Discipline Specific Elective (DSE)**	
Total		**22**		**Diploma (Food Technology)**
Sem IV	**Title**	**Credits**	**Course Type**	
FFT 235	Meat, Fish and Poultry	2-0-1-3	Core Course (CC)	
FFT 236	Dairy Science	3-0-1-4	Core Course (CC)	
FFT 237	Food Quality Management and Quality Assurance	3-0-1-4	Skill Enhancement Course (SEC)	
FFT 209	Data Analysis	1-1-0-2	Generic Elective (GE)	
FFT 210	Technical Writing*	1-0-0-1	Foundation / Ability Enhancement Course (AEC)	
FFT 280	Industrial Training for 15-30 days	0-0-2-2	Skill Enhancement Course (SEC)	
FFT 258	**Crop Production**	**2-0-02**	**Generic Course**	
	Total	**19**		
Grand Total		**77**		

Sem V	Title	Credits	Course Type	Exit Qualification
FFT 331	Fundamentals of Food Engineering	3-0-1-4	Core Course (CC)	**Three Year UG Degree (Food Technology)**
FFT 332	Biochemistry and Human Nutrition	3-0-0-3	Core Course (CC)	
FFT 333	Concepts of Biotechnology	2-0-1-3	Generic Elective (GE)	
FFT 334	Waste Management Practices	2-0-0-2	Generic Elective (GE)	
FFT 380	Seminar	0-0-1-1	Skill Enhancement Course (SEC)	
ELECTIVE-II (*Any Two)*				
FFT 353	Technology of Indigenous milk Products	2-0-1-3	Discipline Specific Elective (DSE)	
FFT 356	Food Fermentation Technology		Discipline Specific Elective (DSE)	
FFT 357	**Nutraceuticals and Functional Foods**	**3-0-03**	**Discipline Specific Elective (DSE)**	
	Total	**19**		
Sem VI	**Title**	**Credits**	**Course Type**	
FFT 335	Food and Agribusiness Management	2-0-0-2	Skill Enhancement Course (SEC)	
FFT 336	Plant Design and Layout	2-0-0-2	Skill Enhancement Course (SEC)	
FFT 385	Industrial Project (10 weeks which may extend during summer vacation)	0-0-10-10	Core Course (CC)	
FFT 358	**Medicinal Plants**	**2-0-0-2**	**Generic Course (SEC)**	
	Total	**16**		
Grand Total		**109**		

Sem VII	Title	Credits	Course Type	Exit Qualification
FFT 504	Research Methodology and Statistics	3-1-0-4	Generic Elective (GE)	**Four year UG Degree (Food Technology) 'With Research'**
FFT 555	**Food Additives**	**2-0-0-2**	**Discipline Specific Elective (DSE)**	
FFT 390	Thesis	0-0-10-10	Discipline Specific Elective (DSE)	
	Total	**16**		
Sem VIII	**Title**	**Credits**	**Course Type**	
FFT 390	Thesis	0-0-20-20	Discipline Specific Elective (DSE)	
Grand Total		**147**		

Sem IX	Title	Credits	Course Type	
FFT 503	Instrumentation and Analytical Techniques	3-0-1-4	Core Course (CC)	
FFT 557	Spices and Flavour Technology	3-0-0-3	Skill Enhancement Course (SEC)	
FFT 509	Food Quality, Safety Standards and Certification	3-0-0-3	Core Course (CC)	
ELECTIVE-Any Four				
FFT 651	Entrepreneurship in Food Processing	2-0-0-2	Discipline Specific Elective (DSE)	
FFT 653	Food Rheology		Discipline Specific Elective (DSE)	
FFT 654	Food Product Development		Discipline Specific Elective (DSE)	
FFT 658	Food By-product management		Discipline Specific Elective (DSE)	
FFT 659	Advanced Food Chemistry		Discipline Specific Elective (DSE)	
FFT 553	**Speciality Foods**		Discipline Specific Elective (DSE)	
	Total	**18**		
Sem X				
FFT 507	Packaging of Food Materials	3-0-0-3	Core Course (CC)	
FFT 508	Food Engineering	3-1-0-4	Core Course (CC)	
FFT 510	Advanced Food Microbiology	3-0-1-4	Core Course (CC)	
Elective- Any Two				
FFT 660	**Processing of Fruits and Vegetables**	**1-0-1-2**	Discipline Specific Elective (DSE)	
FFT 552	Intellectual Property Rights	2-0-0-2	Discipline Specific Elective (SEC)	
FFT 554	Fundamentals of Nutrition		Discipline Specific Elective (SEC)	
FFT 652	Food Fermentation and Microbial Technology		Discipline Specific Elective (SEC)	
FFT 641	Seminar	0-0-1-1	Skill Enhancement Course (SEC)	
	Total	**16**		
	Grand Total	**181**		

5-year Integrated UG&PG Food Technology Programme

CC: Core Course, AEC: Ability enhancement Course/ Foundation course, SEC: Skill Enhancement Course, GE: Generic Elective, DSE: Discipline Specific Elective, Elective / Minor courses to be opted from other dept. relevant to research work

REVISED DETAILED STRUCTURE OF

FIVE YEAR INTEGRATED
BCA & MCA (Data Science)

with effect from Session 2021-22

FIVE YEAR INTEGRATED
BCA & MCA (Data Science)

Centre of Computer Education & Training

Institute of Professional Studies

University of Allahabad

Prayagraj-211002

CREDIT STRUCTURE of Five Year Integrated BCA and MCA (Data Science) Programme

SEMESTER-I

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
THEORY								
1.	**IDS001**	Mathematics-I	2	1	0	3	40	60
2.	**IDS002**	'C' Programming with Data Structures	2	1	0	3	40	60
3.	**IDS003**	Data Engineering	2	1	0	3	40	60
4.	**IDS004**	Foundations of Data Science	2	1	0	3	40	60
5.	**IDS005**	Computer Fundamentals & Internet Programming	2	1	0	3	40	60
6.	**IDS006**	Communications Skills	2	1	0	3	40	60
7.	**IDS051**	Data structures using 'C' Lab	0	1	3	4	40	60
8.	**IDS052**	Internet Programming Lab	0	1	3	4	40	60
		TOTAL	**12**	**08**	**06**	**26**		

SEMESTER-II

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
THEORY								
1.	**IDS007**	Applied Algebra	2	1	0	3	40	60
2.	**IDS008**	Object Oriented Programming using PYTHON	2	1	0	3	40	60
3.	**IDS009**	Computer Organization & Architecture	2	1	0	3	40	60
4.	**IDS010**	Database Management System	2	1	0	3	40	60
5.	**IDS011**	Operating System	2	1	0	3	40	60
6.	**IDS012**	Entrepreneurship Development & Management	2	1	0	3	40	60
7.	**IDS053**	Python Programming Lab	0	1	4	5	40	60
8.	**IDS054**	DBMS Lab + Digital Electronics Lab	0	1	4	5	40	60
		TOTAL	**12**	**08**	**08**	**28**		

SEMESTER-III

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
THEORY								
1.	**IDS013**	Fundamentals of Statistics	2	1	0	3	40	60
2.	**IDS014**	Introduction to Artificial Intelligence	2	1	0	3	40	60
3.	**IDS015**	Advanced Data Structures	2	1	0	3	40	60
4.	**IDS016**	Discrete Mathematical Structures	2	1	0	3	40	60
5.	**IDS017**	Web Development Using PYTHON	2	1	0	3	40	60
6.	**IDS018**	Fundamentals of Computer Networks	2	1	0	3	40	60
7.	**IDS055**	Advanced Data Structures Lab	0	1	4	5	40	60
8.	**IDS056**	Web Development Lab	0	1	4	5	40	60
		TOTAL	**12**	**08**	**08**	**28**		

SEMESTER-IV

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
THEORY								
1.	**IDS019**	Probability Theory for Data Science	2	1	0	3	40	60
2.	**IDS020**	Advanced Algorithms and Analysis	2	1	0	3	40	60
3.	**IDS021**	Software Engineering	2	1	0	3	40	60
4.	**IDS022**	Advanced Database Management	3	1	0	4	40	60
5.	**IDS023**	Computational Intelligence	3	1	0	4	40	60
6.	**IDS024**	Ethics in Information Technology	2	1	0	3	40	60
7.	**IDS057**	AI and Software Engineering Lab	0	0	4	4	40	60
8.	**IDS058**	Database Management System Lab	0	0	4	4	40	60
		TOTAL	**14**	**6**	**08**	**28**		

SEMESTER-V

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
THEORY								
1.	**IDS025**	Optimization Techniques	2	1	0	3	40	60
2.	**IDS026**	Introduction to Machine Learning	2	1	0	3	40	60
3.	**IDS027**	Data Visualization	2	1	0	3	40	60

4.	**IDS028**	Statistical Analysis using 'R' Language	2	1	0	3	40	60
5.	**IDS029**	Transforms and Their Applications	2	1	0	3	40	60
6.	**IDS030**	Statistical Pattern Recognition	2	1	0	3	40	60
7.	**IDS059**	Machine Learning Lab	0	1	4	5	40	60
8.	**IDS060**	'R' programming Lab	0	1	4	5	40	60
		TOTAL	**12**	**08**	**08**	**28**		

SEMESTER-VI

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.	**IDS031**	Data Mining & Warehousing	3	1	0	4	40	60
2.	**IDS032**	Formal Languages & Automata Theory	2	1	0	3	40	60
3.	**IDS033**	Big Data Systems	2	1	0	3	40	60
4.	**IDS034**	Mathematical Modeling and Simulations	2	1	0	3	40	60
5.	**IDS035**	Artificial Neural Network and Deep learning	3	1	0	4	40	60
6.	**IDS036**	Business Analytics	2	1	0	3	40	60
7.	**IDS061**	Deep Learning Lab	0	1	3	4	40	60
8.	**IDS062**	Data Mining Lab	0	1	3	4	40	60
		TOTAL	**14**	**08**	**06**	**28**		

SEMESTER-VII

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.	**IDS037**	Bio-inspired Data Engineering	3	1	0	4	40	60
2.	**IDS038**	Research Methodology	2	1	0	3	40	60
3.	**IDS039**	Work Place Skills	1	1	0	2	40	60
4.	**IDS063**	Colloquium	0	1	2	3	40	60
5.	**IDS064**	Research / Development based	0	0	16	16		

		Project Phase One					40	60
			TOTAL	**06**	**04**	**18**	**28**		

SEMESTER-VIII

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.	**IDS040**	Fuzzy Logic and its Applications	3	1	0	4	40	60
2.	**IDS041**	Blockchain Technology	3	1	0	4	40	60
3.	**IDS065**	Research/ Development based **Project Phase Two**	0	0	20	20	40	60
		TOTAL	**06**	**02**	**20**	**28**		

SEMESTER-IX

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.	**IDS042**	Language Processing and Information Retrieval	3	1	0	4	40	60
2.	**IDS043**	Applied Predictive Analytics	3	1	0	4	40	60
3.	**IDS044**	Multivariate & Time Series Analysis	3	1	0	4	40	60
4.	**IDS045**	Complex Network Analysis	3	1	0	4	40	60
5.	**IDS –EL01– A/B/C**	Elective-I	3	1	0	4	40	60
6.	**IDS066**	Lab	0	0	4	4	40	60
7.	**IDS067**	Mini Project	0	0	6	6	40	60
		TOTAL	**15**	**05**	**10**	**30**		

SEMESTER-X

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.	**IDS046**	Domain Engineering	3	1	0	4	40	60
2.	**IDS047**	Applications of Data Science	3	1	0	4	40	60
3.	**IDS-EL02-**	Elective-II	3	1	0	4	40	60

	A/B/C							
4.	**IDS-EL03-A/B/C**	Elective-III	3	1	0	4	40	60
5.	**IDS068**	Elective Basket Lab	0	0	6	6	40	60
6.	**IDS069**	Main Project	0	0	10	10	40	60
		TOTAL	**12**	**04**	**16**	**32**		

List of Electives:

Electives	**Bucket A**	**Bucket B (Cloud computing)**	**Bucket C (Data Security)**	**Bucket D (Mathematics for Data Science)**
Elective I	Image and Video Analysis	Cloud computing	Cryptography	Calculus and Its Applications
Elective II	Text Analytics	Security in Cloud	Introduction to Cyber forensics	Linear Algebra
Elective III	Computer Vision	Parallel and distributed computing	Data and Information security	Ordinary Differential Equation(ODE) and its Applications

REVISED DETAILED STRUCTURE OF

BCA Programme

with effect from Session 2022-23

Bachelor of Computer Applications (BCA)

THREE YEAR COURSE

Centre of Computer Education & Training

Institute of Professional Studies

University of Allahabad

Prayagraj-211002

SEMESTER I								
S.No.	**Course Code**	**Course Title**	**Credit**					
			L	T	P	C	Int.	Ext.
1	BCA101	Mathematics -I	2	1	0	3	40	60
2	BCA102	Statistics	2	1	0	3	40	60
3	BCA103	Digital Electronics	2	1	0	3	40	60
4	BCA104	Fundamentals of Programming with 'C'	2	1	0	3	40	60
5	BCA105	Communication Skills	2	1	0	3	40	60
6	BCA106	Discrete Structures & Graph Theory	2	1	0	3	40	60
7	BCA231	Lab I: Programming in C	0	1	3	4	40	60
	BCA232	Lab II : Digital Electronics	0	1	3	4	40	60
			12	2	12	26		

SEMESTER II								
S.No.	**Course Code**	**Course Title**	**Credit**					
			L	T	P	C	Int.	Ext.
1	BCA107	Mathematics -II	2	1	0	3	40	60
2	BCA108	Database Management System	2	1	0	3	40	60
3	BCA109	Computer Organization & Architecture	2	1	0	3	40	60
4	BCA110	Data Structures	2	1	0	3	40	60
5	BCA111	Software Engineering	2	1	0	3	40	60
6	BCA112	Principles of Management	2	1	0	3	40	60
7	BCA233	Lab I : DBMS	0	1	3	4	40	60
	BCA234	Lab II : Data Structures	0	1	3	4	40	60
			12	2	12	26		

SEMESTER III								
S.No.	**Course Code**	**Course Title**	**Credit**					
			L	T	P	C	Int.	Ext.
1	BCA113	Core Java	2	1	0	3	40	60
2	BCA114	Design & Analysis of Algorithms	2	1	0	3	40	60
3	BCA115	Introduction to System Software	2	1	0	3	40	60
4	BCA116	Principles of Programming Languages	2	1	0	3	40	60

5	BCA117	Fundamentals of Computer Networks	2	1	0	3	40	60
6	BCA118	LINUX & Shell Programming	2	1	0	3	40	60
7	BCA235	Lab I: Core Java	0	1	3	4	40	60
	BCA236	Lab II: LINUX & Shell Programming	0	1	3	4	40	60
			12	2	12	26		

SEMESTER IV

S.No.	Course Code	Course Title	Credit					
			L	T	P	C	Int.	Ext.
1	BCA119	Operating Systems	2	1	0	3	40	60
2	BCA120	Machine Learning Techniques	2	1	0	3	40	60
3	BCA121	Compiler Design	2	1	0	3	40	60
4	BCA122	Introduction to Artificial Intelligence	2	1	0	3	40	60
5	BCA123	OOPS using PYTHON	2	1	0	3	40	60
6	BCA124	Principles of Cryptography and Cyber Security	2	1	0	3	40	60
7	BCA237	Lab I: Machine Learning Lab	0	1	3	4	40	60
	BCA238	Lab II: PYTHON Programming Lab	0	1	3	4	40	60
			12	2	12	26		

SEMESTER V

S.No.	Course Code	Course Title	Credit					
			L	T	P	C	Int.	Ext.
1	BCA125	.Net Framework & C#	2	1	0	3	40	60
2	BCA126	Optimization Techniques	2	1	0	3	40	60
3	BCA127	Computer Graphics	2	1	0	3	40	60
4	BCA128	Fundamentals of Data Science	2	1	0	3	40	60
5	BCA129 (A/B/C)	Elective I	3	1	0	4	40	60
6	BCA239	Lab in C#	0	1	3	4	40	60
	BCA240	Mini Project	0	2	6	8	40	60
			11	3	14	28		

SEMESTER VI

S.No.	Course Code	Course Title	Credit					
			L	T	P	C	Int.	Ext.

1	BCA130	Data Warehousing & Data Mining	3	1	0	4	40	60
2	BCA131 (A/B/C)	Elective II	3	1	0	4	40	60
3	BCA241	Main Project	0	0	20	20	40	60
			6	2	20	28		

Elective I:

S. No.	Course Code	Course Title
1.	BCA129 – A	Digital Image Processing
2.	BCA129 – B	Cyber Ethics
3.	BCA129 – C	Artificial Neural Networks & Deep Learning

Elective II:

S. No.	Course Code	Course Title
1.	BCA131 – A	Computer Vision
2.	BCA131 - B	Parallel Computing
3.	BCA131 – C	Distributed Systems

REVISED DETAILED STRUCTURE OF

MCA CURRICULUM

with effect from Session 2022-23

Master of Computer Applications (MCA)
TWO YEAR COURSE

Centre of Computer Education & Training

Institute of Professional Studies

University of Allahabad

Prayagraj-211002

SEMESTER I								
S.No.	Course Code	Course Title	Credit					
			L	T	P	C	Int.	Ext.
1	MCA540	Programming in 'C' with Data Structures	2	1	0	3	40	60
2	MCA541	Database Management System	2	1	0	3	40	60
3	MCA542	Computer Organization & Architecture	2	1	0	3	40	60
4	MCA543	Principles of Management	2	1	0	3	40	60
5	MCA544	Software Engineering & CASE Tools	2	1	0	3	40	60
6	MCA545	Discrete Structures & Graph Theory	2	1	0	3	40	60
7	MCA650	Lab I: Data Structures in C & Assembly Language	0	1	3	4	40	60
	MCA651	Lab II : DBMS & Software Engineering	0	1	3	4	40	60
			12	2	12	26		

SEMESTER II								
S.No.	Course Code	Course Title	Credit					
			L	T	P	C	Int.	Ext.
1	MCA546	Theory of Computation	2	1	0	3	40	60
2	MCA547	OOPS with PYTHON	2	1	0	3	40	60
3	MCA548	Artificial Intelligence & Robotics	2	1	0	3	40	60
4	MCA549	Design and Analysis of Algorithms	2	1	0	3	40	60
5	MCA550	Operating System & LINUX Shell Programming	2	1	0	3	40	60
6	MCA551	Data Communication & Networks	2	1	0	3	40	60
7	MCA652	Lab I : PYTHON	0	1	3	4	40	60
	MCA653	Lab II : Shell Programming & Data Communication Networks	0	1	3	4	40	60
			12	2	12	26		

SEMESTER III								
S.No.	Course Code	Course Title	Credit					
			L	T	P	C	Int.	Ext.
1	MCA552	.Net Framework with C#	2	1	0	3	40	60
2	MCA553	Principles of Cryptography and Cyber Security	2	1	0	3	40	60
3	MCA554	Compiler Design	2	1	0	3	40	60
4	MCA555	Optimization Techniques	2	1	0	3	40	60
5	MCA556	Machine Learning Techniques	2	1	0	3	40	60
6	MCA557 A/B/C	Elective I (BUCKET 1/2/3)	2	1	0	3	40	60
7	MCA654	Lab in C#	0	1	3	4	40	60
	MCA655	Project : Phase I(Bucket Oriented)	0	1	5	6	40	60
			12	2	14	28		

SEMESTER IV								
S.No.	**Course Code**	**Course Title**	**Credit**					
			L	T	P	C	Int.	Ext.
1	MCA558	Mobile Computing & Applications	3	1	0	4	40	60
2	MCA559 A/B/C	Elective II (BUCKET 1/2/3)	3	1	0	4	40	60
3	MCA656	Project : Phase II(Bucket Oriented)	0	4	16	20	40	60
			6	6	16	28		

Elective Bucket 1	**Elective Bucket 2**	**Elective Bucket 3**
MCA557 A : Computational Complexity	MCA557 B : Core and Advanced Java Script	MCA557 C : Core and Advanced Java Script
MCA559 A : Data Compression	MCA559 B : Web development using Django and Web Deployment using Web Services	MCA559 C : Android App Development using Flutter Framework

Revised Course Structure and Syllabus of

M.Sc. Bioinformatics Program (2024)

CENTRE OF BIOINFORMATICS

INSTITUTE OF INTERDISCIPLINARY STUDIES

University of Allahabad

UNIVERSITY OF ALLAHABAD
CENTRE OF BIOINFORMATICS

Programme: M. Sc. Bioinformatics
Duration: 2 Years (4 Semester)
Total Credit: 98 (Semester Wise: 24 + 24 + 24 + 26 = 98)

Paper Code	Paper Name	Credit
SEMESTER – I		24
BIF501	Biochemistry and Biophysics	3
BIF502	Genomics and Proteomics	3
BIF503	Mathematics and Statistics	3
BIF504	Scripting Languages and Algorithm for Bioinformatics	3
BIF505	Sequence Analysis and Molecular Phylogeny	3
BIF506	Communication Skill development	3
BIF531	**LAB – Biological Databases and Sequence Analysis**	3
BIF532	**LAB – Programming in PERL, R, and Python**	3
SEMESTER – II	**TOTAL**	**24**
BIF511	Translational Bioinformatics	3
BIF512	Networks and Systems Biology	3
BIF513	Structural Bioinformatics	3
BIF514	Datamining and Warehousing of Biological Data	3
BIF515	Transcriptomics and Metabolomics	3
Elective- Any One		3
BIF516	Agriculture Bioinformatics	
BIF517	Biomedical Data Mining	
BIF533	**LAB – Biomolecular Modeling and Simulation**	3
BIF534	**LAB – JAVA and MySQL**	3
SEMESTER – III	**TOTAL**	**24**
BIF521	Applied Bioinformatics	4
BIF522	Computer Aided Drug Designing (CADD)	4
BIF523	DNA Computing	4
Elective- Any One		3
BIF524	Stem Cell Bioinformatics	
BIF525	Research Methodology	
BIF535	**LAB – Chemoinformatics & CADD**	3
BIF536	**Mini Project**	6
SEMESTER – IV	**TOTAL**	**26**
BIF537	**Dissertation**	**26**

Department of Commerce and Business Administration
Faculty of Commerce
University of Allahabad

Course Structure and Syllabus
Five Year Integrated Programme in Management

w.e.f. Academic Session: 2023-2024

Structure of FIVE YEAR INTEGRATED PROGRAMME IN MANAGEMENT (IPM)
CREDIT STRUCTURE

SEMESTER-I

S.N.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.		Foundation Course - 1	2	1		3	40	60
2.		Skill Based Elective - 1	2	1		3	40	60
3.	IPMC-101	Fundamentals of Management	3	1		4	40	60
4.	IPMC-102	Accounting for Managers	3	1		4	40	60
5.	IPMC-103	Fundamentals of Computing	3	1		4	40	60
6.	IPMC-104	Workshop on Presentation Skills	1		3	4		
		TOTAL				22		

SEMESTER-II

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.		Foundation Course – 2	2	1		3	40	60
2.		Skill Based Elective – 2	2	1		3	40	60
3.	IPMC-201	Business Communication	3	1		4	40	60
4.	IPMC-202	Quantitative Techniques	3	1		4	40	60
5.	IPMC-203	Business Economics	3	1		4	40	60
6.	IPMC-204	Seminar			4	4		
		TOTAL				22		

SEMESTER-III

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.	IPMC-301	Business Research	3	1		4	40	60
2.	IPMC-302	Principles of Marketing	3	1		4	40	60
3.	IPMC-303	Business Law	3	1		4	40	60
4.		Elective 01	3	1		4	40	60
5.		Elective 02	3	1		4	40	60
6.	IPMC-304	Dissertation	1		1	2		
		TOTAL				22		

SEMESTER-IV

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
THEORY								
1.	IPMC-401	Human Resource Management	3	1		4	40	60
2.	IPMC-402	Financial Management	3	1		4	40	60
3.	IPMC-403	Business Environment	3	1		4	40	60
4.		Elective 03	3	1		4	40	60
5.		Elective 04	3	1		4	40	60
6	IPMC-404	Socio-Economic Survey			2	2		
		TOTAL				22		

SEMESTER-V

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
THEORY								
1.	IPMC-501	Business Ethics and Corporate Governance	3	1		4	40	60
2.	IPMC-502	Stock Market Operations	3	1		4	40	60
3.	IPMC-503	Business Statistics	3	1		4	40	60
4.		Elective 05	3	1		4	40	60
5.		Elective 06	3	1		4	40	60
6.	IPMC-504	Internship			2	2		
		TOTAL				22		

SEMESTER-VI

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
THEORY								
1.	IPMC-601	Innovation and Creativity Management	3	1		4	40	60
2.	IPMC-602	Organisational Behaviour	3	1		4	40	60
3.	IPMC-603	Managerial Economics	3	1		4	40	60
4.		Elective 07	3	1		4	40	60
5.		Elective 08	3	1		4	40	60
6.	IPMC-604	Viva-Voce			2	2		
		TOTAL				22		

SEMESTER-VII

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.	IPMC-701	Management Information System	3	1		4	40	60
2.	IPMC-702	Production and Operations Management	3	1		4	40	60
3.	IPMC-703	Indirect Taxes	3	1		4	40	60
4.		Elective 09	3	1		4	40	60
5		Elective 10	3	1		4		
6	IPMC-704	Rural Field Survey	1		1	2	40	60
		TOTAL				22		

SEMESTER-VIII

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.	IPMC-801	International Business	3	1		4	40	60
2.	IPMC-802	Operations Research	3	1		4	40	60
3.	IPMC-803	Direct Taxes	3	1		4	40	60
4.		Elective 11	3	1		4	40	60
5		Elective 12	3	1		4		
6	IPMC-804	Industrial tour			2	2	40	60
		TOTAL				22		

SEMESTER-IX

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.	IPMC-901	Strategic Management and Business Policy	3	1		4	40	60
2.	IPMC-902	Project Management	3	1		4	40	60
3.	IPMC-903	Entrepreneurship Development	3	1		4	40	60
4.		Elective 13	3	1		4	40	60
5.		Elective 14	3	1		4	40	60
6.	IPMC-904	Internship			2	2	40	60
		TOTAL				22		

SEMESTER-X

S. No.	Course Code	Course Title	L	T	P	Credit	Int.	Ext.
		THEORY						
1.	IPMC-1001	Major Project Dissertation	2		20	22	40	60

3/10/23 02/10/23 5/10/23 2/10/23

Electives Courses

General Management	Financial Management
IPME-101: Personality Development IPME-102: Behavioural Economics IPME-103: Managing Online Businesses IPME-104: Family business management IPME-105: Stress Management IPME-106: Corporate Social Responsibility IPME-107: Start-up ecosystems and Management IPME-108: Intellectual Property Rights IPME-109: Indian management thought and practices	IPME-201: Indian Financial System IPME-202: Behavioural Finance IPME -203: Financial Services IPME-204: Security Analysis & Portfolio Management IPME -205: Financial Modeling for Business IPME -206: Risk Management in business IPME -207: Financial Derivatives IPME -208: Financial econometric IPME -209: Capital and securities market IPME -210: Personal Financial Planning IPME -211: Financial Reporting & Analysis
Human Resource Management	**Marketing Management**
IPME-301: Strategic Human Resource Management IPME-302: Performance Management IPME-303: Leadership Development IPME-304: International Human Resource Management IPME-305: Managing Organisational Change IPME-306: Industrial Relations IPME-307: Labour Laws IPME-308: Talent Development IPME-309: Competency and Skill Management IPME-310: Organisation Development IPME-311: Training Management	IPME- 401: Digital Marketing IPME- 402: Customer Relationship Management IPME- 403: Advertising Management IPME- 404: Marketing Research IPME- 405: Social Media Marketing IPME- 406: Agri Business and Rural Marketing IPME- 407: Brand and Product Management IPME- 408: Advanced Selling Skills and Sales Management IPME- 409: Marketing Analytics IPME- 410: Consumer Behaviour IPME- 411: International Logistics Management
Supply Chain Management	**Skill Courses**
IPME-501: Agri-Food Supply Chain Management IPME-502: Commercial Aspects of Transportation and Logistics Industry IPME-503: Digital Innovation & Technology in Supply Chain Management IPME-504: Logistics Regulation and Compliance IPME-505: Transportation and Shipping Logistics Management IPME-506: Innovations in Supply Chain IPME-507: Retail Supply Chain Management IPME-508: Supply Chain Finance IPME-509: Transportation Systems & Network Design IPME-510: Sustainable Supply Chain	As offered by the University of Allahabad **Foundation Courses** As offered by the University of Allahabad

Faculty of Commerce
Department of Commerce and Business Administration
University of Allahabad
Prayagraj

REVISED SYLLABUS

FOR

M.B.A. 1st & 2nd Semester

Two Year Post Graduate Programme

Full Time Four Semesters

(Choice Based Credit System)

w.e.f. Academic Session: 2024-2025

MBA Course Structure and Syllabus

The Programme

The MBA Programme is a regular full time Two Year Post Graduate Programme comprising of Four Semesters redesigned and updated under the Regulations on Choice Based Credit System. The Programme requirements include 94 credits (72 credits from Core Courses, 16 credits from Elective Courses, 2 credits for Rural/Market Survey, 2 credits for Summer Internship Project & Viva- Voce and 2 credits for Dissertation and Viva- Voce. The Programme has the following salient features:

i. Five Core Courses in the First Semester with **20 Credits** in total;
ii. Five Core Courses including 2 Credit for Field Survey in Second Semester with **22 Credits** in total;
iii. Summer Internship Project of 6-8 weeks duration in an industrial establishment after the Second Semester Examination;
iv. Four Core Courses, Summer Internship Project of **2** Credit and two Elective Courses from any one of the four elective groups In Third Semester with **26 Credits** in total;
v. Four Core Courses, Two Elective Courses from any one of the four elective groups and Project Dissertation of **2** Credits in the Fourth Semester with **22 Credits** in total.

The details of MBA Course Structure are as follows:

MBA 1st Semester shall comprise the following Five Core Courses

MAN – 515	Management Concepts and Processes	4 Credits
MAN – 516	Managerial Economics	4 Credits
MAN – 517	Accounting for Managers	4 Credits
MAN – 518	Business Communication	4 Credits
MAN – 519	Quantitative Techniques	4 Credits

MBA 2nd Semester shall comprise the following Five Core Courses and Field Survey

MAN – 520	Marketing Management	4 Credits
MAN – 521	Human Resource Management	4 Credits
MAN – 522	Operations Management	4 Credits
MAN – 523	Financial Management	4 Credits
MAN – 524	Research Methodology	4 Credits
MAN- 525	Rural/Market Survey	2 Credits

Note : Summer Training of 6-8 weeks to be undertaken by the students during the Summer Break after the 2nd Semester Examination.

Department of Electronics and Communication

J.K. Institute of Applied Physics & Technology

University of Allahabad, Allahabad

B. Tech. (CSE & ECE) Course Structure and Syllabus

B.Tech. 1st Semester (CSE & ECE)						
Paper	Course Code	L-T-P-C	Credits	Six theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BEC101	3-0-0-3	3	Engineering Mathematics - I	40	60
Paper – 2	BEC102	3-0-0-3	3	Engineering Mathematics - II	40	60
Paper – 3	BEC103	3-0-0-3	3	Engineering Physics	40	60
Paper – 4	BEC104	3-0-0-3	3	Basic Electronics	40	60
Paper – 5	BEC105	3-0-0-3	3	Computer and Programming Fundamentals	40	60
Paper - 6	BEC106	2-0-4-4	4	Communication Skill I and Communication Skill Practice I	40	60
Practicals	BEC107	0-0-8-4	4	Electronics Lab I	40	60
	BEC108	0-0-4-2	2	Computer Lab I : C Programming	40	60

B.Tech. 2nd Semester (CSE & ECE)						
Papers	Course Code	L-T-P-C	Credits	Six theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BEC201	3-0-0-3	3	Mathematics - III	40	60
Paper – 2	BEC202	3-0-0-3	3	Applied Numerical Analysis	40	60
Paper – 3	BEC203	3-0-0-3	3	Digital Electronics	40	60
Paper – 4	BEC204	3-0-0-3	3	Electronics Device & Circuits	40	60
Paper – 5	BEC205	3-0-0-3	3	Circuit Theory	40	60
Paper - 6	BEC206	3-0-0-3	2	Communication Skill II	40	60
Practicals	BEC207	0-0-12-6	6	Basic & Digital Electronics Lab	40	60
	BEC208	0-0-4-2	2	Communication Skill Practice II	40	60

B.Tech. 3rd Semester (CSE)						
Paper	Course Code	L-T-P-C	Credits	Six theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BC301	3-0-0-3	3	Discrete Mathematical Structures#	40	60
Paper – 2	BC302	3-0-0-3	3	Database Systems#	40	60
Paper – 3	BC303	3-0-0-3	3	Data Structure#	40	60
Paper – 4	BEC304	3-0-0-3	3	Basic Electrical Engineering	40	60
Paper – 5	BEC305	3-0-0-3	3	Computer Organization & Architecture*	40	60
Paper - 6	BEC306	2-0-0-2	2	Industrial Management– I*	40	60
Practicals	BEC307	0-0-8-4	4	Microprocessor Lab	40	60
	BEC308	0-0-8-4	4	Engineering Drawing & Workshop	40	60

B.Tech. 4th Semester (CSE)						
Paper	Course Code	L-T-P-C	Credits	Six theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BC401	3-0-0-3	3	Operating Systems #	40	60
Paper – 2	BC402	3-0-0-3	3	Theory of Computation #	40	60
Paper – 3	BC403	3-0-0-3	3	Design & Analysis of Algorithms #	40	60
Paper – 4	BEC404	3-0-0-3	3	Control Systems*#	40	60
Paper – 5	BEC405	3-0-0-3	3	Signals & Systems*	40	60
Paper - 6	BEC406	2-0-0-2	2	Industrial Management II*	40	60
Practicals	BEC407	0-0-8-4	4	Instrumentation & Control Lab	40	60
	BC408	0-0-8-4	4	Data Structure & Algorithm Lab	40	60

B.Tech. 5th Semester (CSE)						
Paper	Course Code	L-T-P-C	Credits	Six theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BC501	3-0-0-3	3	Artificial Intelligence#	40	60
Paper – 2	BC502	3-0-0-3	3	Compiler Design#	40	60
Paper – 3	BC503	3-0-0-3	3	Computer Graphics#	40	60
Paper – 4	BEC504	3-0-0-3	3	Web Technology	40	60
Paper – 5	BEC505	3-0-0-3	3	Computer Networks*	40	60
Paper - 6	BEC506	3-0-0-3	3	Digital Communication I*	40	60
Practicals	BC507	0-0-10-5	5	Computer Graphics & Database Lab	40	60
	BC508	0-0-6-3	3	Design Project – Phase I	40	60

B.Tech. 6th Semester (CSE)						
Paper	Course Code	L-T-P-C	Credits	Six theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BC601	3-0-0-3	3	Advanced Concepts of Programming Language#	40	60
Paper – 2	BC602	3-0-0-3	3	Operational Research#	40	60
Paper – 3	BC603	3-0-0-3	3	Advanced Computer Architecture	40	60
Paper – 4	BC604	3-0-0-3	3	Software Engineering	40	60
Paper – 5	BEC605	3-0-0-3	3	Digital Signal Processing*	40	60
Paper - 6	BEC606	3-0-0-3	3	Digital Communication II*	40	60
Practicals	BC607	0-0-10-5	5	Digital Signal Processing Lab	40	60
	BEC608	0-0-6-3	3	Design Project – Phase II	40	60

B.Tech. 7th Semester (CSE)						
Paper	Course Code	L-T-P-C	Credits	Four theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BC701	3-0-0-3	3	Big Data Analysis	40	60
Paper – 2	BEC702	3-0-0-3	3	Mobile Communication*	40	60
Paper – 3	BEC703	3-0-0-3	3	Microcontroller & Microprocessor interfacing*	40	60
Paper – 4	BEC704	3-0-0-3	3	Image Processing*	40	60
Practicals	BC705	0-0-8-4	4	Project – Phase I (Dissertation & Viva Voce)	40	60
	BC706	0-0-6-3	3	Image Processing Lab	40	60
	BC707	-	1	Tour	40	60

B.Tech. 8th Semester (CSE)						
Paper	Course Code	L-T-P-C	Credits	Four theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BC801	3-0-0-3	3	Cyber Security	40	60
Paper – 2	BC802	3-0-0-3	3	Multimedia Technology	40	60
Paper – 3	BEC803	3-0-0-3	3	Elective I :	40	60
Paper – 4	BC804	3-0-0-3	3	Elective II	40	60
Practicals	BC805	0-0-12-6	6	Project - Phase II{Seminar-2 Credits & Dissertation & Viva Voce-4 Credits}	40	60
	BC806	-	1	Comprehensive Viva	40	60
	BC807	-	1	Paper Writing & Presentation	40	60

List of Electives (CSE)

1. Computer Vision
2. Natural Language Processing
3. Ubiquitous Computing
4. Fault Tolerant Computing
5. Fuzzy Systems
6. Neural Networks
7. Embedded Systems

B.Tech. 3rd Semester (ECE)						
Paper	Course Code	L-T-P-C	Credits	Six theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BE309	3-0-0-3	3	Network Analysis & Synthesis	40	60
Paper – 2	BE310	3-0-0-3	3	Electronic Instrumentation & Measurement	40	60
Paper – 3	BE311	3-0-0-3	3	Analog Circuits & Systems	40	60
Paper – 4	BEC304	3-0-0-3	3	Basic Electrical Engineering*	40	60
Paper – 5	BEC305	3-0-0-3	3	Computer Architecture & Organization *	40	60
Paper - 6	BEC306	2-0-0-2	2	Industrial Management I*	40	60
Practicals	BEC307	0-0-8-4	4	Microprocessor Lab	40	60
	BEC308	0-0-8-4	4	Engineering Drawing & Workshop	40	60

B.Tech. 4th Semester (ECE)						
Paper	Course Code	L-T-P-C	Credits	Six theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BE 410	3-0-0-3	3	EM Wave Theory	40	60
Paper – 2	BE 411	3-0-0-3	3	Semiconductor Device Technology	40	60
Paper – 3	BE 412	3-0-0-3	3	Electrical Engineering	40	60
Paper – 4	BEC 404	3-0-0-3	3	Control Systems*	40	60
Paper – 5	BEC 405	3-0-0-3	3	Signal & Systems*	40	60
Paper - 6	BEC 406	2-0-0-2	2	Industrial Management II*	40	60
Practicals	BEC 407	0-0-8-4	4	Instrumentation & Control Lab	40	60
	BE 413	0-0-8-4	4	Electrical Engineering Lab - II	40	60

B.Tech. 5th Semester (ECE)						
Paper	Course Code	L-T-P-C	Credits	Six theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BE 509	3-0-0-3	3	Antenna and Wave Propagation	40	60
Paper – 2	BE 510	3-0-0-3	3	Digital Telephony	40	60
Paper – 3	BE 511	3-0-0-3	3	Fiber Optic Communication I	40	60
Paper – 4	BEC 504	3-0-0-3	3	Computer Networks*	40	60
Paper – 5	BEC 505	3-0-0-3	3	Communication Systems*	40	60
Paper - 6	BEC 506	3-0-0-3	3	Digital Communication I*	40	60
Practicals	BE 512	0-0-10-5	5	Analog Communication & Fiber Optic Lab	40	60
	BE 513	0-0-6-3	3	Design Project - Phase I	40	60

B.Tech. 6th Semester (ECE)						
Paper	Course Code	L-T-P-C	Credits	Six theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BE 610	3-0-0-3	3	Micro Electronics & VLSI Design	40	60
Paper – 2	BE 611	3-0-0-3	3	Engineering Materials	40	60
Paper – 3	BE 612	3-0-0-3	3	Fiber Optic Communication II	40	60
Paper – 4	BE 613	3-0-0-3	3	Computer Networks*	40	60
Paper – 5	BEC 605	3-0-0-3	3	Digital Signal Processing*	40	60
Paper - 6	BEC 606	3-0-0-3	3	Digital Communication II*	40	60
Practicals	BEC 607	0-0-10-5	2	Digital Signal Processing Lab	40	60
	BE 615	0-0-6-3	3	Design Project - Phase II	40	60

B.Tech. 7th Semester (ECE)						
Paper	Course Code	L-T-P-C	Credits	Four theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BE 701	3-0-0-3	3	Microwave Technology	40	60
Paper – 2	BEC 702	3-0-0-3	3	Mobile Communication*	40	60
Paper – 3	BEC 703	3-0-0-3	3	Microcontroller & Microprocessor interfacing	40	60
Paper – 4	BEC 704	3-0-0-3	3	Image Processing*	40	60
Practicals	BE 709	0-0-8-4	4	Project - Phase I (Dissertation & Viva Voce)	40	60
	BE 710	0-0-6-3	3	Microwave Communication Lab	40	60
	BEC 707	-	1	Tour	40	60

B.Tech 8th semester (ECE)						
Paper	Course Code	L-T-P-C	Credits	Four theory Papers & Practical Labs	Sessional Marks	End Semester Marks
Paper – 1	BE 808	3-0-0-3	3	Satellite Communication	40	60
Paper – 2	BE 809	3-0-0-3	3	Radar Engineering & Navigational Aids	40	60
Paper – 3	BEC 803	3-0-0-3	3	Mobile Ad-hoc Network*	40	60
Paper – 4	BE 810	3-0-0-3	3	Elective	40	60
Practicals	BE 811	0-0-12-6	6	Project - Phase II {Seminar-2 Credits & Dissertation & Viva Voce-4 Credits}	40	60
	BE 812	-	1	Comprehensive Viva	40	60
	BE 813	-	1	Paper Writing & Presentation	40	60

List of Electives (ECE)

8. Advanced Fiber Optic Communication
9. Advance Antenna Theory & Techniques
10. Internet of things (IOT)
11. Embedded Systems

Department of Electronics and Communication
J.K. Institute of Applied Physics & Technology
University of Allahabad, Allahabad

M. Tech. (Electronics and Communication Engineering) Course Structure and Syllabus

M.Tech. 1st Semester (ECE)						
First Semester	Course Code	L-T-P-C	Credits	Four theory Paper & a Practical Lab	Sessional Marks	End Semester Marks
Paper – 1	MEC 501	3-0-0-3	3	Advanced Digital Signal Processing	40	60
Paper – 2	MEC 502	3-0-0-3	3	Digital Communication	40	60
Paper – 3	MEC 503	3-0-0-3	3	VLSI Technology	40	60
Paper – 4	MEC 504	3-0-0-3	3	Wireless Sensor & Actuator Networks	40	60
Practical	MEC 505	0-0-16-8	8	Practical Lab	40	60

M.Tech. 2nd Semester (ECE)						
Second Semester	Course Code	L-T-P-C	Credits	Four theory Paper & a Practical Lab	Sessional Marks	End Semester Marks
Paper – 1	MEC 506	3-0-0-3	3	Advanced Fiber Optic Communication	40	60
Paper – 2	MEC 507	3-0-0-3	3	Advanced Antenna Theory & Techniques	40	60
Paper – 3	MEC 508	3-0-0-3	3	Internet of Things (IoT)	40	60
Paper – 4	MEC 509	3-0-0-3	3	Elective	40	60
Practical	MEC 510	0-0-16-8	8	Practical Lab	40	60

M.Tech. 3rd Semester (ECE)						
Paper	Course Code	L-T-P-C	Credits	One theory Paper & Project	Sessional Marks	End Semester Marks
Paper – 1	MEC 601	4-0-0-4	4	Elective Paper	40	60
Project	MEC 602	0-0-32-16	4	Project – Phase I – Seminar	40	60
			6	Project – Phase I – Dissertation	40	60
			6	Project – Phase I – Viva Voce	40	60

M.Tech. 4th Semester (ECE)						
Project	Course Code	L-T-P-C	Credits	Project & Paper Writing	Sessional Marks	End Semester Marks
Project	MEC 603	0-0-40-20	6	Project – Phase II – Seminar	40	60
			6	Project – Phase II – Dissertation	40	60
			6	Project – Phase II – Viva Voce	40	60
			2	Paper Writing & Presentation	40	60

Department of Electronics and Communication
J.K. Institute of Applied Physics & Technology
University of Allahabad, Allahabad

M. Tech. (Computer Science and Engineering) Course Structure and Syllabus

M.Tech. 1st Semester (CSE)						
Paper	Course Code	L-T-P-C	Credits	Four theory Papers & Practical Lab	Sessional Marks	End Semester Marks
Paper – 1	MCT 511	3-0-0-3	3	Advanced Computer Algorithms	40	60
Paper – 2	MCT 512	3-0-0-3	3	Advanced Concepts in Image Processing	40	60
Paper – 3	MCT 513	3-0-0-3	3	Intelligent Techniques	40	60
Paper – 4	MCT 514	3-0-0-3	3	High Performance Computing	40	60
Practical	MCT 515	0-0-15-8	8	Computer Lab	40	40

M.Tech. 2nd Semester (CSE)						
Paper	Course Code	L-T-P-C	Credits	Four theory Papers & Practical Lab	Sessional Marks	End Semester Marks
Paper – 1	MCT 516	3-0-0-3	3	Cyber Security	40	60
Paper – 2	MCT 517	3-0-0-3	3	Ubiquitous Computing	40	60
Paper – 3	MCT 518	3-0-0-3	3	Computer Vision	40	60
Paper – 4	MCT 519	3-0-0-3	3	Natural Language Processing	40	60
Practical	MCT 520	0-0-15-8	8	Computer Lab	40	60

M.Tech. 3rd Semester (CSE)						
Paper	Course Code	L-T-P-C	Credits	One theory Paper & Project	Sessional Marks	End Semester Marks
Paper – 1	MCT 604	4-0-0-4	4	Elective Paper	40	60
Projects	MCT 605	0-0-32-16	4	Project – Phase I – Seminar	40	60
			6	Project – Phase I – Dissertation	40	60
			6	Project – Phase I – Viva Voce	40	60

M.Tech. 4th Semester (CSE)						
Paper	Course Code	L-T-P-C	Credits	Project & Paper Writing	Sessional Marks	End Semester Marks
Projects	MCT 606	0-0-40-20	6	Project – Phase II – Seminar	40	60
			6	Project – Phase II – Dissertation	40	60
			6	Project – Phase II – Viva Voce	40	60
			2	Paper Writing & Presentation	40	60

DEPARTMENT OF ZOOLOGY, UNIVERSITY OF ALLAHABAD

Syllabus of M.Sc. Agricultural Entomology based on Choice Based Credit System (CBCS), 2024-25

Semester I

AGE 501:Insect Morphology

UNIT I: General characters of an insect; insect body wall, its structure and derivatives; cuticular outgrowths, segmentation, sclerites and sutures.

UNIT II: Head: structure and modification; tentorium; structure and types of mouthparts and antennae.

UNIT III: Thorax: general structure; Wings: structure and modification, wing venation, wing coupling apparatus; Legs: structure, types and modifications.

UNIT IV: Abdomen: Structure; Segmentation and appendages, genitalia and their modifications in important insect orders; Stridulatory organs and sound producing organs.

AGE 502: Systematics of Insects

Unit I: Origin and eevolution of insects, Importance of taxonomy. Hierarchic classification, types species. Procedures in taxonomy, International Code of Zoological Nomenclature. Collection and Preservation of Insects.

Unit II: Major Classification of class Insecta. Habits, Habitats, distinguishing characters and classification of order upto super Family: Thysanura, Isoptera, Odonata, Orthoptera, Dictyoptera.

Unit III: Habits, Habitats, distinguishing characters and classification of order upto super Family: Dermaptera,Thysanoptera, Hemiptera, Neuroptera, Strepsiptera.

Unit IV: Habits, Habitats, distinguishing characters and classification of order upto super Family: Trichoptera, Lepidoptera, Coleoptera, Hymenoptera and Diptera.

AGE 503: Insect anatomy and physiology

Unit I: Structure, modification and physiology of digestive system. Food, nutrients and nutrition; minerals, carbohydrates, proteins, lipids and their role in growth and development; artificial diets.

Unit II: Structure, modification and physiology of circulatory and respiratory systems.

Unit III: Structure, modification and physiology of nervous system, sensory organs and muscular system.

Unit IV: Structure, modification and physiology of excretory and reproductive system.

AGE 504: Insect Ecology and Behaviour

Unit I: Insects Community structure & dynamics. Effect of Environmental factors on growth, development, population dynamics and distribution of insects. Insect plant interactions.

Unit II: Arthropod population monitoring, Pest forecasting. Diapause and causes of out breaks.

Characterization of insect colonization, k and r Strategies. Community ecology- Concept of guild, Organisation of communities-Hutchinson Ratio, May's d/w, Relation between the two and their association with Dyar's Law and Przibram's law.

Unit III: Introduction to insect behaviour. Mechanisms of Insect Behaviour: Sensory perception of insects, Control of insect behaviour: genetic, neural, physiological, environmental. Defence behaviour: Passive defence: crypsis, aposematic defenses, mimicry, passive and systemic chemical defences; active defences: startle, attack; group defence.

Unit IV: Insect Behaviour and the Environment: Orientation, Migration and navigation. Insect Communication: Visual, Mechanical and Chemical. Reproductive Behaviour: Mate finding and selection, Mate competition and courtship behaviour, Parental care. Social Behaviour: Cooperative living and altruism, Aggressive Behaviour.

AGE 531:Lab Course/Practical

AGE 532: Field visit and report

Semester-II

AGE 505: Insect Embryology and Endocrinology

Unit I: Insect Egg, Fertilization, Early Embryonic Development: Cleavage and the blastoderm, Gastrulation, Blastokinesis; Post Embryonic development: Metamorphosis-types; general features and types of larvae and pupae.

Unit II: Unusual types of development: Viviparity, Polyembryony, Parthenogenesis, Pedogenesis, Polyphenism. Diapause.

Unit III: Exocrine and Endocrine glands, their structure and function.

Unit IV: Hormones: Structure, transport, function and its mode of action; Regulation of hormone titer; Hormonal control of growth, metamorphosis and diapause.

AGE 506: Insect Toxicology

Unit: I: History, scope and principles of chemical controls; Insecticides and their classification, Structure and mode of action of organochlorines, organophosphates, carbamates, pyrethroids, chlordimeform, neonicotinoids, oxadiazines, phenyl pyrozoles, botanicals, chitin synthesis inhibitors, avermectins and fumigants; Systemic insecticides.

Unit II: Principles of toxicology; evaluation of insecticide toxicity; determination of LD_{50}, LT_{50}, LC_{50}, etc., joint action of insecticides- synergism, potentiation and antagonism; factors affecting toxicity of insecticides; insecticide compatibility, selectivity and phytotoxicity.

Unit III: Insecticide formulations; Methods of application of insecticides, appliances; Aerial application of insecticides; Insecticide metabolism; detoxification enzymes and their role in

metabolism; Insecticides resistance, mechanisms, types, and genetics of insecticide resistance; management and pest resurgence.

Unit IV: Pesticide residues, their significance and environmental implications; Insecticide Act, registration and quality control of insecticides; safe use of pesticides; diagnosis and treatment of insecticide poisoning. Basic concept involved in choosing pesticides in IPM.

AGE 507:Plant Resistance to Insects

Unit I: History and importance of plant resistance, principles, classification, components, types and mechanisms of plant resistance to insects. Factors affecting plant resistance including biotypes and measures.

Unit II: Insect-host plant relationships: theories and basis. Chemical ecology, tritrophic interactions. Secondary plant metabolites and their defences against phytophagous insects.

Unit III: Basis of resistance: Antixenosis, Antibiosis, Tolerence, acquired and induced resistance. Resistance development, evaluation techniques.

Unit IV: Genetic of resistance: Vertical, horizontal, oligogeneic and polygeneic resistance. Biotechnological approaches of development of transgenic resistant plants. Insect resistance to transgenic plants and its management. Successful examples of resistant crop varieties in India and world.

AGE 508: Insect Vectors of Plant Diseases

Unit I: Historical background of Insect vector-borne plant disease. Important insect vectors and their characteristics; mouth parts and feeding processes of important insect.

Unit II: Insect vectors and their relationship with Plant pathogenic viruses, bacteria, Fungi and Mycoplasma. Mechanism of Pathogen transmission; Transmission efficiency.

Unit III: Transmission of plant viruses by aphids, whiteflies, mealy bugs, thrips, psyllids, and beetles.

Unit IV: Transmission of mycoplasma and bacteria by insects (leaf hoppers, plant hoppers etc.). Epidemiology and management of insect vector transmitted diseases.

AGE 533:Lab Course/Practical

AGE 534: Field visit and report

Semester-III

AGE 509: Principles of Integrated Pest Management

Unit-I: Causes of success of insects, Origin of insect pests; History of insect pest control; Basic principles and components of insect pest management; Mechanical control, Physical control

Unit-II: Cultural control: Crop rotation, tilling the soil, destruction of places of breeding or over

wintering refuge, destruction or provision of alternate hosts, time of planting and harvesting, trap crops, nutrient management, clean cultivation etc., Biological Control.

Unit-III: Chemical control: synergists, formulations, application and appliances, repellents, attractants, botanicals, Synthetic organic insecticides, Pest resurgence and physiology of insecticidal resistance

Unit-IV: Innovative approaches of pest control: behavioural control, hormonal control and genetic control, IGR: JH Mimics & MH-agonist; Transgenic plants: history, *Bacillus thuriengensis* and its mode of action on insect, development of *Bt* plant by recombinant DNA technology, resistance management of *Bt*-crop, prospective and controversies of *Bt*-crop.

AGE 510: Pests of Agricultural crops

Unit I: Systematic position, identification, distribution, host range, biology, bionomics, nature of damage and management of insect pest of cereals, oilseeds and pulses.

Unit II: Systematic position, identification, distribution, host range, biology, bionomics, nature of damage and management of insect pests of vegetables, fruits and plantation crops.

Unit III: Systematic position, identification, distribution, host range, biology, bionomics, nature of damage and management of insect pests of fibre crops, sugar cane and spices.

Unit IV: Distribution, host range, biology, bionomics, nature of damage and management of Polyphagous pests: grasshopper, locusts, termites, hairy caterpillars, cut-worms and white grubs.

AGE 511: Medical and Veterinary Entomology

Unit I: Brief introduction to carriers and Vectors, insect reservoirs and hosts vector relationship. Adaptation in insect to act as vectors, Forensic entomology – basic concept and its importance.

Unit II: The biology, life history, mode of transmission, type of injury or infection, diseases, treatment and control of mosquitoes, sand flies, tsetse fly, human flea (*Pulex irritans*), head louse (*Pediculus humanus*) and bed bug (*Cimex hemipterus*) and blow flies.

Unit III: Introduction to Veterinary entomology. Common insect orders of veterinary importance. Molecular tools used in veterinary entomology.

Unit IV: The biology, life history, mode of attack, nature of injury and infection, damage or loss, treatment and control of stableflies (*Stomxys morsitans*), equine botflies (*Gasterophilus intestinalis*). Cattle tick (*Boophilus microplus*), chicken mite (*Dermanyssus gallinae*) cattle blood sucking lice (*Linognathus vituli*) and cattle warblefly (*Hypodermabovis*).

AGE 512: Stored Grain Pest and their Management

Unit I: Introduction, history of storage entomology. Important pests viz., insects, rodents, birds and microorganisms associated with stored grain and field conditions including agricultural products.

Unit II: Grain storage- types of storage structures i.e., traditional, improved and modern. Ideal seeds storage conditions, Ecology of insect pests of stored grains with special emphasis on role of moisture, temperature and humidity in safe storage. Stored grain deterioration process, physical and biochemical changes and consequences.

Unit III: Systematic position, identification, distribution, host range, biology, nature and extent of damage of important stored grain pests of rice, wheat and pulses.

Unit IV: Control of infestation by insect pests. Preventive measures- Hygiene/sanitation, disinfestations of stores/receptacles, legal methods. Curative measures, non-chemical control measures- ecological, mechanical, physical, cultural, biological and engineering. Chemical control- prophylactic and curative characteristics of pesticides, their use and precautions in their handling with special emphasis on fumigants. Integrated approaches to stored grain pest management.

AGE 535:Lab Course/Practical

AGE 536: Field visit and report

Semester- IV

AGE 513: Biostatistics and Computer Application

Unit I: Basic definitions and applications, Sampling techniques, Data collection and presentation: types of data, methods of data collection, tabular and graphical representation of data.

Unit II: Frequency distribution, Measures of central tendency: mean, median, mode; Measures of variability of variation: Range, Interquartile range, standard deviation, variance; Correlation and regression: positive and negative correlation, ANOVA.

Unit III: Tests of significance: Chi-square, t-test, F-test, Duncan's Multiple Range Test, large sample test (Z test) and standard error. Introduction to probability theory and distribution; standard, binomial, poisson’s and normal distributions. Probit Analysis.

Unit IV: Design of Experiments, Introduction to computers and computer applications, MS Office, spreadsheets and presentation software. Uses of software packages like SPSS, SAS, etc.

Note: The candidate may opt any two of the following electives

AGE 551: Biological Control of Insects

Unit I: History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; Principles of classical biological control- introduction, augmentation, Inundation and conservation.

Unit II: Biology, adaptation, host seeking behaviour of predatory and parasitic groups of insects. Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa etc., their mode of action.

Unit III: Mass production of quality bio-control agents- techniques, formulations, economics, field

release/application and evaluation.

Unit IV: Successful biological control projects, analysis, trends and future possibilities of biological control. Import of natural enemies- Quarantine regulations; Biotechnology in biological control.

AGE 552: **Plant Quarantine**

Unit I: History of quarantine legislations, Quarantine: domestic and international. Quarantine restrictions in the movement of agricultural produce, seeds and planting material; Exotic pests/diseases and their status**.**

Unit-II: Plant Bio-security and Bio-safety: Invasive alien species, Bio-warfare, National Regulatory Mechanism and International Agreements/Conventions; issues related to GM crops; strategies for combating risks and costs associated with agro-terrorism.

Unit-III: Identification of plant pest/diseases prevalence; contamination of food with toxigens, microorganisms and their elimination; Symptomatic diagnosis and other techniques to detect pest/pathogen infestations; VHT and other safer techniques of dis-infestation of infected material.

Unit-IV: Industrial registration; APEDA, Import and Export of bio-control agents. WTO regulations; non-tariff-barriers; Pest risk analysis; pesticide industry; Sanitary and Phytosanitary measures. Principles and Procedures of Certification: Role of international agencies in certification and quality control, fixing tolerance limits for diseases and insect pests in certification, accreditation of seed testing laboratories.

AGE 553: Commercial Entomology

Unit I: General introduction of commercially important insect orders, Historical and cultural aspects. Insect products and their marketing, government policies, Skill India and Startups in commercial entomology. Insect as food source, medicines, pollinators.

Unit II: Biology, characteristic and life history of silk worms. Silk and its uses, adulteration, , rearing, diseases, parasites and management of silkworms.

Unit III: Study of different species of honey bees, life history, behaviour and habitats, bee keeping, diseases, enemies and parasites of honey bees. Production and marketing of quality honey and value added honey products, adulteration. Establishment and maintenance of apiaries.

Unit IV: Lac insects its biology, habit and habitat, lac culture, commercial uses, natural enemies and their management.

AGE 554: Pest of Horticultural Crops

Unit I: Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage, seasonal abundance and management of insect pests of important fruit crops.

Unit II: Systematic position, identification, distribution, host-range, bionomics, nature and extent of

damage, seasonal abundance and management of insect pests of major vegetable crops.

Unit III: Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage, seasonal abundance and management of insect pests of plantation crop-

Unit IV: Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage, seasonal abundance and management of insect pests of ornamental, medicinal and aromatic plants and pests in polyhouses/protected cultivation.

AGE 555: Dissertation

AGE 537-541: Lab Course/Practical

AGE 542: Field visit and report

DEPARTMENT OF STATISTICS

UNIVERSITY OF ALLAHABAD

M.A./M.Sc. Statistics

To be effective from 2023-24

Course Outline

1st Semester July to December

Paper	Duration L-T-P-C	Maximum Marks
STA501: MATRIX ALGEBRA AND LINEAR ESTIMATION	4-1-0-5	100
STA503: SURVEY SAMPLING	4-1-0-5	100
STA504: MEASURE AND PROBABILITY THEORY	4-1-0-5	100
ELECTIVE (CHOSE ANY ONE)		
ELECTIVE I: STA551: R PROGRAMMING AND STATISTICAL COMPUTING	4-1-0-5	100
ELECTIVE II: STA669: STATISTICAL COMPUTING USING PYTHON	4-1-0-5	100
STA531: Lab	0-1-5-5	100

2nd Semester January to May

Paper	Duration L-T-P-C	Maximum Marks
STA502: MULTIVARIATE ANALYSIS	4-1-0-5	100
STA505: ESTIMATION THEORY	4-1-0-5	100
STA 507: REGRESSION ANALYSIS	4-1-0-5	100
ELECTIVE (CHOSE ANY ONE)		
ELECTIVE I: STA506: TIME SERIES ANALYSIS	4-1-0-5	100
ELECTIVE II: STA561: POPULATION STUDIES AND DEMOGRAPHY	4-1-0-5	100
STA532: LAB	0-1-5-5	100

3rd Semester July to December

Paper	Duration L-T-P-C	Maximum Marks
STA552: KNOWLEDGE DISCOVERY AND DATA MINING	4-1-0-5	100
STA601: TESTING OF HYPOTHESIS, SEQUENTIAL ANALYSIS AND NON-PARAMETRIC INFERENCE	4-1-0-5	100
STA670: SURVIVAL ANALYSIS AND CLINICAL TRIALS	4-1-0-5	100
ELECTIVE (CHOSE ANY ONE)		
ELECTIVE I: STA653: OFFICIAL AND NATIONAL DEVELOPMENT STATISTICS	4-1-0-5	100
ELECTIVE II: STA654: ADVANCED MULTIVARIATE ANALYSIS	4-1-0-5	100
ELECTIVE III: STA655: ECONOMETRICS	4-1-0-5	100
STA631: LAB	0-1-5-5	100

4th Semester January to May

Paper	Duration L-T-P-C	Maximum Marks
STA602: ANALYSIS OF VARIANCE AND DESIGN OF EXPERIMENTS	4-1-0-5	100
STA656: STOCHASTIC PROCESS	4-1-0-5	100
ELECTIVE (CHOSE ANY ONE)	4-1-0-5	100

ELECTIVE I: STA652: STATISTICAL DECISION THEORY AND BAYESIAN THEORY	4-1-0-5	100
ELECTIVE II: STA671: ADVANCED OPERATION RESEARCH	4-1-0-5	100
ELECTIVE II: STA672: BIOSTATISTICS	4-1-0-5	100
ELECTIVE II: STA673: FORESTRY AND ENVIRONMENTAL STATISTICS	4-1-0-5	100
STA633: LAB	0-1-5-5	100
STA634: MAJOR PROJECT	5 credit	100

Post graduate Programme in M.Sc. in Textile and Apparel Designing
Semester System

SEMESTER I

Paper Code	Papers	Credits	L-T-P-C	Marks		
				Sessional	End Semester	Total
HOM580	Textile Industry of India	4	4-0-0-4	40	60	100
HOM581	Apparel Designing and Construction-I	3	3-0-0-3	40	60	100
HOM582	Apparel Designing and Construction-I (Practical)	3	0-0-6-3	40	60	100
HOM583	Fashion Retailing and Merchandising	3	3-0-0-3	40	60	100
HOM584	Dyeing and Finishing	3	3-0-0-3	40	60	100
HOM585	Dyeing (Practical)	4	0-0-8-4	40	60	100
	Total	**20**				**600**

SEMESTER II

Paper Code	Papers	Credits	L-T-P-C	Marks		
				Sessional	End Semester	Total
HOM586	Textile Printing	4	4-0-0-4	40	60	100
HOM587	Textile Printing(Practical)	4	0-0-8-4	40	60	100
HOM588	CAD in Textile and Fashion –I (Practical)	4	0-0-8-4	40	60	100
HOM589	Research Methods and Statistics	4	3-1-0-4	40	60	100
HOM590	Fabric Construction Techniques	4	4-0-0-4	40	60	100
	Total	**20**				**500**

SEMESTER III

Paper Code	Papers	Credits	L-T-P-C	Marks		
				Sessional	End Semester	Total
HOM591	Entrepreneurship Management	3	3-0-0-3	40	60	100
HOM592	Textile Testing	3	3-0-0-3	40	60	100
HOM593	Textile Testing (Practical)	4	0-0-8-4	40	60	100
HOM594	Apparel Designing and Construction-II (Practical)	6	0-0-12-6	40	60	100
HOM595	CAD in Textile and Fashion-II (Practical)	4	0-0-8-4	40	60	100
	Total	**20**				**500**

SEMESTER IV

Paper Code	Papers	Credits	L-T-P-C	Marks		
				Sessional	End Semester	Total
HOM596	Scientific paper writing	4	0-0-8-0	40	60	100
HOM597	Seminar	8	0-0-16-8	40	60	100
HOM598	Dissertation	6	0-0-12-6	40	60	100
HOM599	Summer Training	6	0-0-12-6	40	60	100
	Total	**24**				**400**

The total credits of the 2 years semester of P.G. (Textile and Apparel Designing) are 84.

Syllabus

MSc. Food and Nutrition

Paper Code	Papers	Credits	L-T-P-C	Marks		
				Sessional	End Semester	Total
Semester First						
FAN501	Physiology	3	3-0-0-3	40	60	100
FAN502	Basics of Nutrition	5	3-0-4-5	40	60	100
FAN503	Principles of Food Science	5	3-0-4-5	40	60	100
FAN504	Biochemistry of Nutrition	3	2-0-2-3	40	60	100
FAN505	Basics of Statistics and Computer Application	4	2-1-2-4	40	60	100
		Total 20				
Semester Second						
FAN506	Research Methods	4	3-1-0-4	40	60	100
FAN507	Advanced Nutritional Biochemistry	5	3-0-4-5	40	60	100
FAN508	Instrumentation in Nutrition	2	2-0-0-2	40	60	100
FAN509	Food Microbiology & Food Safety	5	3-0-4-5	40	60	100
FAN510	Advanced Human Nutrition	5	3-0-4-5	40	60	100
		Total 20				
Semester Third						
FAN511	Food Chemistry and Food Analysis	5	3-0-4-5	40	60	100
FAN512	Therapeutic Nutrition	5	3-0-4-5	40	60	100
FAN513	Institutional Food Management	4	3-1-0-4	40	60	100
FAN514	Public Health Nutrition	5	3-0-4-5	40	60	100
FAN515	Food Processing & Food Laws	3	3-0-0-3	40	60	100
		Total 22				
Semester Fourth						
FAN516	Seminar	4	0-0-4-4	40	60	100
FAN517	Scientific Writing	2	2-0-0-2	40	60	100
FAN518	Statistical Techniques and Data Analysis	2	2-0-0-2	40	60	100
FAN519	Dissertation	15	0-0-30-15	40	60	100
		Total 23				

Total credits for the 2 years Semester of P. G. (Food and Nutrition) are 85.

University of Allahabad

Department of Journalism and Mass Communication

Syllabus and Programme Structure

(CBCS Syllabus)

Programme Name:

M.A. (Mass Communication)

{With effect from the Academic Session: 2024-2025}

University of Allahabad

Department of Journalism and Mass Communication

Programme Name:

M.A. (Mass Communication)

Programme Summary

Course Code	Course Type	Course Title	Teaching Hours (Per week)			Credit
			L	T	P	
SEMESTER- I						
MAS501	Core	Principles and Theory of Mass Communication	4	1	-	05
MAS502	Core	Reporting and Editing for Print Media	4	1	-	05
MAS551	Elective	Film & Art Appreciation	4	1	-	05
MAS552		Photo Journalism	4	1	-	
MAS531	Practical	Basics of Computer	-	-	10	05
SEMESTER- II						
MAS503	Core	Scripting for Broadcast Media	4	1	-	05
MAS504	Core	Development Communication	4	1	-	05
MAS553	Elective	Advertising & Public Relations	4	1	-	05
MAS554		Media Management	4	1	-	
MAS532	Practical	Lab Journal & Magazine	-	-	10	05
SEMESTER- III						
MAS505	Core	Communication Skills	4	1	-	05
MAS506	Core	News and Current Affairs Production for Television and Radio	4	1	-	05
MAS555	Elective	Indian Constitution & Government and Press Law	4	1	-	05
MAS556		Media Ethics	4	1	-	
MAS533	Practical	Video Editing and Broadcast Programme Production	-	-	10	05
SEMESTER- IV						
MAS507	Core	Communication Research	4	1	-	05
MAS557	Elective	New Media	4	1	-	05
MAS558		Digital Marketing	4	1	-	
MAS534	Practical	Field Visits and Internship	-	5	-	05
MAS535	Practical	Final Projects	-	5	-	05
					Total Credit	**80**

Abbreviations: L= Lecture; T= Tutorials; P= Practical

Centre

of

SCIENCE AND SOCIETY

{M.Sc. Design and Innovation in Rural Technology (Four Semesters) Programme}
(Syllabus)

UNIVERSITY OF ALLAHABAD

PRAYAGRAJ: 211002

SUMMARIZED SYLLABUS WITH MARKING SCHEME AND CREDITS

SEMESTER- I

Course no.	Marks	Course title	Credits
DRT- 501	100	Introduction to Design and Innovation in Rural Technology and development	3
DRT- 502	100	Rural Empowerment	3
DRT- 503	100	Innovation, Concept and Models of Rural Development	3
DRT- 504	100	Global approach in Innovative Rural technology	3
DRT- 531	100	Practical of DRT- 501 and DRT- 502 (Training programme/Project work)	4
DRT- 532	100	Practical of DRT- 503 and DRT- 504 (Village Exposure)	4
Total			20

SEMESTER- II

Course no.	Marks	Course title	Credits
DRT- 505	100	Natural resource management practices in India	3
DRT- 506	100	Innovative technologies in Production and Post-harvest management	3
DRT- 507	100	Innovation in productivity and Sustainable management	3
DRT- 508	100	Design and Innovation Commercial Production Technologies	3
DRT- 533	100	Practical of DRT- 505 and DRT- 506	4
DRT- 534	100	Practical of DRT- 507 and DRT- 508	4
Total			20

SEMESTER- III

Course no.	Marks	Course title	Credits
DRT-601	100	Design and Innovation in Rural Entrepreneurship	3
DRT- 602	100	History of Indian traditional Medicine	3
DRT- 603	100	Science, Technology and Society Interaction	3
DRT-604	100	Design and Innovation in Integrated Rural Health Management	3
DRT- 635	100	Practical of DRT- 601 and DRT- 602 (Medical based Field work survey)	4
DRT- 636	100	Practical of DRT- 603 and DRT- 604 (Village Survey for Endemic Diseases)	4
Total			20

SEMESTER- IV

Course no.	Marks	Course title	Credits
DRT- 605	100	Economic status of Rural India	3
DRT- 606	100	IT in Rural Development	3
DRT- 607	100	Dissertation/Thesis/Prototype development	5
DRT 651-DRT-654	100	Elective Papers	3
DRT-638-DRT-641	100	Practical based on Elective Papers	2
DRT- 637	100	Practical of DRT- 513 and DRT- 514	4
Total			20

Elective Papers

Course Code	**Marks**	**Elective***	**Credits**
DRT 651	100	Innovation in Rural Entrepreneurship	3
DRT 652	100	Rural Health Management	3
DRT 653	100	Innovative Commercial Production Technologies	3
DRT 654	100	IT in Rural Development	3
DRT 638	100	Field Work based on Course DRT 651	2
DRT 639	100	Field Work based on Course DRT 652	2
DRT 640	100	Field Work based on Course DRT 653	2
DRT 641	100	Field Work based on Course DRT 654	2
Total			**20**

Regulations, Course Structure & Syllabus

of

5-year Integrated UG and PG Food Technology Programme

Centre of Food Technology
Institute of Professional Studies
University of Allahabad

Revised Course Structure
5-year Integrated UG and PG Food Technology Programme

Sem I	Title	Credits	Course Type	Exit Qualification
FFT 131	Fundamentals of Food Processing	2-0-1-3	Core Course (CC)	
FFT 132	Concepts of Food Science	3-0-1-4	Core Course (CC)	
FFT 133	Basic Food Chemistry-I	3-0-1-4	Core Course (CC)	
FFT 105	General Bioscience	2-0-0-2	Generic Elective (GE)	
FFT 106	Conversation and Documentation Skills	2-0-1-3	Ability Enhancement Course (AEC)/Foundation course	
FFT 107	Concepts of Laboratory Techniques	0-0-2-2	Skill Enhancement Course (SEC)	
Total		**18**		**Certificate(Food Technology)**
Sem II	**Title**	**Credits**	**Course Type**	
FFT 134	Introduction to Food Hygiene and Sanitation	2-0-1-3	Core Course (CC)	
FFT 135	Principles of Food Microbiology	2-0-1-3	Core Course (CC)	
FFT 136	Food Packaging	2-0-1-3	Core Course (CC)	
FFT 137	Fruits and Vegetable Processing	2-0-1-3	Skill Enhancement Course (SEC)	
FFT 108	Environmental Studies*	3-0-0-3	Foundation / Ability Enhancement Course (AEC)	
FFT 104	Introduction to Computer Application*	2-0-1-3	Foundation / Ability Enhancement Course (AEC)	
Total		**18**		
Grand Total		**36**		
Sem III	**Title**	**Credits**	**Course Type**	**Exit Qualification**
FFT 231	Basic Food Chemistry-II	2-0-1-3	Core Course (CC)	
FFT 232	Food Quality and Analysis	3-0-1-4	Core Course (CC)	
FFT 233	Food Processing Operations	3-0-0-3	Core Course (CC)	
FFT 234	Technology of Cereals, Pulses and Oilseed	3-0-1-4	Core Course (CC)	
FFT 208	Disaster and Risk Management	2-0-0-2	Generic Elective (GE)	
ELECTIVE-I (Any Two)				
FFT 255	Bakery and Confectionery Products Technology	2-0-1-3	Discipline Specific Elective (DSE)	
FFT 256	Beverage Technology		Discipline Specific Elective (DSE)	
FFT 257	**Basics of Nutrition**	**3-0-0-3**	**Discipline Specific Elective (DSE)**	
Total		**22**		
Sem IV	**Title**	**Credits**	**Course Type**	**Diploma (Food Technology)**
FFT 235	Meat, Fish and Poultry	2-0-1-3	Core Course (CC)	
FFT 236	Dairy Science	3-0-1-4	Core Course (CC)	
FFT 237	Food Quality Management and Quality Assurance	3-0-1-4	Skill Enhancement Course (SEC)	
FFT 209	Data Analysis	1-1-0-2	Generic Elective (GE)	
FFT 210	Technical Writing*	1-0-0-1	Foundation / Ability Enhancement Course (AEC)	
FFT 280	Industrial Training for 15-30 days	0-0-2-2	Skill Enhancement Course (SEC)	
FFT 258	**Crop Production**	**2-0-02**	**Generic Course**	
	Total	**19**		
Grand Total		**77**		

Sem V	Title	Credits	Course Type	Exit Qualification
FFT 331	Fundamentals of Food Engineering	3-0-1-4	Core Course (CC)	**Three Year UG Degree (Food Technology)**
FFT 332	Biochemistry and Human Nutrition	3-0-0-3	Core Course (CC)	
FFT 333	Concepts of Biotechnology	2-0-1-3	Generic Elective (GE)	
FFT 334	Waste Management Practices	2-0-0-2	Generic Elective (GE)	
FFT 380	Seminar	0-0-1-1	Skill Enhancement Course (SEC)	
ELECTIVE-II (*Any Two)*				
FFT 353	Technology of Indigenous milk Products	2-0-1-3	Discipline Specific Elective (DSE)	
FFT 356	Food Fermentation Technology		Discipline Specific Elective (DSE)	
FFT 357	**Nutraceuticals and Functional Foods**	**3-0-03**	**Discipline Specific Elective (DSE)**	
	Total	**19**		
Sem VI	**Title**	**Credits**	**Course Type**	
FFT 335	Food and Agribusiness Management	2-0-0-2	Skill Enhancement Course (SEC)	
FFT 336	Plant Design and Layout	2-0-0-2	Skill Enhancement Course (SEC)	
FFT 385	Industrial Project (10 weeks which may extend during summer vacation)	0-0-10-10	Core Course (CC)	
FFT 358	**Medicinal Plants**	**2-0-0-2**	**Generic Course (SEC)**	
	Total	**16**		
Grand Total		**109**		

Sem VII	Title	Credits	Course Type	Exit Qualification
FFT 504	Research Methodology and Statistics	3-1-0-4	Generic Elective (GE)	**Four year UG Degree (Food Technology) 'With Research'**
FFT 555	**Food Additives**	**2-0-0-2**	**Discipline Specific Elective (DSE)**	
FFT 390	Thesis	0-0-10-10	Discipline Specific Elective (DSE)	
	Total	**16**		
Sem VIII	**Title**	**Credits**	**Course Type**	
FFT 390	Thesis	0-0-20-20	Discipline Specific Elective (DSE)	
Grand Total		**147**		

Sem IX	Title	Credits	Course Type	
FFT 503	Instrumentation and Analytical Techniques	3-0-1-4	Core Course (CC)	
FFT 557	Spices and Flavour Technology	3-0-0-3	Skill Enhancement Course (SEC)	
FFT 509	Food Quality, Safety Standards and Certification	3-0-0-3	Core Course (CC)	
ELECTIVE-Any Four				
FFT 651	Entrepreneurship in Food Processing	2-0-0-2	Discipline Specific Elective (DSE)	
FFT 653	Food Rheology		Discipline Specific Elective (DSE)	
FFT 654	Food Product Development		Discipline Specific Elective (DSE)	
FFT 658	Food By-product management		Discipline Specific Elective (DSE)	
FFT 659	Advanced Food Chemistry		Discipline Specific Elective (DSE)	
FFT 553	**Speciality Foods**		Discipline Specific Elective (DSE)	
	Total	**18**		
Sem X				
FFT 507	Packaging of Food Materials	3-0-0-3	Core Course (CC)	
FFT 508	Food Engineering	3-1-0-4	Core Course (CC)	
FFT 510	Advanced Food Microbiology	3-0-1-4	Core Course (CC)	
Elective- Any Two				
FFT 660	**Processing of Fruits and Vegetables**	**1-0-1-2**	Discipline Specific Elective (DSE)	
FFT 552	Intellectual Property Rights	2-0-0-2	Discipline Specific Elective (SEC)	
FFT 554	Fundamentals of Nutrition		Discipline Specific Elective (SEC)	
FFT 652	Food Fermentation and Microbial Technology		Discipline Specific Elective (SEC)	
FFT 641	Seminar	0-0-1-1	Skill Enhancement Course (SEC)	
	Total	**16**		
	Grand Total	**181**		

5-year Integrated UG&PG Food Technology Programme

CC: Core Course, AEC: Ability enhancement Course/ Foundation course, SEC: Skill Enhancement Course, GE: Generic Elective, DSE: Discipline Specific Elective, Elective / Minor courses to be opted from other dept. relevant to research work

Revised Syllabus

M. Sc. Food Technology

Centre of Food Technology
University of Allahabad
Allahabad

M.Sc in Food Technology

Course Structure

Semester	Paper Code		Title of paper	Credits			
				L	T	P	Total (C)
I	**FFT 501**		Principles of Food Processing	3	1	0	4
	FFT 502		Food Chemistry	3	0	1	4
	FFT 503		Instrumentation and Analytical Techniques	3	0	1	4
	FFT 504		Research Methodology and Statistics	3	1	0	4
	FFT 591		Communication Skills	1	0	1	2
	FFT 592		Basics of Computer Application	1	0	1	2
			TOTAL	**14**	**2**	**4**	**20**
II	**FFT 505**		Post Harvest Technology of Horticulture Crops	2	0	1	3
	FFT 506		Food Microbiology	3	0	1	4
	FFT 507		Packaging of Food Materials	3	0	0	3
	FFT 508		Food Engineering	3	1	0	4
	Elective- I (Any two)	**FFT 551**	Processing of Meat, Fish and Poultry Products	2	0	0	2
		FFT 552	Intellectual Property Rights				
		FFT 553	Specialty Foods				
		FFT 554	Fundamentals of Nutrition				
		FFT 557	Spices and Flavour Technology				
	FFT 593		Communication skills and Scientific writing	1	0	1	2
			TOTAL	**16**	**1**	**3**	**20**
III	**FFT 601**		Processing of Cereals, Pulses and Oilseeds	3	0	1	4
	FFT 602		Processing of Milk and Milk Products	3	0	1	4
	FFT 603		Quality Control, Food Standards and Food laws	3	0	0	3
	Elective- II (Any two)	**FFT 651**	Entrepreneurship in Food Processing	2	0	0	2
		FFT 652	Food Fermentation and Microbial Technology				
		FFT 653	Food Rheology				
		FFT 654	Food Product Development				
		FFT 655	Advanced Food Analysis	1	0	1	2
	FFT 691		Workplace Skills	1	0	1	2
	FFT 604		Training and Workshop	0	0	2	2*
	FFT 641		Seminar	0	0	1	1
			TOTAL	**14**	**0**	**6**	**20**
IV	**FFT 646**		Thesis	**0**	**0**	**20**	**20**
			Total Credits	**44**	**3**	**33**	**80**

*Non Credit Requirement

Centre

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SCIENCE AND SOCIETY

{M.Sc. Design and Innovation in Rural Technology (Four Semesters) Programme}
(Syllabus)

UNIVERSITY OF ALLAHABAD

PRAYAGRAJ: 211002

ORDINANCE FOR M.Sc. DESIGN AND INNOVATION IN RURAL TECHNOLOGY BASED ON SEMESTER SYSTEM, IIDS, FACULTY OF SCIENCE UNIVERSITY OF ALLAHABAD

1. The admission to the course of M.Sc. degree in Design and Innovation in Rural Technology open to any candidate who has earned Bachelor degree under 10+2+3 pattern of education with Botany, Agriculture sciences discipline of any Indian University or any accredited institution or any foreign University which the academic council of the University of Allahabad may recognize from time to time for this purpose.
2. The candidates shall be admitted through the entrance test conducted by the University followed by Group discussion and Personal Interview at the Centre in the ratio of 60:40 (60% marks entrance test conducted by University, 30% group discussion and 10% for Personal interview). There shall be separate merit lists for General, SEBC (OBC) and SC/ST candidates.
3. The total number of the candidates admitted to this course will be 15 (Fifteen) and the number may vary from time to time according to the directives of the University.
4. The course shall consist of theory papers and practical based on these papers spread over four semesters.

RULES AND REGULATIONS
EXAMINATION, EVALUATION AND THE MARKING SYSTEM

AS PER CBCS RULE

OBJECTIVE

ORIGIN-To begin with a course dedicated towards overall development of rural technology, the Centre of Science and Society (Rural Technology and Development) {M.Sc. (Four Semesters) Programme} under the Coordinator-ship/ Directorship (Honorarium basis) University of Allahabad, efforts will made to retrieve funds under **CSR** (Corporate- Social Responsibility) from Coal India, NTPC, IFFCO, and Private Industry *viz*., Kirloskar, Mahindra Tractors, Monsanto etc. In addition to this, the Ministry of Rural Technology and Ministry of Small and Medium Scale Industries, Govt. will also render support in establishing an independent Centre of Science and Society (Rural Technology and Development) which will incorporate advancement of technological and social aspect of rural development.

OBJECTIVES AT A GLANCE

- Assessment of rural area and people.
- Rural Entrepreneurships (self-employment through sericulture, lac farming, flower farming, mushroom culture, bee keeping, preparation of natural dyes, bio composting, E-waste management, Biofertilizers etc.).
- Safe and eco-friendly technologies promotion and their compatibility amongst villagers.
- Conservation and promotion of indigenous knowledge.
- Socio-nutritional-economic development of indigenous peoples through appropriate integrated technology and awareness.
- Generating awareness regarding government policies (monitoring and documentation).
- Rural planning and implementation of rural development projects.
- To develop skill in students to for aforementioned tasks.

SUMMARIZED SYLLABUS WITH MARKING SCHEME AND CREDITS

SEMESTER- I

Course no.	Marks	Course title	Credits
DRT- 501	100	Introduction to Design and Innovation in Rural Technology and development	3
DRT- 502	100	Rural Empowerment	3
DRT- 503	100	Innovation, Concept and Models of Rural Development	3
DRT- 504	100	Global approach in Innovative Rural technology	3
DRT- 531	100	Practical of DRT- 501 and DRT- 502 (Training programme/Project work)	4
DRT- 532	100	Practical of DRT- 503 and DRT- 504 (Village Exposure)	4
Total			20

SEMESTER- II

Course no.	Marks	Course title	Credits
DRT- 505	100	Natural resource management practices in India	3
DRT- 506	100	Innovative technologies in Production and Post-harvest management	3
DRT- 507	100	Innovation in productivity and Sustainable management	3
DRT- 508	100	Design and Innovation Commercial Production Technologies	3
DRT- 533	100	Practical of DRT- 505 and DRT- 506	4
DRT- 534	100	Practical of DRT- 507 and DRT- 508	4
Total			20

SEMESTER- III

Course no.	Marks	Course title	Credits
DRT-601	100	Design and Innovation in Rural Entrepreneurship	3
DRT- 602	100	History of Indian traditional Medicine	3
DRT- 603	100	Science, Technology and Society Interaction	3
DRT-604	100	Design and Innovation in Integrated Rural Health Management	3
DRT- 635	100	Practical of DRT- 601 and DRT- 602 (Medical based Field work survey)	4
DRT- 636	100	Practical of DRT- 603 and DRT- 604 (Village Survey for Endemic Diseases)	4
Total			20

SEMESTER- IV

Course no.	Marks	Course title	Credits
DRT- 605	100	Economic status of Rural India	3
DRT- 606	100	IT in Rural Development	3
DRT- 607	100	Dissertation/Thesis/Prototype development	5
DRT 651-DRT-654	100	Elective Papers	3
DRT-638-DRT-641	100	Practical based on Elective Papers	2
DRT- 637	100	Practical of DRT- 513 and DRT- 514	4
Total			20

Elective Papers

Course Code	**Marks**	**Elective***	**Credits**
DRT 651	100	Innovation in Rural Entrepreneurship	3
DRT 652	100	Rural Health Management	3
DRT 653	100	Innovative Commercial Production Technologies	3
DRT 654	100	IT in Rural Development	3
DRT 638	100	Field Work based on Course DRT 651	2
DRT 639	100	Field Work based on Course DRT 652	2
DRT 640	100	Field Work based on Course DRT 653	2
DRT 641	100	Field Work based on Course DRT 654	2
Total			**20**

DETAILED SYLLABUS FOR THE 2- YEAR POST- GRADUATE COURSE DESIGN AND INNOVATION IN RURAL TECHNOLOGY

SEMESTER- I Syllabus

DRT 501- Introduction to Design and Innovation in Rural Technology and development

UNIT- I Indian Rural society – Nature and Characteristics, Factors of Indian Society, Tribal, Rural, Urban-Rural Urban continuum. Sustainable Development, Social Welfare, Social Work

UNIT- II Demography of rural areas, British setup and independent Indian setup, Rural Social structure, Problems of Weaker Sections, Social Problems in India: Population Explosion, Unemployment, Poverty, Gender Discrimination and Inequality, Farmers' suicide, Violation of Human Rights and Women in rural society.

UNIT- III Educational and cultural setup in various parts of the country, administrative setup, link up with district headquarters, Andragogy and Pedagogy.

UNIT- IV Rural Institutional Systems, Religious, Concept, Nature, Function and its Changing Structure, Education, Objectives, Functions and Importance, Cooperation, Concept, Nature, Scope, Role and Significance in Rural Development.

UNIT-V Computer Fundamentals, MS-Office, Data analysis and Interpretation

DRT 502- Rural Empowerment

UNIT- I Great Educators and their methods: Upanishadic Rishis, Booker Education in Rural areas, Education with emphasis on Primary and secondary education. Major Social Reformers and their Work: Raja Ram Mohan Roy, Mahatma Jyotibha Phule

UNIT- II Brief History of Adult Education- influence of Paulo Frere Pre-Independence and Post Independence efforts in India, Adult Education Programme since 1978 and latest Development.

UNIT- III Concept of Rural technology development, Scope of Rural technology, Causes of Rural Backwardness, Need for Rural technology Development and its Constraints.

UNIT- IV Rural Education with emphasis on Primary, Adult and Community Education, Development of Rural Women and Children- Status and Development Strategies

UNIT-V Different education commissions of India and their recommendations.

DRT 503- Innovation, Concept and Models of Rural Development

UNIT-I Innovation, Definition and Basic concepts. Types and Generation of Innovative Models.

UNIT-II System of Innovation, Components and Characteristics, Indian and International Innovation Institutions, Participatory Rural Appraisal (PRA),

UNIT-III Paradigms of Rural Development- Lewis Model of Economic Development, Self Help Group, Concept, Characteristics and Functions, National Rural Livelihood Mission (NRLM), DDU-GKY, Salient features, Nature and Scope.

UNIT-IV Experiments in Rural Development before independence: Sriniketan, Martandam, Sevagram, Baroda, Firka Development, Nilokheri and Etawa Pilot Project.

UNIT-V 'Big Push' theory of Development, Myrdal's thesis of 'Spread and Backwash Effects. Gandhian Model

DRT 504- Global Approach in Innovative Rural technology

UNIT- I Concept of rural technology and growth in general, Distinction between growth and Development, Indicators of Development, Measures of Development.

UNIT- II Poverty and Unemployment Rural Development and Environmental Protection, Participatory rural development.

UNIT-III Rural development Experiences in Asian countries - Need of Rural Development in Asian Countries, Sustainable Rural Development and Globlization.

UNIT-IV Success of Grameen Model in India, approaches to Rural Development in India.

UNIT- III Role of Panchayati Raj Institutions in Rural Development with special reference to Indian constitution. Different Rural Commissions of India, Land Acquition Bill.

DRT 531- Practical of DRT- 501 and DRT- 502

Exposure visit to a village and preparation of report. Exposure visit to a State Agricultural University. A case study on the beneficiaries of any rural development programmes. A compulsory exposure for training programme/project work.

DRT 532- Practical of DRT- 503 and DRT- 504

Exposure visit to any NGOs/Govt. agencies engaged in rural development activities. Conducting socio-economic surveys in the villages to understand the social structure, tribal social system, their values and norms. Survey of a village to find out the major problems**.** Identification of social changes in the villages.

SEMESTER- II Syllabus

DRT- 505- Natural resource management practices in India

UNIT- I Types and classification of natural resource, factors influencing resource availability, ecological, social and economic dimension of resource management

UNIT- II Land resources: Land as a resource. Dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification.

UNIT-III. Forest resources: forest vegetation, status and distribution, major forest types and their characteristics. Uses, over-exploitation, deforestation and case studies. Timber extraction, mining, dams and their effects on forest and tribal people, forest management.

UNIT-IV- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Water ecology and management.

UNIT-V - Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

DRT- 506- Innovative technologies in Production and Post- harvest management

UNIT- I Plant Protection - Plant disease, Plant pests' needs for its control, biological control of pests. Integrated Weed management. Agricultural Development under the Plans, Organizational Aspects of Agriculture: Land Reforms, Agro-forestry

UNIT- II Impact of Information Technology on development, growth and governance, satellite communication and remote sensing, geo-informatics application, geospatial information technologies, Information Technology in Agriculture,

UNIT- III Rural Industrialization- Concept, Importance of Rural Industrialization, Village and Cottage Industries, Livestock production, breeding and maintenance (poultry, goattry and piggery).

UNIT- IV Importance and scope of vegetables in India. Identification of vegetables & their seeds, improved nursery raising, sowing & transplanting of vegetables.

UNIT- V Aquaculture and Fisheries industry in rural setup specially culture and rearing of Carp, Prawn, Poly culture, Pearl culture etc. Different government schemes related to fisheries.

DRT- 507- Innovation in Productivity and Sustainable Management

UNIT- I **Basic Botany-** Classification, Morphology and Anatomy of Plants, Main fruits grown in rural places, Orchard Management practices, Processing and marketing of fruits,

UNIT- II Preparation of Nursery, Importance of cultivation of selected medicinal and aromatic plants. Propagation, planting methods, Bonsai Technology.

UNIT- III **Bee-keeping**: Detailed study of honey bee, its various species and their habits, Rearing techniques of honey bee, Difference between traditional and modern bee keeping. Care and management of bee hive, bee wax and honey; and their utility. Economics of bee keeping.

UNIT- IV **Lac Culture and Sericulture**: Cultivation, species, Importance, management of pests & diseases and Marketing.

UNIT- V Different emerging rural industrial technologies, their applications: Horticulture, Floriculture, Pomology, Olericulture; production and possibilities in global economy etc.

DRT- 508- Design and Innovation in Commercial production technologies

UNIT- I Commercial production technologies-nature, concept, applications and recent technical advancement.

UNIT- II **Mushroom Cultivation**: Morphology and life-cycle, Importance of mushroom as a health food, a cash crop and eco- friendly commodity, Wild and cultivated mushroom, Edible and poisonous types, Tropical and temperate species, Mushroom spawns, media and substrate for different species.

UNIT- III **Biofertilizers**: Bacterial, algal and fugal, Production technology and post-harvest handling of fresh and processed products and their marketing.

UNIT- IV **Vermicomposting**: Principles and functions of Vermicomposting, Biological mechanism of Vermicomposting, large- scale and small- scale production of vermicomposts.

UNIT- V **Biopesticides and Bio-supplements**; herbal soaps, fumigants and hygienic products.

DRT- 533- Practical of DRT- 505 and DRT- 506

Identification of various crops of kharif, rabi and zaid season and seed requirement. Familiarization with various chemicals like- fertilizers, pesticidials, herbicides, insecticides and fungicides. Calculation of fertilizer and pesticides doses. Use of farm implements & equipments. Identification of some important weeds, diseases and pests. Working at organic plots. Analysis of decomposition patterns of animal waste & agro-residuals. Nutrient value of common animal wastes and agro-residues as potential manures.

DRT- 534- Practical of DRT- 507 and DRT- 508

Bee-keeping: Identification and use of commonly used equipments in bee keeping, Identification of queen, drone and worker cells, Occupants of bee colony and the role of individual. Lac Culture, Tasar culture and Sericulture: Identification and description of various host plants of lac, tasar and sericulture, Rearing of lace, tsar and silk worm and cocoon maintenance. Mushroom Cultivation: Pure culture of mushroom---preparation and maintenance of inoculum Dairy**:** Substrate formulations, composting and pasteurization. Vermicomposting: Preparation and demonstration.

SEMESTER- III Syllabus

DRT- 601- Design and Innovation in Rural Entrepreneurship

UNIT- I Entrepreneurship: Concept of Entrepreneurship, origin and Development of Entrepreneurship. Entrepreneurship Movement in India, role of entrepreneurship in economic development.

UNIT- II Small Industries Development corporation (SIDC), Small Scale industries Board (SSIB), State Small Industries Development Corporations (SSIDC), Technical Consultancy Organizations (TCOs).

UNIT- III Rural Entrepreneurship: Meaning of rural entrepreneurship, need for rural entrepreneurship, problems of rural entrepreneurship, NGOs and rural entrepreneurship, Training and Development of rural Entrepreneurs.

UNIT- IV Entrepreneurship Development programmes (EDPs): Need for EDPs, Objectives of EDPs, Course content and curriculum of EDPs, Phases of EDPs, Evaluation of EDPs. Project Identification and Selection, STARTUP, SEED, PMKVY, TREAD, STEP, ATAL INNOVATION MISSION, MAKE IN INDIA, PRISM, Project Formulation and Appraisal.

UNIT- V Agencies Supporting Entrepreneurs: District Industries Centre (DICs), Micro, Small and Medium Enterprise (MSME), National Small Industries Corporation (NSIC)

DRT 602- History of Indian traditional Medicine

UNIT- I History of Indian system of medicine viz. Ayurveda, Siddha, Surgery etc.

UNIT- II Different methods for prevention of diseases, use of medicinal plants in rural areas.

UNIT- III Simple physical and breathing exercise, Acupressure, yoga and other techniques based on traditional knowledge and wisdom for sound health and sound mind.

UNIT- IV WHO's approach to deal with Rural Health and Sanitation, Personal hygiene and environmental hygiene, Sanitation programme and implementation, Appropriate treatment against serious acute ailment such as diarrhoea, dehydration, and health care for the vulnerable groups.

UNIT- V Local health traditions, primary health care, medicinal plant garden for conservation and utilization of medicinal plants; Scientific documentation of traditional and indigenous knowledge related to plants used for healthcare.

DRT- 603- Science, Technology and Society Interactions

UNIT–I Concept of Science: Nature of scientific knowledge. Scientific method, demarcation between science and non science, Scientific temper vs. humanistic temper.

UNIT–II Science, Technology and Culture; Science and Politics, Public Understanding of Science, Science and Religion, Science and Ethics

UNIT–III Technology – Society Interface: Techno science, Social Construction of Technology, .Gender and Technology, Innovation and its impact in the society

UNIT–IV Development of Science in India: Pre-colonial Science; Colonial science; Science in Post Independent India; Origin and growth of scientific institutions and societies in India; Evolution of S&T Policy.

UNIT–V Innovation and Intellectual Property Rights: Pre-IPR system of protection- Secrecy/Trade guilds/Cartels; Basic forms of IPRs- Patent, copyright, trademark, 0industrial design; TRIPS, IPR in India; Traditional knowledge, IPR and Benefit sharing, Indigenous knowledge and its appropriation IPR & Traditional Medicine, Private vis-à-vis community based ownership, Bio piracy, Breeders vis à-vis Farmers rights.

DRT 604- Design and Innovation in Integrated Rural Health Management

UNIT-I Safe Drinking water, Concept and need, Rural Technology to get safe drinking water, Different schemes and programmes.

UNIT-II Women health in Rural India; factors, Sex ratio. Health neglect and its changing scenario in the context of government programme. Mortality and morbidity factors, influencing nutrition and health.

UNIT-III Government Health insurance schemes, bank insurance, smart card for BPL families. Various schemes for family, including free vasectomy, single girl child reward, etc.

UNIT-IV Community Health centre schemes and government hospital schemes for poor.

UNIT-V Corporate Social Responsibility: Evidences and The practice of CSR in the context of rural development in India.

DRT 635- Practical of DRT)- 601 and DRT- 602

Health: Practice of physical and breathing exercise, acupressure and yoga. Identification and use of some commonly available medicinal plants. First aid techniques for common injuries and

accidents. Visit to a community health centre, primary health centre and sub centre. Preparation of ORS. A field work survey for health care

DRT- 636- Practical of DRT- 603 and DRT- 604

Human Nutrition and Nutrition Education. Preparation of a balanced and nutritional value chart for commonly available fruits and vegetables Safe Drinking water: Preparation of water filter using locally available materials, Use of lime, alum etc. to purify water. Sanitation: Construction of soak pit, garbage pit, Visit and study of different components of low cost latrines and its construction, Preparation of posters and leaflets for awareness programme. Reporting and recommendation of various human diseases in Rural Area.

SEMESTER- IV Syllabus

DRT- 605- Economic status of Rural India

UNIT- I Unemployment and Underemployment in Rural Areas- Problems, Causes.

UNIT- II Poverty- Causes of Rural Poverty, Poverty alleviation programmes in India- Success and Failure analysis. Poverty alleviation through Micro Finance

UNIT- III Empowerment of Rural Women through Self Help Groups. Commercial Banks, Cooperative Banks, NABARD, Rural Insurance.

UNIT- IV Component and classification of rural markets, Rural credit Institutions, Problems in Rural marketing, rural demand. Finace schemes related to economics, Rural Credit – Sources of Credit, Institutional and Non- Instititutional, Institutional Credit for Rural Development in India.

UNIT- V Civil Society and NGO Management, Understanding Civil Societies, Role of Civil Societies, Administrative and financial structure of NGOs, Guideline for NGO Management, NGOs as Society, NGOs as non-profit company, NGOs as Trust.

DRT 606-IT in Rural Development **Credits: 3**

UNIT-I Elementary knowledge about computer hardware and software, operating system, MS-Office.

UNIT-II Data analysis and appropriate software, Different graph type, operating SPSS

UNIT-III Numerical methods of Data Presentation: Mean, Median, Mode, Standard deviation, Correlation, Correlation, Regression, Chi Square Test.

UNIT-IV Audio-Visual Aids: Materials and Equipment-Planning Preparation and use of different types of audio-visual aids-Projectors Films-Tape recorder Television.

UNIT-V Introduction of GIS and its components-spatial data organization and management, Remote sensing and its application in rural development.

DRT 607: Dissertation / Thesis / Prototype development

The topic would be decided by the candidate in consultation with the respective supervisor. Dissertation / thesis will be based on existing branches of botany and the title will be decided keeping the view on the modern aspect in the related discipline. It will be the part of semester IV; however, the title of dissertation / thesis will be assigned by concerned faculty member/board in the beginning of semester III to provide sufficient time to complete dissertation / thesis.

DRT- 637- Practical of DRT- 605 and DRT- 606

To identify the causes of rural unemployment through survey in villages. Measurement of farm holdings with special reference to land situation and study of land ownership pattern. To study a functional SHG(Self Help Group) to understand method and procedure, record-keeping, linkages and income generating activities. Study of a village market to analyze the marketing chain and its functioning.

Elective Papers- (There shall be four elective papers, and student has to opt only one)

DRT 651: Innovation in Rural Entrepreneurship **Credits: 3**

UNIT I: Entrepreneurship: Concept, knowledge and skills requirement; characteristic of successful entrepreneurs; role of entrepreneurship in economic development; entrepreneurship process; factors impacting emergence of entrepreneurship; managerial vs. entrepreneurial approach and emergence of entrepreneurship

UNIT II: Starting the venture: generating business idea – sources of new ideas, methods of generating ideas, creative problem solving, opportunity recognition; feasibility study – market feasibility, technical/operational feasibility, financial feasibility; drawing business plan; preparing project report; presenting business plan to investors, STARTUP, SEED, PMKVY, TREAD, STEP, ATAL INNOVATION MISSION, MAKE IN INDIA.

UNIT III: Functional plans: marketing plan – marketing research for the new venture, steps in preparing marketing plan, organizational plan – form of ownership, designing organization structure, job design, manpower planning; Financial plan – cash budget, working capital, Performa income statement Performa cash, perform balance sheet, break even analysis.

UNIT IV: Sources of finance: debt or equity financing, commercial banks, venture capital; financial institutions supporting entrepreneurs; Intellectual Property Rights.

UNIT V: Rural Entrepreneurship: need for rural entrepreneurship, problems of rural entrepreneurship, NGOs and rural entrepreneurship, Training and Development of rural Entrepreneurs

DRT-652: Rural Health Management **Credits: 3**

UNIT I: Health Education, health planning & management, school health, health economics Information System, hospital waste management, Disaster management.

UNIT II: Health Status of Women in Rural Area; Nutritional Anaemia; Child Development: Status, education, health, Governmental Programmes for children development.

UNIT III: Epidemiology: Definition & aims Epidemiological approach. Basic measurement in Epidemiology, Types of Epidemiological studies.

UNIT IV: Infectious disease, Investigation of an epidemic of Leptospirosis, Malaria, Dengue in Rural set Up & in post disaster situations, Health advice to travelers, Screening for diseases

UNIT V: Prevention of accidents, investigation of public health problems as relevant to basic sciences for a health officer, First aid.

DRT-653-Innovative Commercial production technologies **Credits: 3**

Unit-I Commercial production technologies-nature, concept, applications and recent technical advancement.

Unit-II **Mushroom Cultivation**: Morphology and life-cycle, Importance of mushroom as a health food, a cash crop and eco- friendly commodity, Wild and cultivated mushroom, Edible and poisonous types, Tropical and temperate species, Mushroom spawns, media and substrate for different species.

Unit-III **Biofertilizers**: Bacterial, algal and fugal, Production technology and post-harvest handling of fresh and processed products and their marketing.

Unit-IV **Vermicomposting**: Principles and functions of Vermicomposting, Biological mechanism of Vermicomposting, large- scale and small- scale production of vermicomposts.

Unit-V **Biopesticides and Biosupplements**; herbal soaps, fumigants and hygienic products

DRT 654-IT in Rural Development **Credits: 3**

UNIT-I Elementary knowledge about computer hardware and software, operating system, MS-Office.

UNIT-II Data analysis and appropriate software, Different graph type, operating SPSS

UNIT-III Numerical methods of Data Presentation: Mean, Median, Mode, Standard deviation, Correlation, Correlation, Regression, Chi Square Test.

UNIT-IV Audio-Visual Aids: Materials and Equipment-Planning Preparation and use of different types of audio-visual aids-Projectors Films-Tape recorder Television.

UNIT-V Introduction of GIS and its components-spatial data organization and management, Remote sensing and its application in rural development.

Regulations, Course Structure & Syllabus

of

5-year Integrated UG and PG Food Technology Programme

Centre of Food Technology
Institute of Professional Studies
University of Allahabad

Objectives of the Programme

- To impart knowledge of various areas related to Food Science and Technology.
- To familiarize the students about the processing and preservation techniques of pulses, oilseeds, spices, fruits and vegetables, meat, fish, poultry, milk, & milk products.
- To emphasize the importance of food safety, food quality, food plant sanitization, food laws and regulations, food engineering and packaging in food industry.
- To inculcate ability to develop new food products and establish owns enterprise.

Regulations for 5-year Integrated UG and PG*Food TechnologyProgrammeEligibility for admission:

S.No.	Eligibility	Entry Point	Exit Point after successful completion	Degree offered
1.	A candidate must have passed 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture having scored not less than 50% marks (45% for SC&ST candidates) in aggregate.	First Semester	Second Semester / One year	***Certificate (Food Technology)***
		-	Fourth semester / Two year	***Diploma (Food Technology)***
		-	Sixth semester / Three year	***UG(Food Technology)***
		-	Eight Semester/ Four year	***UG (Food Technology) 'With Research'***
		-	Tenth Semester/ Five year	**5-year Integrated UG and PG Food Technology Programme**

**Presently B.Sc. and M.Sc.*

I. Duration of Programme:

(i) The UG programme shall extend over a period of 8 consecutive semesters spread over 4 academic years – two semesters constituting one academic year with multiple exit points outlined in S. No. I and 5-year Integrated UG and PG Food Technology Programme shall extend over a period of 10 consecutive semesters spread over 5 academic years. The duration of each semester shall normally be 15 weeks excluding examinations.

II. No. of Seats

5-year Integrated UG and PG Food Technology: **50**
(University reservation policy will be implemented for admission)

III. Fees:

The fees (per semester) in 5-yearIntegrated UG and PG Food Technology Programme is as follows:

S. No.	Semester	Amount (Rs.)
1	Semester I	30,000/- + 5000/-(caution money Refundable as per rule) = 35,000/-
2.	Semester II	30,000/-
3	Semester III	30,000/-
.4.	Semester IV	30,000/-
5.	Semester V	30,000/-
6.	Semester VI	30,000/-
7.	Semester VII	35,000/-
8.	Semester VIII	35,000/-
9.	Semester IX	35,000/-
10.	Semester X	35,000/-

IV. Examination and Assessment, Scheme of examination, Revision of Regulations and Curriculum will be as per "*University of Allahabad Regulations for Choice Based Credit System (CBCS) on the academic programmes in the University(Framed under Clauses 1(a)(i) and 3(a)(x) of Ordinance LX: The Organization and Conduct of Examinations.)" vide letter no. CoE/456/2016 dated 23/8/2016.*

Types of Courses

- **Core Course (CC):** A course which should compulsorily be studied by a candidate as a core requirement is termed as a Core Course.
- **Elective / Minor Course:** Generally, a course which can be chosen from a pool of courses which may be very specific, specialized or advanced or supportive to the discipline / subject of study which provides the extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called and Elective Course.
- **Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University /Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
- **Generic Elective (GE) Course:** An elective course chosen generally from an unrelated discipline/ subject, with an intention to seek exposure is called a Generic Elective.
- **Ability Enhancement Course (AEC)/Foundation Course:** An elective course offered as a part of foundation course aiming in building the basic skills and abilities to increase the proficiency of the candidate is called Ability Enhancement Course.
- **Skill Enhancement Course (SEC):** An course chosen from specific courses related to the subject expertise of the programme to develop expertise and skills in the concerned field is called as Skill Enhancement Course.
- **Dissertation/ Thesis/Project:** An elective course design to acquire special/advanced knowledge such as supplement study/support study through a project work and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called Dissertation/Thesis/Project.

Revised Course Structure
5-year Integrated UG and PG Food Technology Programme

Sem I	Title	Credits	Course Type	Exit Qualification
FFT 131	Fundamentals of Food Processing	2-0-1-3	Core Course (CC)	
FFT 132	Concepts of Food Science	3-0-1-4	Core Course (CC)	
FFT 133	Basic Food Chemistry-I	3-0-1-4	Core Course (CC)	
FFT 105	General Bioscience	2-0-0-2	Generic Elective (GE)	
FFT 106	Conversation and Documentation Skills	2-0-1-3	Ability Enhancement Course (AEC)/Foundation course	
FFT 107	Concepts of Laboratory Techniques	0-0-2-2	Skill Enhancement Course (SEC)	
Total		**18**		**Certificate(Food Technology)**
Sem II	**Title**	**Credits**	**Course Type**	
FFT 134	Introduction to Food Hygiene and Sanitation	2-0-1-3	Core Course (CC)	
FFT 135	Principles of Food Microbiology	2-0-1-3	Core Course (CC)	
FFT 136	Food Packaging	2-0-1-3	Core Course (CC)	
FFT 137	Fruits and Vegetable Processing	2-0-1-3	Skill Enhancement Course (SEC)	
FFT 108	Environmental Studies*	3-0-0-3	Foundation / Ability Enhancement Course (AEC)	
FFT 104	Introduction to Computer Application*	2-0-1-3	Foundation / Ability Enhancement Course (AEC)	
Total		**18**		
Grand Total		**36**		
Sem III	**Title**	**Credits**	**Course Type**	**Exit Qualification**
FFT 231	Basic Food Chemistry-II	2-0-1-3	Core Course (CC)	
FFT 232	Food Quality and Analysis	3-0-1-4	Core Course (CC)	
FFT 233	Food Processing Operations	3-0-0-3	Core Course (CC)	
FFT 234	Technology of Cereals, Pulses and Oilseed	3-0-1-4	Core Course (CC)	
FFT 208	Disaster and Risk Management	2-0-0-2	Generic Elective (GE)	
ELECTIVE-I (Any Two)				
FFT 255	Bakery and Confectionery Products Technology	2-0-1-3	Discipline Specific Elective (DSE)	
FFT 256	Beverage Technology		Discipline Specific Elective (DSE)	
FFT 257	**Basics of Nutrition**	**3-0-0-3**	**Discipline Specific Elective (DSE)**	
Total		**22**		**Diploma (Food Technology)**
Sem IV	**Title**	**Credits**	**Course Type**	
FFT 235	Meat, Fish and Poultry	2-0-1-3	Core Course (CC)	
FFT 236	Dairy Science	3-0-1-4	Core Course (CC)	
FFT 237	Food Quality Management and Quality Assurance	3-0-1-4	Skill Enhancement Course (SEC)	
FFT 209	Data Analysis	1-1-0-2	Generic Elective (GE)	
FFT 210	Technical Writing*	1-0-0-1	Foundation / Ability Enhancement Course (AEC)	
FFT 280	Industrial Training for 15-30 days	0-0-2-2	Skill Enhancement Course (SEC)	
FFT 258	**Crop Production**	**2-0-02**	**Generic Course**	
	Total	**19**		
Grand Total		**77**		

Sem V	Title	Credits	Course Type	Exit Qualification
FFT 331	Fundamentals of Food Engineering	3-0-1-4	Core Course (CC)	**Three Year UG Degree (Food Technology)**
FFT 332	Biochemistry and Human Nutrition	3-0-0-3	Core Course (CC)	
FFT 333	Concepts of Biotechnology	2-0-1-3	Generic Elective (GE)	
FFT 334	Waste Management Practices	2-0-0-2	Generic Elective (GE)	
FFT 380	Seminar	0-0-1-1	Skill Enhancement Course (SEC)	
ELECTIVE-II (*Any Two)*				
FFT 353	Technology of Indigenous milk Products	2-0-1-3	Discipline Specific Elective (DSE)	
FFT 356	Food Fermentation Technology		Discipline Specific Elective (DSE)	
FFT 357	**Nutraceuticals and Functional Foods**	**3-0-03**	**Discipline Specific Elective (DSE)**	
	Total	**19**		
Sem VI	**Title**	**Credits**	**Course Type**	
FFT 335	Food and Agribusiness Management	2-0-0-2	Skill Enhancement Course (SEC)	
FFT 336	Plant Design and Layout	2-0-0-2	Skill Enhancement Course (SEC)	
FFT 385	Industrial Project (10 weeks which may extend during summer vacation)	0-0-10-10	Core Course (CC)	
FFT 358	**Medicinal Plants**	**2-0-0-2**	**Generic Course (SEC)**	
	Total	**16**		
Grand Total		**109**		

Sem VII	Title	Credits	Course Type	Exit Qualification
FFT 504	Research Methodology and Statistics	3-1-0-4	Generic Elective (GE)	**Four year UG Degree (Food Technology) 'With Research'**
FFT 555	**Food Additives**	**2-0-0-2**	**Discipline Specific Elective (DSE)**	
FFT 390	Thesis	0-0-10-10	Discipline Specific Elective (DSE)	
	Total	**16**		
Sem VIII	**Title**	**Credits**	**Course Type**	
FFT 390	Thesis	0-0-20-20	Discipline Specific Elective (DSE)	
Grand Total		**147**		

Sem IX	Title	Credits	Course Type	
FFT 503	Instrumentation and Analytical Techniques	3-0-1-4	Core Course (CC)	
FFT 557	Spices and Flavour Technology	3-0-0-3	Skill Enhancement Course (SEC)	
FFT 509	Food Quality, Safety Standards and Certification	3-0-0-3	Core Course (CC)	
ELECTIVE-Any Four				
FFT 651	Entrepreneurship in Food Processing	2-0-0-2	Discipline Specific Elective (DSE)	
FFT 653	Food Rheology		Discipline Specific Elective (DSE)	
FFT 654	Food Product Development		Discipline Specific Elective (DSE)	
FFT 658	Food By-product management		Discipline Specific Elective (DSE)	
FFT 659	Advanced Food Chemistry		Discipline Specific Elective (DSE)	
FFT 553	**Speciality Foods**		Discipline Specific Elective (DSE)	
	Total	**18**		
Sem X				
FFT 507	Packaging of Food Materials	3-0-0-3	Core Course (CC)	
FFT 508	Food Engineering	3-1-0-4	Core Course (CC)	
FFT 510	Advanced Food Microbiology	3-0-1-4	Core Course (CC)	
Elective- Any Two				
FFT 660	**Processing of Fruits and Vegetables**	**1-0-1-2**	Discipline Specific Elective (DSE)	
FFT 552	Intellectual Property Rights	2-0-0-2	Discipline Specific Elective (SEC)	
FFT 554	Fundamentals of Nutrition		Discipline Specific Elective (SEC)	
FFT 652	Food Fermentation and Microbial Technology		Discipline Specific Elective (SEC)	
FFT 641	Seminar	0-0-1-1	Skill Enhancement Course (SEC)	
	Total	**16**		
	Grand Total	**181**		

5-year Integrated UG&PG Food Technology Programme

CC: Core Course, AEC: Ability enhancement Course/ Foundation course, SEC: Skill Enhancement Course, GE: Generic Elective, DSE: Discipline Specific Elective, Elective / Minor courses to be opted from other dept. relevant to research work

SEMESTER-I

Core Course FFT 131 :Fundamentals of Food Processing

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective: To acquaint with principles of different techniques used in processing and preservation of foods.

Course Content

UNIT I 5 lectures

Introduction: Definition and scope of Food Science and Technology, Sources of food, scope and benefit of industrial food preservation, perishable, non perishable food, causes of food spoilage.

UNIT II 10 lectures

Thermal processing methods of preservation: Principle: Canning, blanching, pasteurization, sterilization, evaporation.

Use of low temperature: Principle and effect on quality. Chilling, cold storage, freezing.

Preservation by drying dehydration and concentration: Principle, Methods and effect on quality.

Preservation by radiation: Definition, Methods of Irradiation, Direct & Indirect effect, measurement of radiation dose, dose distribution, effect on microorganisms.

UNIT III 5 lectures

Presentation of foods by Preservatives: chemicals, antioxidants, mold inhibiters, antibodies, acidulates etc.

Preservation by salt & sugar: Principle, Method and effect on food quality.

UNIT IV 5 lectures

Preservation by fermentation: Definition, Advantages, disadvantages.

UNIT V 5 lectures

Recent methods in preservation: Pulsed electric field processing, High pressure processing, processing using ultrasound, dielectric, ohmic and infrared heating.

Practical

- Introduction to food laboratory.
- To study the effect of enzymatic browning in fruits and vegetables.
- To study different types of blanching of fruits and vegetables.
- Preservation of food by canning.
- To perform cut out analysis of caned product.
- Preservation of food by high concentration of sugar i.e. jam.
- Preservation of food by high concentration of salt/acid i.e. pickle.
- Preservation of food by addition of chemicals i.e. tomato ketchup.
- Preservation of food by drying in a cabinet drier.
- Preservation of fruits & vegetables by freezing.
- Preservation of milk by pasteurization and sterilization.

Reference Books:

- Food Processing Technology by P.J.Fellows, Woodhead publishing ltd.
- Food Science by N.N. Potter, CBS publishing.
- Physical principles of Food Preservation. Vol. II by M. Karel, O.R. Fenema and D.B. Lurd,Maroel, Dekker Inc. New York.
- The technology of food preservation by N.W.Desrosier and J.N. Desrosier, CBS publishing.

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Core Course FFT 132: Concepts of Food Science

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective: To impart knowledge of various areas related to Food science and technology.

Course Content

UNIT I 14 lectures

Introduction to Food Science*:* Historical development of food science and technology, Evolution of Food Processing from prehistoric times till date, Introduction to various branches of Food Science and Technology

Cereals and Millets: Wheat- structure and composition, types (hard, soft/ strong, weak). Process of malting, Gelatinization of starch, types of browning. Rice- Composition of rice obtained by different dehusking methods, parboiling of rice- advantages and disadvantages. Millets -Varieties, composition and uses of maize, sorghum, barley, rye, oats, triticale, pearl millet and finger millet.

Pulses: Introduction, common names and scientific names of different pulses. Chemical composition of pulses, processing of pulses- soaking, germination, decortications, cooking and fermentation. Toxic constituents in pulses and its detoxification processes.

UNIT II 6 lectures

Fats and Oils: Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids. Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, and hydrogenation. Rancidity - hydrolytic and oxidative rancidity and its prevention. Definition margarine, butter, hydrogenated vegetable oil, lard.

UNIT III 8 lectures

Fruits and Vegetables: Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments. Post harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes during the storage of fruits and vegetables.

UNIT IV 12 lectures

Flesh Foods - Meat, Fish, Poultry: Meat - Definition of carcass, composition of meat, concept of red meat and white meat. Fish - Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish, spoilage of fish. Poultry - Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality.

Milk and Milk Products: Definition of milk, typical chemical composition of milk of different species i.e. buffalo, cow, goat. Composition of milk, its constituents, various steps in processing of milk. An overview of types of market milk and milk products-cheese, paneer, ice cream, ghee, butter, flavoured milk, imitation milk.

Condiments and spices: Composition and importance of spices.

UNIT V 5 lectures

Sensory evaluation of food: Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duo-trio test, triangle test, hedonic scale, chemical dimension of basic tastes.

Practical

- To study the gelatinization temperature range and % sag of various cereal starches.
- To study the factors affecting gelatinization of cereal starches.
- To study germination of whole pulses and legumes.
- To study fermentation in cereals and pulses.
- To study non-enzymatic browning; caramelization in various sugars.
- To detect the adulteration in fats and oils by qualitative tests.
- To detect the presence of adulterants in milk.
- To perform the recognition test for the four basic tastes.
- To perform the sensitivity / threshold tests for four basic tastes.
- To recognize few odors and to learn to memorize them.

Reference Books:

- Food Science by B. Srilakshmi, publishing, New Age International (P) ltd. publications.
- Food Science by N.N. Potter, CBS publishing.
- Food Science by S. Manay, New Age International (P) ltd. publications.

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Core Course FFT 133 : Basic Food Chemistry-I

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective:

• To understand the chemistry of foods - composition of food, role of each component and their interaction.
• To understand the functional aspects of food components and to study their role in food processing.

Course Content

UNIT I 8 lectures

Introduction to Food Chemistry: Definition, Composition of food, Water: Definition of water in food, Structure of water and ice, Types of water, Sorption phenomenon, Water activity and packaging, Water activity and shelf-life

UNIT II 10 lectures

Lipids: Classification of lipids, Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point; Chemical properties-reichertmeissel value, polenske value, iodinevalue, peroxide value, saponification value; Effect of frying on fats; Changes in fats and oils- rancidity, lipolysis, flavor reversion, Auto-oxidation and its prevention; Technology of edible fats and oils- Refining, Hydrogenation and Interesterification, Fat Mimetics

UNIT III 10 lectures

Proteins: Protein classification and structure; Nature of food proteins(plant and animal proteins); Properties of proteins (electrophoresis, sedimentation, amphoterism and denaturation); Functional properties of proteins eg. organoleptic, solubility, viscosity,binding; gelation / texturization, emulsification, foaming.

UNIT IV 9 lectures

Carbohydrates: Classification(mono, oligo and poly saccharides); Structure of important polysaccharides(starch, glycogen, cellulose, pectin,hemicellulose, gums); Chemical reactions of carbohydrates –oxidation, reduction , with acid &alkali; Modified celluloses and starches

UNIT V 8 lectures

Vitamins: Structure, Importance and Stability; Water soluble vitamins; Fat soluble vitamins
Flavour: Definition and basic tastes; Chemical structure and taste; Description of food flavours; Flavour enhancers

Practicals:

- Preparation of primary and secondary solutions
- Estimation of moisture content
- Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR.
- Determination of refractive index and specific gravity of fats and oils.
- Determination of smoke point and percent fat absorption for different fat and oils.
- Determination of percent free fatty acids
- Estimation of saponification value
- Estimation of reducing and non-reducing sugars using potassium ferricyanide method.

Reference Books:

- Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York,1996
- Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada,2002
- Wong, Dominic WS, Food Enzymes, Chapman and Hall, New York, 1995
- Potter,N.N.andHotchkiss,J.H, Food Science, 5th Ed., Chapman & Hall,1995
- DeMan, J.M., Principles of Food Chemistry, AVI, NewYork, 1980

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Generic Elective Course FFT 105: General Bioscience

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective: Fundamentals of Bioscience is based on the structural organisation of the human body and the general functions of the body systems, emphasizing the relationship between structure and function.

Course Content:

UNIT I 3 lectures
Level of organization in life (water to protein).

UNIT II 5 lectures
Cytology - cell composition, structure and function.

UNIT III 9 lectures
Animal systems and plant physiology with introductory food biochemistry.
Plant and animal taxonomy - With reference to edible groups and their identification.
Domestication, improvement and disease control of animal and plants species.

UNIT IV 7 lectures
Economic biology - Cereals, pulses, fruits, Vegetables, Beverages, Meat, Dairy, Piggery, aquaculture, and other edible animal and plant product.
Introduction of Ecology and environment of edible species of plant and animals.

UNIT V 6 lectures
Brief introduction of genetics and evolution of Taxa with human interaction.
Plant and animal breeding, genetic engineering and GM Food (a brief introduction).

Reference Books:

- Biosciences by Taylor, Cambridge University Press.
- Biology by Storer, Viva publishing.

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Ability Enhancement Course FFT 106: Conversation and Documentation Skills
Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: Basic knowledge of English

Objective: To equip the students with skills to write to communicate and articulate in English (verbal as well as writing) and to acquaint the students with the knowledge and use of computers and to introduce the basic principles, organization and operational aspects of computers.

Course Content

UNIT I 6 lectures
Introduction to Communication & Grammar : Consonant & Vowel Sounds, Indianism, Syllable & Syllable Stress, Determiners, Articles, Tense & Time, Preposition, Prepositional Phrases, Subject-Verb Agreement, Active – Passive Voice, Intonation & Modulation, Conjunctions

UNIT II 7 lectures
Formal Writing Skills: Composition Writing: Business Letters (Functions of a Business Letter, Layout of a Business Letter, Salient Features of a Business Letter, Kinds of Business Letter, Application Writing)

UNIT III 5 lectures
Conversation Skills: Nature of Conversation, Purpose of Conversation, Guidelines for Effective Conversation Skills, Proverbs used in Everyday Conversation with their Meanings/Explanations

UNIT IV 5 lectures
Documentation Skills: Introduction to Documentation: Meaning, Purpose, Need.

UNIT V 7 lectures
A short introduction to Computers, digitalized era, global connection via net, Drafting of Text, Excel, E Mails, Making Presentations, MS Word

Practical

Communication Skills

- Verbal &Non Verbal Communication
  Verbal Communication - Extempore, Just a Minute, Declamation, Dialogue, Monologue
  Non verbal Communication - Guess the Mime, Dumb Charades, Formal & Informal Writing, Facial Expressions, Dressing & Clothing

- Oral Communication - Day to today talk, formal talk, informal talk, conversation
- Body Language
  Right body postures, Eye Contact, Pet Fiddles, how to walk, talk and present oneself.
- Group Discussion Skills (Meaning, Characteristic, Do's & Don'ts, Relevance, Moderating a group Discussion
- Presentation Skills - Confidence, Effective Delivery of ideas, Convincing the audience, basic courtesies
- Public Speaking - Oration, Debates
- English Movie Sessions

Documentation Skills

- Basics of Computers, usage of short cut keys, taking out print outs, page set ups.
- Making of Power point Presentation
- E- Mail (Subject line, salutation, subscription, how to mark cc, drafting, sending of mails, reverts, forwarding of mails, attaching pictures and documents, attaching ppts
- Differentiation between hardware and software and practical usage of both.
- Diagrammatic representation of pie-charts, tabular presentation of data/info, Etc
- Basic use of MS Excel/Spread Sheets

Reference Books:

- High School English Grammar and Composition - Wren & Martin, Publisher - Churchill Livingstone
- Anthology of English Language and Communication Skills - Sharma S R, Jacob, Mark Publications
- Language and Communication Skills - Shastri, Rameshchandra, ABD Publications
- A Course in Academic Writing - Renu Gupta, Orient Blackswan Publications.

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SkillEnhancement Course FFT 107: Concepts of Laboratory Techniques

Credits: (0-0-2-2)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective: To acquaint the students with handling and analyzing the high end equipment and to learn the concept and principles of food analysis equipment.

Course Content

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware

Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution, Handling techniques of solutions; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values.

Preparation of different agro-chemical doses in field and pot applications

Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability

Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

General Laboratory Safety: Preparing for laboratory work, during laboratory work and cleaning up before leaving, General Characteristics & procedure for handling & storage of hazardous materials and control of hazards.

Reference Books

- Furr A.K. 2000. CRC Hand Book of Laboratory Safety. CRC Press.
- Gabb M.H.&Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

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SEMESTER-II

Core Course: FFT 134: Introduction to Food Hygiene and Sanitation

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective:

The knowledge and skills required to produce healthy meals for the family with regard to safety, effective organisation and management of family resources, and the needs and lifestyles of family members

Course Content

UNIT I 2 lectures

Principles of hygiene and its relation to food preparation.

UNIT II 8 lectures

General hygienic and sanitary practices to be followed by different food business operators - fruits and vegetable, milk and milk product, meat and meat product, catering etc.

UNIT III 10 lectures

General hygienic and sanitary requirements for different areas - location and surroundings, layout and design of food establishment premises, equipment & containers, facilities, food operations and controls, management and supervision, food testing facilities, audit, documentation and records, sanitation and maintenance of establishment premises, personal hygiene, product information and consumer awareness, training.

UNIT IV 5 lectures

Water quality - water standards and analysis of physical, chemical and microbiological characteristics of water.

UNIT V 5 lectures

Waste treatment - fundamentals of physical, biological & chemical waste treatments.

Practical

- Analysis of water used in food industries
  - Determination of acidity of the given sample of water.
  - Determination of alkalinity of the given sample of water.
  - Determination of the total hardness of Water.
  - Determination of pH of the given sample of Water.
  - Determination of Conductivity of the given sample of Water.
  - Determination of Total Solids of the given sample of Water.
  - Determination of Total Dissolved Solids of the given sample of Water.
  - Determination of Turbidity of the given sample of Water.
- Assessment of surface sterilization using swab and rinse method.
- Case Study of food hygiene and sanitation (GMP/GHP) of a food industry.
- Preparation of HACCP Plan

Reference Books:

- Food plant sanitation – Packer and Litchfield (Reinhold Publ.)
- Handbook of analysis and quality control for fruits and vegetables products by S. Ranganna, Mcgraw Hill Pub. Co. New York.

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Core Course FFT 135:Principles of Food Microbiology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food.

Course Content

UNIT I 5 lectures

Introduction of microbiology, History and significance of food microbiology.

Classification of microbes, Structure of microbes, Metabolism of microbes.

UNIT II 5 lectures

Environmental microbiology: microbiology of air and water.

UNIT III 5 lectures

Food contamination and public health: food poisoning

UNIT IV 10 lectures

Food microbiology and spoilage of fruits and vegetables, milk and milk products, cereals and cereal products.

Industrial microbiology: Industrial application of microbes.

UNIT V 5 lectures

Thermal inactivation of microbes: pasteurization, sterilization etc. concept of TDT, F, Z and D values. Factors affecting heat resistance.

Antimicrobial agents: mechanism and action

Practical

- An introduction to microbiology, aseptic technique and safety.
- Preparation of culture media.
- To sterilize the media and equipment.
- To prepare serial dilutions.
- Plating techniques
- Culturing the bacteria on a solid media by using serial dilution method and determining the number of viable cells in the culture (standard plate count).
- Introduction to microscopy and to study cell morphology with simple staining.
- To study cell morphology and cell arrangement with negative stain.
- To stain bacteria with gram stain.
- To stain bacterial cells by wet-mount technique to check the mobility (flagellin) in bacterial cell.
- To stain bacterial cells with malachite green stain to check the presence of endospore.

Reference Books:

- Food microbiology by V. Ramesh, MJP publishing.
- Food microbiology by W.C. Frazier, Ist Edition by Mcgraw Hill Pub. Co. New York.
- Modern Food Microbiology, J.M. Jay. CBS publisher.

Core Course FFT 136: Food Packaging

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: A basic course on food processing

Objective: To acquaint the students with packaging methods, packaging materials, packaging machineries, modern packaging techniques etc.

Course Content

UNIT I 7 lectures

Packaging–Concepts, definition, Significance, classification. Deteriorative changes in food and packaging methods for prevention.

UNIT II 7 lectures

Primary packaging media – Properties and application of Paper, paper boards, metals, plastics, glass. Food containers-rigid containers and flexible packaging materials. Application of different packaging materials in food industry. eg. bags, pouches, wrappers, cartons etc.

UNIT III 8 lectures

Factors determining the packaging requirements of various foods, Packaging of perishable and processed foods.

UNIT IV 8 lectures

Advancements in packaging: Biodegradable packaging, Edible packaging, Active packaging, Modified atmosphere packaging, Vacuum packaging, Aseptic packaging

Practical

- Familiarization of different types of packaging materials.
- To perform vacuum packaging of food sample and carry out its storage study.
- To perform modified atmospheric packaging of food sample and carry out its storage study.
- Cut out analysis of canned food
- Determination of wax absorptiveness of paper

Reference Books

- Robertson, G.L. "Food Packaging: Principles and Practice". 2nd Edition. Taylor & Francis, 2006.
- Ahvenainen, Raija. "Novel Food Packaging Techniques". Wood Head Publishing, 2003.
- Mathlouthi, M. "Food packaging and Preservation". Aspen Publications, 1999.
- Paine, F.A. and Paine, H.Y. 1983. A Handbook of Food Packaging. Leonard Hill, Glasgow, UK.

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Core Course FFT 137: Fruits and Vegetable Processing

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course on Food Science

Objective

To acquaint with the proper handling technologies of fruits and vegetables to reduce post harvest losses and acquaint with principles and methods of preservation of fruits and vegetables into various products.

Course Content

UNIT I 2 lectures

Pre-packaging of fresh fruits and vegetables. Storage techniques for fresh fruits and vegetables.

UNIT II 6 lectures

Primary processing: grading, sorting, cleaning, washing, peeling, slicing and blanching

UNIT III 6 lectures

Dehydration of fruits and vegetables using various drying technologies like sun drying, solar drying, osmotic, tunnel drying, fluidized fed drying, freeze drying.

UNIT IV 8 lectures

Processing of juices: Processing of vegetable juice, Processing of fruit juice

Manufacturing of fruit juices concentrates, puree and pastes, Preparation of jam, jellies and marmalades.

UNIT V 8 lectures

Preparation of preserve and candied fruits, Pickling of fruits and vegetables,Waste management in fruits and vegetable processing units

Practical

- Determination of ascorbic acid, acidity, total soluble soild.
- Evaluation of pectin content.
- Preparation and quality evaluation of fruit jam, fruit jelly, fruit marmalade; squash
- Processing of tomato products; Ketchup
- Preparation of dehydrated vegetables.
- Determination of chemical preservatives- benzoic acid, KMS
- Visit to commercial storage, and canning unit.

Reference Books

- Lal G, Siddapa GS &Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.
- Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.

- Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.
- Verma LR. & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

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Ability Enhancement Course FFT 108:Environmental Studies

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the natural resources and the ecosystem, and ecology.

Course Content

UNIT I 5 lectures

The Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance.

Natural Resources: Renewable and Non-Renewable Resources, Natural Resources and Associated Problems, Renewable Resources

UNIT II 15 lectures

Ecosystems: Concept of an Ecosystem, Structure and Functions of an Ecosystem, Energy Flow in the Ecosystem: The Water Cycle, The Carbon Cycle, The Oxygen Cycle, The Nitrogen Cycle, The Phosphorus Cycle, The Sulphur Cycle, The Energy Flow, Integration of Cycles in Nature, Food Chains, Food Webs and Ecological Pyramids, Introduction, Types, Characteristic Features, Structure and Functions.

UNIT III 3 lectures

Biodiversity: Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation, Conservation of Biodiversity: In Situ and Ex Situ.

UNIT IV 15 lectures

Pollution: Definition, Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards, Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Waste, Pollution Case Studies, Social Issues and the Environment From Unsustainable to Sustainable Development, Urban Problems Related to Energy, Water Conservation, Rainwater Harvesting, Watershed Management, Consumerism and Waster Products

Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents an Holocaust.

UNIT V 7 lectures

The Environmental (Protection) Act- The Air (Prevention and Control of Pollution) Act, TheWater(Preventionand Control of Pollution) Act

Value Education: Environmental Values, Valuing Nature, Valuing Cultures, Social Justice, Human Heritage, Equitable Use of Resources, Common Property Resources, Ecological Degradation.

Reference Books

- Kumarasamy, K., A.Alagappa Moses And M.Vasanthy, 2004. Environmental Studies, Bharathidsan University Pub, 1, Trichy
- Rajamannar, 2004, Environmental Studies, Evr College Pub, Trichy
- Kalavathy,S. (Ed.) 2004, Environmental Studies, Bishop Heber College Pub., Trichy

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Ability Enhancement Course FFT 104:Introduction to Computer Application

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective: To acquaint the students with the knowledge and use of computers and to introduce the basic principles, organization and operational aspects of computers.

Course Content

UNIT I 5 lectures

Microsoft Word and its applications (in relation with Food Industry)

Font formatting, Paragraph formatting, Inserting images, auto shapes symbols, diagrams, header & footer, References, watermarks and Hyperlinks, Style & Formatting, Mail Merge through word, Excel, Access database, Page setup, Printing a document

UNIT II 5 lectures

MS Excel and its applications (in relation with Food Industry)

Making column chart & pie chart and chart formatting, Use of general functions & formula (autosum, using basic arithmetic operators: +,-,*,/), Use of filter & sorting, Cell references, header & footer, age setup, use of page break preview, printing worksheets.

UNIT III 10 lectures

MS PowerPoint and its applications (in relation with Food Industry)

Creating own design, formatting objects on a slide, Use of Slide Master to control the design & formatting of a presentation, Use of Image, audio, video in the presentation, Slide show setup, slide transition, use of animation, Use of narration in presentation, Print setup & Printing handouts of a presentation.

UNIT IV 5 lectures

Internet & Web Applications (in relation with Food Industry

UNIT V 5 lectures

Websites, Internet applications, Google Applications (G mail, Google search, G Drive, Google Docs) and other Email Services, Industry customer approach.

Practical

- Applications of MS Excel to solve the problems of food technology
- Statistical quality control, Sensory evaluation of food, and Chemical kinetics in food processing;
- Use of word processing software for creating reports and presentation;
- Familiarization with the application of computer in food industries -Milk plant, Bakery Units, Fruit & Vegetable processing Unit;
- Familiarization with software related to food industry;
- Ergonomics application in the same; Visit to Industry and case study problems on computer.
- Visit to Industry and case study problems on computer.

Reference Books

- Fundamentals of Computers by E. Balagurusamy (Author) Publisher: McGraw Hill Education (India) Private Limited
- Ms Office 2007 in a Nutshell by S. Saxena (Author) Publisher: S.Chand (G/L) & Company Ltd
- Computer Fundamentals Paperback – by P. K. Sinha (Author) Publisher: BPP

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SEMESTER-III

Core Course FFT 231: Basic Food Chemistry - II

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: Basic Food Chemistry -I

Objective :

To acquaint with properties and role of various constituents in foods, interaction and changes during processing.

Course Content

UNIT I 8 lectures

Minerals: Major and minor minerals, Metal uptake in canned foods, Toxic metals

UNIT II 9 lectures

Natural Food Pigments: Introduction and classification; Food pigments(chlorophyll, carotenoids, anthocyanins and flavonoids,beet pigments, caramel)

UNIT III 10 lectures

Browning Reactions In Food: Enzymatic browning, Non – Enzymatic browning, Maillard reaction, Caramelization reaction, Ascorbic acid oxidation

UNIT IV 8 lectures

Enzymes: classification, General characteristics, Enzymes in food processing, Industrial Uses of Enzymes, Immobilized enzymes

UNIT V 10 lectures

Physico-chemical and nutritional changes occurring during food processing treatments: Drying and dehydration, Irradiation, Freezing, Canning

Practicals

1. Estimation of total ash
2. Estimation of minerals
3. Determination of thermal inactivation time of enzymes in fruits and vegetables.
4. Estimation of iodine value
5. Estimation of peroxide value
6. Determination of carotenoids w.r.t flour pigments.
7. Extend of non-enzymatic browning by extraction methods.

Reference Books:

1. deMan, John M., Principles of Food Chemistry ,3rd Ed., Springer 1999
2. Desrosier, Norman W. and Desrosier., JamesN.,The technology of food preservation , 4th Ed., Westport, Conn. : AVI Pub. Co., 1977.
3. Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York,1996
4. Fuller, Gordon W, New Product Development From Concept to Marketplace,CRC Press,2004.
5. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada,2002

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Core Course FFT 232: Food Quality and Analysis

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A basic course in Laboratory Techniques

Objective

To develop an understanding and methodologies of instrumental techniques in food analysis used for objective methods of food quality parameters.

Course Content

UNIT I 10 lectures

Introduction to quality attributes: Appearance, flavour, textural factors and additional quality factors.

Sensory Analysis: Introduction to sensory analysis; general testing conditions, Requirements of sensory laboratory; organizing sensory evaluation programme. Factors influencing sensory measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and gloss; Detection, threshold and dilution tests, discrimination, descriptive, affective; Ranking tests; Methods of sensory evaluation of different food products.

UNIT II 10 lectures

Colour:Importance and need of colour determination, methods of colour determination with Hunter Colour lab, CIE system and their applications. classification- artificial and natural.

Flavour: Importance of flavour, food flavours, factors affecting food product flavours, measurement of food flavours. Texture: Food texture, Physical characteristics of food, working of texture measuring instruments such as Texture Analyser, Texture Profile Analysis (TPA).

UNIT III 10 lectures

Chromatography: Principle and working of Gas chromatography (GC), High pressure liquid chromatography (HPLC), Thin layer chromatography (TLC), Column Chromatography, chromatographic methods applied as quality control.

Spectroscopy: Beers and Lambert's Law. General principles of colorimeters and spectrophotometers, Atomic absorption spectroscopy, IR spectroscopy, Flouremetry.

UNIT IV 7 lectures

Methods for food analysis: Estimation of carbohydrates, protein, fat, vitamins and minerals

Food Adulteration: Definition, types of adulterants and their detection.

UNIT V 8 lectures

Natural toxins. Contaminants formed during processing – nitrosamines, acrylamide etc. natural food contaminants and contaminants form packaging materials.

Food Additives: Introduction, need of food additives in food processing and preservation. Characteristics and classification of food additives. Safety and quality evaluation of additives and contaminants, Acute and chronic studies, NOEL, ADI, LD50.

Antimicrobial agents. -Nitrites, sulphides, sulphur-di-oxide, sodium chloride, hydrogen peroxide.

Antioxidants - Introduction, mechanism of action, natural and synthetic anti-oxidants, technological aspect of antioxidants.

Practical

- Preparation of standard solutions for the chemical analysis i.e. HCl, H_2SO_4, $KMnO_4$, Sodium Thiosulphate and Iodine.
- Determination of proximate composition of food- moisture, protein, crude fat, crude fiber, ash, total carbohydrates and Calorific Value by standard AOAC procedures
- Determination of minerals in food products: Calcium by Titration, Phosphorus by Spectrophotometer, Iron by Spectrophotometer,
- Determination of pH and total acidity of various food samples.
- Determination of total sugars, reducing and non-reducing sugars in various food samples.
- Detection of adulterants in various food (turmeric, red chilli, coffee, honey, flour)etc.
- Qualitative analysis of compounds by chromatography techniques- a) Thin layer Chromatography, b) Paper Chromatography: Descending, Ascending and Circular Paper chromatography.
- Estimation of metals - Fe, Ca, Cu, Cu, Pb, Zn, Sn and Cr- by atomic absorption spectrometer and flame photometer. Demonstration of AAS for estimation of metals.
- Colour measurement (L a b values) by X Rite.
- Use of electrophoresis in the determination of proteins.
- To conduct sensory evaluation of the given samples using descriptive method.
- To perform the difference testes (Paired comparison test, Duo trio test and Triangle test) in the given sample
- Texture analysis of raw and processed foods.

Reference Books

- Clifton M & Pomeranz Y. 1988. Food Analysis - Laboratory Experiments. AVI Publ.
- Gruenwedel DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. I. Physical Characterization. Marcel Dekker.
- Nollet LML. 1986. Handbook of Food Analysis. Vol. I. Marcel Dekker.

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Core Course FFT 233: Food ProcessingOperations

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on food processing

Objective

To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I 5 lectures

Introduction: Basic principles of food processing, Conservation of mass and energy, Units and dimensions of engineering parameters, dimensionless ratios, and calculations involving various physical parameters.

UNIT II 10 lectures

Distillation: Distillation, Steam distillation, applications and equipment – determination of height equivalent of theoretical plate (HETP) – McCabe-Thiele method – reflux ratio. Molecular distillation, theory and examples. Mass transfer phenomenon applied to food systems

UNIT III 10 lectures

Evaporation: Needs, basic principles, Calculations, Single and multiple effect evaporation, Heat economy – enthalpy balances for evaporators, Vapour recompression, Thermo and mechanical systems, boiling point elevation, Falling film, climbing film tubular evaporators, plate evaporators, thin film and scraped surface evaporators.

UNIT IV 10 lectures

Contact Equilibrium Separation Processes: Concentrations, Gas-liquid equilibria, Solid liquid equilibria, Equilibrium concentration relationships, operating conditions; Basics of Solid-liquid extraction processes, liquid-liquid extraction, with food application examples, Crystallization

UNIT V 10 lectures

Leaching and Extraction: Leaching – Leaching equipments – principles of continuous and countercurrent leaching. Liquid extraction – extraction equipment – principles of extraction. Special extraction techniques – supercritical fluid extraction. Applications; extraction of Fatty acids, oleoresins and essential oils; Relative advantages, limitations and economics. Mechanical extraction – Expellers, screw press, filter press.

Reference Books

- Albert Ibarz, Cannovas, G.V. Unit Operations in Food Engineering. CRC Press. 2003.
- J.M. Coulson, J.F. Richardson, J.H. Harker - Coulson & Richardson's Chemical Engineering - Vol 2 Particle Technology and Separation Processes, Fifth Edition, 2002. Butterworth & Heinemann - Elsevier science Ltd.

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Core Course: FFT 234 : Technology of Cereals, Pulses and Oil Seeds

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course in Food Science

Objective

To acquaint with production and consumption trends, structure, composition, quality evaluation, and processing technologies for product development and value addition of various cereals, pulses and oilseeds.

Course Content

UNIT I 2 lectures

Status, production and major growing areas of cereals, in India and world.

UNIT II 20 lectures

Wheat Processing: Wheat classification, Functionality of wheat flour components.

Rice Processing: Classification, paddy Processing, Parboiling and treatment for quality improvement, Milling, rice products.

Coarse Cereals Products: Maize- Dry and wet milling of corn, corn products, sorghum, pearl millet and small millets processing.

UNIT III 10 lectures

Pulses: Pre-treatment of pulses for milling, milling of major pulses. Methods to improve recovery, Nutrition and anti-nutritional factors in pulses.

UNIT IV 7 lectures

Oil seeds Processing: Groundnut, Mustard, Soybean, Sunflower, Safflower, Sesame and other oil seeds processing.

UNIT V 6 lectures

Special Topics: Processing & Utilization of Soya bean for value added products, Innovative products from cereals, pulses and oilseeds. Extrusion technology for cereals

Practical:

- Physico-chemical examination of wheat and its products test weight, kernel hardness, gluten content.
- Millingof rice with emphasis on quality and recovery.
- Physicochemical tests of rice and flour quality of wheat- gelatinization temperature, water absorption tests.
- Determination of Yeast activity used in fermented cereal products.
- Quality test for wheat flour used in the baked products. Maltose Number, Water Absorption, Sedimentation value, Alcohol Acidity
- Quality tests for oils.
- Texture profile analysis of baked cereal food products by texture analyzer.
- Products of Soybean- tofu, soya milk,
- Estimation of antinutritional factors in pulses- Trypsin inhibitors and tannins.
- Visit to dhal mills

Reference Books

- Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.
- Dendy DAV &Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
- Hamilton RJ &Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.
- Hoseney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed. AACC.

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General Elective Course FFT 208: Disaster and Risk Management

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To familiarize the students with the concept of disaster, how to response to disaster and field work to access the cause.

Course Content

UNIT I 10 lectures

Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and Local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

UNIT II 5 lectures

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT III 5 lectures

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction.

UNIT IV 5 lectures

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion.

UNIT V 5 lectures

Field work / Case studies, Hazard mapping of vulnerable areas, Vulnerability assessment (physical, social, organizational, economical, technological) Risk mitigation planning for vulnerable areas.

Reference Books

- Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan.
- Hodgkinson PE & Stewart M. 1991. Coping with Catastrophe: A Handbook of Disaster Management. Routledge.
- Sharma VK. 2001. Disaster Management. National Centre for Disaster Management, India.

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Discipline Specific Elective Course FFT 255: Bakery and Confectionery Products Technology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on processing of cereals technology

Objective

To familiarize the students with different form of bakery confectionary and the analysis equipment involved, and to acquire the knowledge of manufacturing process of bakery and confectionary products in range.

Course Content

UNIT I (6 lectures)

Bakery and Confectionery industry; raw materials and quality parameters; dough development; dough chemistry;

UNIT II (6 lectures)

Rheological testing of dough-principles of Farinograph, Mixograph, Extensograph, Amylograph / Rapid Visco Analyzer, Falling number, Hosney's dough stickiness tester.

UNIT III (6 lectures)

Technology for the manufacture of bakery products- detailed description of unit operations for the manufacturing of bread, biscuits, cakes and the effect of variations in formulation.

UNIT IV (6 lectures)

Manufacturing of confectionary products: Characteristics and processing of raw material; Technology of manufacturing of toffee, chocolate, hard boiled candies, bars, chewing gums, bubble gums and Characteristics of finished products.

UNIT V (6 lectures)

Equipment used in bakery and confectionary industry: Construction and working of various equipments like Mixers, proofing chambers, dough dividers, moulder and sheeter, baking ovens, cooling chamber, sealing and packaging machines, Rolling and cutting machines.

Practical

- Quality test for wheat flour used in the baked products. Maltose Number, Water Absorption, Sedimentation value, Alcohol Acidity
- Preparation and quality evaluation of cakes
- Preparation and quality evaluation of biscuits
- Preparation and quality evaluation of nan khatai
- Preparation and quality evaluation of cookies
- Effect of syrup consistency and temperature on the quality characteristics of hardboiled sweets
- Preparation and quality evaluation of chocolate
- Visit to bakery and confectionery industries.

Reference Books

- Dubey SC. 2002. Basic Baking. The Society of Indian Bakers, New Delhi.
- Francis FJ. 2000. Wiley Encyclopedia of Food Science & Technology. John Wiley & Sons.
- Manley D. 2000. Technology of Biscuits, Crackers & Cookies. 2nd Ed. CRC Press.

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Discipline Specific Elective Course FFT 256: Beverage Technology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A basic course in Food Science

Objective

In this the students will be exposed to the knowledge of beverage types and manufacturing process involved in different beverage manufacturing industries.

Course Content

UNIT I 6 lectures

Types of beverages and their importance; status of beverage industry in India;

UNIT II 4 lectures

Manufacturing technology for juice-based beverages; synthetic beverages; technology of still, carbonated, low-calorie and dry beverages; isotonic and sports drinks;

UNIT III 4 lectures

Specialty beverages based on tea, coffee, cocoa, spices, plant extracts etc.

UNIT IV 8 lectures

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, wine and related beverages, distilled spirits.

UNIT V 8 lectures

Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, carbonated water.

Practical

- Chemical and microbiological analysis of raw water quality;
- Preparation of regional fruit juices;
- Preparation of whey-based beverages;
- preparation of crush, nectar, blended juice
- Preparation of soy milk, fruit milkshakes, herbal beverages;
- Visit to relevant processing units.

Reference Books

- Srivastava RP & Kumar S. 2003. Fruit and Vegetable Preservation - Principles and Practices. International Book Distributors.
- Hardwick WA. 1995. Handbook of Brewing. Marcel Dekker.
- Hui YH. et al 2004. Handbook of Food and Beverage Fermentation Technology. Marcel Dekker.
- Priest FG & Stewart GG. 2006. Handbook of Brewing. 2nd Ed. CRC.
- Richard P Vine. 1981. Commercial Wine Making - Processing and Controls. AVI Publ.

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Discipline Specific Elective Course FFT 332: Food Biochemistry and Human Nutrition

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students about importance of human nutrition, basic concept of biochemistry and their integrated and role in health.

Course Content

UNIT I 9 lectures

Introduction to the Macro and Micronutrients. Digestion, absorption and Transport.

Calorific value of food, BMR & factors affecting it, Specific Dynamic Action (SDA) of food, calculation of energy requirement (REE), Energy Expenditure.

Recommended Dietary Allowances (RDA)- principles and factors.

Sensory Evaluation of foods – *Organoleptic Analysis, Methods and Tests of Sensory Evaluation, Organizing Sensory Evaluation Programmes, Computer-Aided Sensory Evaluations*

UNIT II 10 lectures

Carbohydrates: Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances

Resistant Starches and Dietary Fibre – *Definition, Sources and Functions*

Metabolic Pathways - *Glycolysis, Gluconeogenesis, Glycogenesis, Glycogenolysis, Citric Acid Cycle* Regulation of blood glucose level.

Diabetes mellitus – Types, etiology, diagnosis, prognosis, altered metabolism and pathophysiology. Hypoglycemia

UNIT III 9 lectures

Proteins & Amino Acids : Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances. Protein Energy Malnutrition

Metabolic Pathways - *Transamination, Deamination, Decarboxylation, Urea Cycle*.

Stress and Anti-freeze Proteins; Protein Isolates and Concentrates. Denaturation of Proteins . Evaluation of Protein Quality .Biochemical Markers- types, examples and diagnostic applications. Immunoglobulins.

UNIT IV 8 lectures

Lipids & Fats: Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances.

Metabolic Pathways - *Fatty Acid Oxidation, Biosynthesis of Fatty Acids* Synthesis and Functions of Cholesterol; Ketogenesis

Rancidity of Fats .Emulsions

UNIT V 9 lectures

Role of Water in Food and Human Health

Vitamins & Minerals: Classification, Functions, Dietary Sources, Deficiencies and Excess, Recommended Dietary Allowances

Anti-nutritional Factors in Foods.

Pigments, Phytonutrients, Antioxidants, Flavour Components – *Definition, Classification, and Functions* and its role in health, food and nutraceutical industry.

- Nelson, D. L. (2003). Lehninger Principles of Biochemistry. Macmilan Worth Publishers, India.
- Deb, A.C. (2004). Biochemistry. Book Agency (P) Ltd. Calcutta, India.
- Satyanarayana, U. (2009). Biochemistry. Books and Allied (P) Ltd. Calcutta, India
- Nutrition Science by B. Srilakshmi
- Fundamentals of Foods & Nutrition by Sumati R. Mudambi

SEM IV

Core Course: FFT 235: Meat, Fish and Poultry

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on Food Science

Objective

To provide an understanding of the technology for handling, processing, preservation and bi-product utilization of meat, poultry and fish products processing.

Course Content

UNIT I 8 lectures

Development of meat and poultry industries in India. Ante-mortem examination of animals and poultry birds. Slaughter and dressing, post-mortem examination. Post-mortem changes in meat and factors affecting them.

UNIT II 5 lectures

Nutritive value of meat. Whole sale and retail cuts. Meat tenderization methods.

UNIT III 10 lectures

Canning of meat and meat products, Restructured meat products, sausages, curing and smoking of meat. Disposal and utilization of meat industry by- products

Chilling and freezing of carcass and meat; canning, cooking, drying, pickling, curing and smoking; prepared meat products like salami, kebabs, sausages, sliced, minced, corned; intermediate moisture and dried meat products; Packaging of meat products.

UNIT IV 10 lectures

Structure, composition and nutritive value of poultry eggs. Poultry dressing, Functional properties of eggs, internal quality of eggs and its preservation.

UNIT V 12 lectures

Fish structure and composition. Cold storage, freezing preservation and canning of fish. Picking of fish, fish protein concentrates, fish meal and by products of fish processing industry

Practical:

- Slaughtering and dressing of meat animals
- Study of post-mortem changes; meat cutting and handling
- Evaluation of meat quality
- Evaluation of quality of eggs
- Preparation of meat products
- Visit to meat processing plants.

Reference Books

- Forrest JC. 1975. Principles of Meat Science. Freeman.
- Govindan TK. 1985. Fish Processing Technology. Oxford & IBH.
- Hui YH. 2001. Meat Science and Applications. Marcel Dekker. 32
- Kerry J. et al. 2002. Meat Processing. Woodhead Publ. CRC Press.
- Pearson AM & Gillett TA. 1996. Processed Meat. 3rd Ed. Chapman & Hall.

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Core Course FFT 236: Dairy Science

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course in food science

Objective

To acquaint with techniques and technologies of testing and processing of milk into various products and by products.

Course Content

UNIT I 9 lectures

Physical properties of milk: Color, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing, boiling point, specific heat, OR, electrical conductivity.

UNIT II 10 lectures

Lactose: Lactose (alpha and beta forms). Significances of lactose in dairy industry.

Milk fat: Composition and structure, and physical properties, crystallization, structure of fat granules, lipolysis, autoxidation, fat constants (saponification value, iodine value, RM value, Polenske value, peroxide value).

Protein and Enzymes: General structure, amphoteric nature, difference between casein and serum protein, different types of casein (acid and rennet), uses of casein, fractionation of protein. Enzymes- catalase, alkaline phosphatase, lipases and proteases.

UNIT III 10 lectures

Market milk industry and milk products: Systems of collection of milk, Reception, Platform testing, Various stages of processing: Filtration, Clarification, Standardization,Homogenization, Pasteurization, Sterilization, Packaging and Storage, Cleaning and Sanitation

UNIT IV 8 lectures

Description and working of clarifier, cream separator, homogenizer and plate heat exchanger.

UNIT V 8 lectures

Flow diagram for manufacture of following milk products: Flavoured milk, Butter, ice-cream, milk powder.

Practical

- To perform platform tests in milk. (Acidity and COB).
- To estimate moisture content in milk.
- To estimate skim milk protein by titration method.
- To estimate milk fat by Gerber method, SNF and specific gravity of milk.
- To check the efficiency of sterilization of milk by Turbidity test.
- To prepare casein and calculate its yield.
- Preparation of flavoured milk
- Preparation of butter
- Visit to a milk industry

Reference Books

- Aneja RP, Mathur BN, Chandhan RC & Banerjee AK. 2002. *Technology of Indian Milk Products*. Dairy India Publ., Delhi.
- De S. 1980. *Outlines of Dairy Technology*. Oxford Univ. Press Publ., New Delhi.
- Smit G. 2003. *Dairy Processing – Improving Quality*. CRC-Woodhead Publ.
- Walstra P, Geurts TJ, Noomen A, Jellema A & Van Boekel MAJS. 1999. *Dairy Technology – Principles of Milk Properties and Processes*. Marcel Dekker.

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Skill Enhancement Course: FFT 237:Food Quality Management and Quality Assurance

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: Course in Food hygiene and Food plant sanitation

Objective

To acquaint the students about quality management in food production chain and the certifications involved in raw material food and industries and different organizational system such as HACCP, GMP/GHP and auditing and surveillance.

Course Content

UNIT I 5 lectures

Quality inspection, quality control, Quality Assurance.

Quality Management System- ISO 9000

UNIT II 10 lectures

Management Principles, Process Model, principles and requirements of ISO 9001

Total quality management; Good Manufacturing Practices, Good Agricultural Practices, Good Laboratory Practices, Quality Management systems QSS. Quality Circles, SQC.

UNIT III 10 lectures

Food Safety Management System- Key role, Principles of FSMS, ISO-22000.

UNIT IV 10 lectures

HACCP- Prerequisites; Principles and steps of HACCP Plan, Hazard Identification, Risk assessment Risk communication with communication agencies and Hazard analysis, CCP Decision Tree, HACCP Plan.

Cleaning and Sanitation, Pest Control, Recall Procedures.

UNIT V 10 lectures

Auditing, Surveillance; Audit, Mock audit, third party quality certifying audit, Auditors and Lead auditors.

Certification, Certification procedures, Certifying bodies, Accrediting bodies, International bodies.

Practical:

- To conduct Hazard Analysis & Risk Assessment of identified hazards
- Determination of CCP through CCP Decision Tree
- Formation of CCP Monitoring Checklist
- Identification of PRP's (GHP & GMP) of food plant
- Preparation of detail flow diagram of manufacturing process & identification of potential hazards of food at each step/process
- Preparation of sample pages of Quality Manual
- Preparation of sample pages of Management System Procedure (MSP)
- Preparation of sample pages of Standard Operating Procedure (SOP)
- Preparation of sample pages of Formats for Quality Management System
- Preparation of on-site audit plan
- Preparation of an Audit CheckList /Observation Sheet
- To conduct Document Review (Adequacy Audit) before Audit
- To conduct opening meeting of audit
- To conduct Closing Meeting
- Preparation of Audit Plan Schedule before an Internal Audit
- To conduct an Audit Meeting before conducting Internal/External Audit
- Preparation of Corrective /Preventive Action Recommendation for the organization after Audit (Report Writing)
- Preparation of report by auditee after correction of non-conformities
- To conduct audit Follow-up

Reference Books

- Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Krammer A &Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ.

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General Education Course FFT 209: Data Analysis

Credits: (1-1-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

The students will be exposed to various research methods and statistical tools required to analyze the experimental data in food research and industry. The focus will be on providing knowledge related to research process, data collection and data analysis etc.

Course Content

UNIT I 6 lectures

Scientific Approach to Research: Meaning, significance, variables

Research Process: Formulating the problem, objectives, hypothesis, Experimental design, sample design, collecting data, analysis of data, interpretation, preparation of report.

UNIT II 6 lectures

Sampling Techniques: Probability and non probability sampling.

Experimental designs: Randomized Block design

UNIT III 6 lectures

Measurements: measurement scale, Frequency distribution, graphical presentation of data.

Measures of Central Tendency: Mean, median and mode, their uses.

UNIT IV 7 lectures

Measures of variability: Mean deviations, Quartile deviation, standard deviation, their uses.

Correlation: Spearman and Pearson's techniques of correlation, Linear regression

UNIT V 5 lectures

Tests of significance of difference between means: t-test, F-test, One way ANOVA.

Applications to food quality assessments

Reference Books

- Aggarwal BL. 2003. Basic Statistics. New Age.
- Kothari CR. 1989. *Research Methodology*. Wiley Eastern.
- Gupta SP. 2004. *Statistical Methods*. S. Chand & Sons

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Ability Enhancement Course FFT 210:Technical Writing

Credits: (1-0-0-1)

Level: Undergraduate

Semester: Spring

Pre-requisite: A basic course on Communication and Documentation skills

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. and equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Course Content

UNIT I 5 lectures

Grammar: Expressions, Modals & Moods, Word Stress, Fluency, Voice, Enhancing Vocabulary Punctuations

UNIT II 5 lectures

Technical Writing: Introduction to Technical writing – Definition, types, characteristics, Report Writing, CV & Resume making, Research paper

UNIT III 5 lectures

Effective Communication Skills: Power Point Presentations (Subject-Oriented), Soft Skills - Proper Body Postures, Right/Positive Body Language, Eye Contact, Public speaking, Interactive Communication Skills -Group Discussions, Debates, Conversations, Telephonic Etiquettes, Facing an interview

UNIT IV Tutorial 5 lectures

Communication Skills: How to make Delivery of Content Effective, Proper Articulation, Modulation, Voice Throw, Proper Stress on Words, Presenting PPT's, Confidence Building, Motivation, Writing Covering Letters , Filling Application Forms

UNIT V Tutorial 10 lectures

Technical Writing : Documentation of Academic credentials, Writing of Introduction, Acknowledgement, Abstract & Conclusion, Commonly used Abbreviations in the Thesis & Research Communication, Structuring the Presentation, Learning how to make PPT's, number of Slides, font, font size, Table Insertions, Picture, Clip Art, Chart, Grammatical Accuracy

Reference Books

- Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek, Chandigarh.
- Shelton James H. 1994. Handbook for Technical Writing. NTC Business Books, Chicago.
- Wren PC & Martin H.2006. High School English Grammar and Composition. S. Chand, New Delhi.

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Skill Enhancement Course FFT 280: Industrial Training-II for 15 days

Credits: (0-0-2-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: Any course in Food Processing

Generic Course FFT 258: Crop Production

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the basics of agriculture and crop farming so as to learn the related field of food processing such as farm machinery, land & water resources, and horticulture.

Course Content

UNIT I 5 lectures

Agriculture and its role in national development, food security; General features of climate - India; Crop environment, weather and significance of various weather elements;

Crop production - definition and scope, crop classification based on season, life cycle, taxonomy and economic use; Growth and yield of crops, growth parameters, yield attributes and factors affecting them

UNIT II 5 lectures

Quality of good seed, ideal condition for germination, seed treatment, hybrid and composite seeds, categories of seeds (certified, foundation and breeder seed); Importance of sowing time, seed rate, sowing methods, plant population; Tillage and Inter-culture operations.

UNIT III 5 lectures

Irrigation - scheduling, methods and water use efficiency; Harvesting, threshing, winnowing, storage and processing.

UNIT IV 10 lectures

Crop rotations, mixed cropping, inter cropping, its objectives and importance; Definitions of mono-cropping, double cropping, multiple/intensive cropping, relay cropping.

Soil as a three phase disperse system, its physical chemical and biological properties; Soil fertility and soil productivity, manures and fertilizers,

UNIT V 5 lectures

Classification of vegetable crops; Types of vegetable farming; Principles of vegetable production; Raising of vegetable seedlings under different environmental conditions

Concepts in Horticulture - methods of propagation, systems of planting and layout, fruit growth and development, fruit maturity and ripening, Post harvest management of fruits.

Reference Books

- Batnakar S &Schware R. 2000. Information and Communication Technology in Development- Cases from India. Sage Publ.
- Meera SN. 2008. ICTs in Agricultural Extension: Tactical to Practical. Ganga- Kaveri Publ. House. JangamWadiMath, Varanasi.
- Willem Zip. 1994. Improving the Transfer and Use of Agricultural Information – A Guide to Information Technology. The World Bank, Washington.

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SEMESTER V

Core Course FFT 331: Fundamentals of Food Engineering

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on unit operations in food processing

Objective

To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I 10 lectures

Process time calculations; Sterilizers and accessories used in canning industries; Engineering aspects of pasteurizer; homogenizer, evaporators (basic principle and single-effect evaporator) and concentrators used in food industries; Seaming machine.

UNIT II 8 lectures

Construction of cold storage; Different types of freezers including plate contact freezer, air blast freezer, cryogenic freezing and refrigerated vans.

UNIT III 9 lectures

Various types of driers (basic principle and drying time) – Tray drier, roller drier, spray drier, fluidized bed drier, freeze drier and solar drier.

UNIT IV 9 lectures

Heat exchangers (including paraflow HEs); Extruders – Basic principles and types, Difference between single- and twin-screw extruders; Kneader; Oil expeller

UNIT V 9 lectures

Advanced separation processes: Dialysis, ultrafiltration, reverse osmosis, electro dialysis and membrane separation.

Practical:

- Determination of viscosity of Newtonian fluid, Non Newtonian fluids;
- Determination of conductivity, calorific value and filtration properties of food& water.
- Calculation of freezing time for some typical foods
- Determination of Textural characteristics TPA of food product
- Evaluation of Bulk density and basics of true and bulk density

Reference books

- Fundamentals of Food Engineering by Stanley Charm.
- Introduction to Food Engineering - R.Paul Singh, Dennis R.
- Fundamentals of Food Process Engineering; Toledo RT; 2nd ed, 2000, CBS Publishers.
- Food process engineering, D.R.Heldman and R.P.Singh

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Core Course FFT 332: Biochemistry and Human Nutrition

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students about importance of nutrition, balanced diets, therapeutic diets for health and role of food and nutraceuticals in health.

Course Content

UNIT I 8 lectures

Introduction to human nutrition.

Macronutrients and micronutrients- Classification and functions.

Digestion, absorption and assimilation of nutrients.

UNIT II 10 lectures

Energy metabolism- Components of energy expenditure, Basal Metabolic Requirements and Activity,
Recommended Dietary Allowances, Food Groups, Concept of a balanced diet, Methods of evaluation of nutritive value of foods.
Nutritional assessment and nutritional policies- Salient features, concept of community nutrition

UNIT III 10 lectures

Carbohydrates- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Proteins- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT IV 7 lectures

Fat- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT V 10 lectures

Vitamin- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Minerals- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Water and electrolytes- Concept and importance

Reference books

- Nutrition Science by B. Srilakshmi
- Fundamentals of Foods & Nutrition by Sumati R. Mudambi
- Textbook of Nutrition : A Life cycle approach by Ravinder Chadha

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General Elective Course FFT 333:Concepts of Biotechnology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on basic microbiology

Objective

To acquaint the students with the fundamental of bio-technology, industrial microbiology and fermentation processes.

Course Content

UNIT I 6 lectures

Prospectus of biotechnology- definition, scope and importance, DNA structure, function and metabolism.

UNIT II 6 lectures

GMO, genetic recombination mechanisms and technique used for improvement in microbial strains; Methods of recombinant DNA technology; Nucleic acid hybridization; Plant and animal cell and tissue culture techniques and their applications.

UNIT III 6 lectures

Molecular markers and their applications; DNA sequencing; Genetic engineering and transgenics; Genomics, transcriptomics and proteomics.

UNIT IV 6 lectures

General application of biotechnology in food industry, pharmaceuticals and agriculture Public perception of biotechnology; Bio-safety and bioethics issues.

UNIT V 6 lectures

Introduction to nanotechnology, history and recent developments, sources of nanoparticles, microbial production of nanoparticles, advantages of microbial nanoparticles and their applications.

FFT 303 Introductory Biotechnology Practical

- Isolation of genomic DNA from different sources
- Gel electrophoresis techniques
- Restriction enzyme digestion, ligation, transformation and screening of transformants
- Demonstration of PCR

Reference Books

- Becker JM, Coldwell GA &Zachgo EA. 2007. Biotechnology – a Laboratory Course. Academic Press.
- Brown CM, Campbell I & Priest FG. 2005. Introduction to Biotechnology. Panima Pub.
- Gupta PK. 2004. Biotechnology and Genomics. Rastogi Publications.
- Sambrook J, Fritsch T &Maniatis T. 2001. Molecular Cloning – a Laboratory Manual. 2nd Ed. Cold Spring Harbour Laboratory Press.

- Singh BD. 2007. Biotechnology Expanding Horiozon. Kalyani Publishers
- Fundamentals of Biotechnology, Prave. P. Faust, V. Sitih. W., Sukatsh, DA, 1987. ASM press.

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Generic Elective Course FFT 334:Waste Management Practices

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on hygiene and plant sanitation

Objective

To acquaint the students with the major source of living ie water, its treatment, analysis and how to make it potable.

Course Content

UNIT I 6 lectures

Selection of sanitizing agents for cleaning, packaging sanitation, food storage sanitation, transport sanitation and water sanitation.

UNIT II 6 lectures

By-products obtained from cereals, pulses, legumes, oil seeds, fruit and vegetables, dairy plant, sugar and bakery, plantation crops and spices egg and poultry processing industry and meat, Fermentation industry.

UNIT III 6 lectures

Characterization of food industry wastes e.g., BOD, COD and total organic content, floatable and suspended solids in water.

UNIT IV 6 lectures

Pretreatment, secondary treatments of solid waste, sludge volume index, advanced techniques activated bio-filtration, biological fluidized bed reactor, dried bacteria culture process

UNIT V 6 lectures

tertiary treatments or advanced waste water treatment system (AWT); polishing ponds, DAF Techniques, micro trainers treatment and disposal of sludge, sand filters, removal of nitrogen, phosphorus, sulphur, physical chemical treatment process.

Reference Books

- Energy Conservation through Waste Utilization, American Society of Mechanical Engineers, New York.
- Kreit F & Goswami DY. 2008. Energy Management and Conservation Handbook. CRC Press.
- Murphy WR &Mckay G. 1982. Energy Management. BS Publ. Patrick DR. 1982.. Energy Management and Conservation. Elsevier Publ.
- Patrick DR., Fardo SW, Richardson RE & Steven 2006. Energy Conservation Guidebook. The Fairmont Press.
- Wulfinghoff DR. Energy Efficiency Manual. Energy Institute Press

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Skill Enhancement Course FFT 380: Seminar

Credits :(0-0-1-1)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on Food Processing/Food Science

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Discipline Specific Elective Course: FFT 353:Technology of Indigenous Milk Products

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on Dairy Technology

Objective

To acquaint the students with the milk and milk based product preparations and the nutritional composition and health effect (good/bad).

Course Content

UNIT I 2 lectures

Status and significance of traditional milk products in India.

UNIT II 7 lectures

Khoa: Classification of types, standards methods of manufacture and preservation factors affecting yield of khoa. Physico-chemical changes during manufacture and storage of khoa. Confectioneries made from Khoa-Burfi, peda, Milkcake, Kalakhand, Gulabjaman and their compositional profile and manufacture practices.

Rabri and Basundhi: Product identification, process description, factors affecting yield physico-chemical changes during manufacture.

UNIT III 7 lectures

Channa: Product description, Standards method of manufacture, packaging and preservation.

Chhana-based sweets, Mechanization of manufacturing process.

Paneer: Product description standards method of manufacture packaging and preservation. Physico-chemical changes during manufacture and storage.

UNIT IV 7 lectures

Srikhand: Chakka product description, standards method of manufacture, small scale and industrial, packaging and preservation aspects. Physico-chemical changes and quality assurance during manufacture and storage.

Sandesh, Mistidahi: Product description method of manufacture and packaging process.

Kheer and Payasam: Product description methods of manufacture, innovations in manufacturing and packaging processes.

UNIT V 7 lectures

Microbiology of indigenous milk products: predominance of spoilage & pathogenic organisms in Curd, Khoa, Channa, Paneer, Shrikhand, control measures & legal specifications.

Biopreservative principles in enhancing the shelf-life of indigenous milk products including active packaging.

Practical:

- Preparation of khoa from cow and buffalo milk.
- Preparation of chhana from buffalo milk.
- Preparation of paneer from buffalo milk.
- Analysis of khoa, chhanna and paneer for total solids, moisture, fat and acidity.
- Preparation of mistidahi, chhaka and srikhand.
- Microbiological examinations of traditional dairy products: Khoa, paneer, coliform counts, yeast and molds counts etc.

Reference Books

- Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. *Technology of Indian Milk Products*. Dairy India Publ.
- De S.1980. *Outlines of Dairy Technology*. Oxford Univ. Press.
- Rathore NS *et al.* 2008. *Fundamentals of Dairy Technology - Theory & Practices*. Himanshu Publ.

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Discipline Specific Elective Course: FFT 356:Food Fermentation Technology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on basic Food Microbiology

Objective:

To understand the principles of food fermentation technology and study the types of starters used in Food Industry

Course Content

UNIT I (5 Lectures)

Importance in food (bacteria, fungi and viruses) Significance of spores.

Types of Microorganisms in Food, Classification and Nomenclature, Morphology and Structure

UNIT II (6 Lectures)

Microbial Growth in Food: Bacterial growth curve, Factors affecting the growth of micro organisms in food.

UNIT III (6 Lectures)

Cultivation of Micro-organisms: Pure culture technique, Methods of isolation and cultivation, Enumeration of Microorganisms- qualitative and quantitative, Rapid Methods of Detection

UNIT IV (6 Lectures)

Fermentation –definition and types, Microorganisms used in food fermentations
Study of a Bio fermentor – its design and operation, Down Stream Processing and Product recovery.

UNIT V (7 Lectures)

Fermented Foods-types, starter cultures and their types, methods of manufacture for vinegar, sauerkraut, yoghurt, soya sauce, tempeh, miso, beer wine and traditional Indian foods, Dairy Fermentations, concept of probiotics.

Practical:

1. Preparation and sterilization of nutrient broth and media
2. Morphological study of bacteria and fungi using permanent slides
3. Simple staining and Gram's staining
4. Standard Plate Count Method
5. Bacteriological Analysis of Water
6. Maintenance of starter cultures, biochemical confirmation tests
7. Development of fermented foods.

Reference books:

1) Frazier William C and Westhoff, Dennis C. Food Microbiology, TMH, New Delhi,2004
2) Jay, James M. Modern Food Microbiology, CBS Publication, New Delhi, 2000
4) Pelczar MJ, Chan E.C.S and Krieg, Noel R. Microbiology, 5th Ed., TMH, New Delhi, 1993.
5) Microbiology of Fermented Foods. Volume II and I. By Brian J. Wood.ElsieverAppliedScience Publication.1997
6) Principles of Fermentation Technology by Stanbury, P.F., Whitekar A. and Hall. 1995.,Pergaman. McNeul and Harvey.

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Discipline Specific Elective Course FFT 357: Nutraceuticals and Functional Foods

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective:

To understand the interrelationship between nutraceuticals and health maintenance and to explain the nutraceutical benefits obtained from different types of foods.

Course Content

Unit 1 (5 lectures)

Functional Food and Nutraceuticals- Definition, history, types and classification.
Perceived effect of diet on disease prevention
Understanding benefits of functional foods and nutraceuticals

Unit 2 (8 lectures)

Microbial and algal nutraceuticals : Probiotics- Important features of probiotic micro- organisms; Health effects of probiotics including mechanism of action; Probiotics in various foods: fermented milk products, non-milk products etc; Quality Assurance of probiotics and safety. Synbiotics for maintaining good health
Algae as source of omega - 3 fatty acids, antioxidants and minerals - extraction and enrichment.

Unit 3 (8 lectures)

Prebiotics- Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases. Perspective for food applications for the – Non-digestible carbohydrates/oligosaccharides, Dietary fibre, Resistant starch, Gums.

Unit 4 (12 lectures)

Nutraceuticals of plant and animal origin: Plant secondary metabolites, classification and sub-classification - Alkaloids, phenols, Terpenoids, Polyphenols: Flavonoids, catechins, isoflavones, tannins, Phytoesterogens, Phytosterols, Glucosinolates, Organo sulphur compounds, Other components – Phytates, Protease. Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases.

Animal metabolites: Sources and extraction of nutraceuticals of animal origin. Examples: chitin, chitosan, glucosamine, chondroitin sulphate and other polysaccharides of animal origin, uses and applications in preventive medicine and treatment. Concept of cosmoceuticals and aquaceuticals.

Unit 5 (12 lectures)

Malnutrition and factors responsible for nutritional disorders and anti-nutritional factors (cyanogens, lectins, enzyme inhibitors, phytoallexins and phytates). Concept of antioxidants - use of antioxidants as dietary supplements in prevention and treatment of cancer, obesity and stress. Role of nutraceuticals and functional foods in pediatrics, geriatrics, sports, pregnancy and lactation. Proteins, Peptides and nucleotides, Conjugated linoleic acid and n-3 fatty acids, Vitamins and Minerals.

Regulations ofNutraceuticals and Functional Foods in India and rest of the world.

Reference Books:

Aluko, Rotimi,Functional Foods and Nutraceuticals,Springer-Verlag New York Inc.,2012.

Satinder Kaur Brar, Surinder Kaur and Gurpreet Singh Dhillon,Nutraceuticals Functional Foods,2014.

Robert E.C. Wildman, Robert,Wildman, Taylor C,Handbook of Nutraceuticals and Functional Foods, Third Edition,Wallace,2002.

Handbook of nutraceuticals Vol I by YahwantVishnupant Pathak, CRC press.2009

Handbook of nutraceuticals Vol II by YahwantVishnupant Pathak, CRC press,2011

SEMESTER-VI

Skill Enhancement Course FFT 335: Food and AgriBusiness Management

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To give basic fundamentals to students for managing the food processing operations starting for raw material procurement to the end consumer and familiarizing them with international trade.

Course Content

UNIT I 3 lectures

Business Management: introduction, theories and functions, food industry management, marketing management and human resource development, personal management. Sectors in food industry and scale of operations in India.

UNIT II 5 lectures

Human Resource Management: Study the basics about HR and related policies and capacity mapping approaches for better management.

UNIT III 7 lectures

Consumer behavior towards food consumption, Consumer Surveys by various Institutes and Agencies, various journals on consumer behavior and market research, internet based data search.

UNIT IV 8 lectures

International trade: basics, classical theory, theory of absolute advantage, theory of comparative modern theory, free trade- protection, methods of protection, quotas, bounties, exchange control, devaluation, commercial treaties, terms of trade, balance of payments, Exim policy, foreign exchange, mechanics of foreign exchange, GATT, WTO, role of WTO. International trade in agriculture. World trade agreements related with food business, export trends and prospects of food products in India.

UNIT V 7 lectures

World consumption of Food: patterns and types of food consumption across the globe. Ethnic food habits of different regions. Govt. Institutions related to international ad trade; APEDA, Tea board, spice board, wine board, MoFPI etc. management of export import organization, registration, documentation, export import logistics, case studies. Export and import policies relevant to horticultural sector.

Reference Books

- Chhabra TN &Suria RK. 2001. Management Process and Perspectives. Kitab Mahal.
- Jhingan ML. 2005. International Economics. 5th Ed. Virnda Publ.
- Kotler P. 2000. Marketing Management. Prentice Hall.
- Reddy SS, Ram PR, Sastry TVN &Bhavani ID. 2004. Agricultural Economics. Oxford & IBH.

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Skill Enhancement Course FFT 336:Plant Design and Layout

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course of unit operations in food processing

Objective

To acquaint the students with the plant layout operation which is required by all industries to check their comparative factors as equipment position raw material handling and end product delivery

Course Content

UNIT I 5 lectures

Introduction : Plant design concepts - situations giving rise to plant design problems - differences in design of food processing and non-food processing plants

UNIT II 8 lectures

General design considerations, Food Processing Unit Operations, Prevention of Contamination, Sanitation, Deterioration, Seasonal Production, Flow Chart for Plant Design, Identification Stage, Looking for a need, Finding a product, Preliminary Screening of ideas, Comparative rating of product ideas: Present Market, Market Growth potential, Costs, Risks,

UNIT III 6 lectures

Plant location: Introduction, Location Decision Process, Factors involved in the plant location decision, Subjective, Qualitative and Semi-Quantitative Techniques

UNIT IV 4 lectures

Food Plant Utilities: Process Water, Steam, Electricity, Plant Effluents.

UNIT V 7 lectures

Plant layout : Importance, Flow Patterns, Basic Types of plant layouts, Product or line layout, Process or functional layout, Cellular or group layout, and Fixed position layout, Plant Layout factors, Layout design Procedure., Maintenance of Food Plant Building

Reference Books

- Peters, M.s and Timmerhaus, K.D, Plant Designs and Economics for Chemical Engineers, 4th Edition McGraw Hill,1991
- Biegler L., grossmann I.E. and Westeberg A.W., Systematic Methods of Chemical Engineering and Process Designs, prentice Hall ,1997.
- Z. B. Maroulis and G. D. Saravacos, Food Process Design, Marcel Dekker 2003.

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Generic Course FFT 358: Medicinal Plants

Credits: (2-0-0-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with Medicinal plant diversity & local healthcare

Course Content:

UNIT I 5 lectures

MAPs: definition, history, importance and future prospects. Medicinal Plants – past and present status in world and India. MAPs as industrial crops - constraints and remedial measures. Medicinal plant diversity & local healthcare.

UNIT II 5 lectures

Promotion of medicinal plant sector at national level: National Medicinal Plant Board and State Medicinal Plant Boards - objectives and functions. Demand and supply of medicinal plants. Herbal industries.

UNIT III 6 lectures

Important medicinal plants of India with their systematics, geographical distribution and uses. Acorus calamus, Adhatodavasica, Abrus precatorius Aloe vera, Phyllanthus amarus, Stevia rebaudiana, Belladona and Cinchona.

UNIT IV 5 lectures

Medicinal use of aromatic plants of India with their systematics, geographical distribution and uses. Introduction and historical background of aromatic plants.

UNIT V 9 lectures

Major, minor and less known aromatic plants of India. Uses of important aromatic plants – citronella, davana, damask rose, geranium, khus grass, large cardamom, lavender, lemon grass, mentha, holy basil, patchouli, rosemary Palmarosa, vetiver, artemisia, eucalyptus, thyme, marjoram and oreganum. Aromatic spices - clove, cinnamon, nutmeg, ajwain, dill, celery, tamarind, garcinia, curryleaf and saffron.

Reference Books:

- Medicinal Plants of Uttarakhand by C.P. Kala (2010). Syllabus - M. Sc. Medicinal and Aromatic Plants 2
- Indian Medicinal Plants by P.C. Trivedi (2009).
- Medicinal Plants of Indian Himalaya by S.S. Samant and U. Dhar.
- Hand Book of Aromatic Plants by S.K. Bhattacharjee (2004).
- Handbook of MAPs by S.K. Bhattacharjee (2009).

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Core Course FFT 385 :Industrial Project

Credits (0-0-10-10)

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SEMESTER-VII

General Elective Course FFT 504 : Research Methodology and Statistics

Credits: (3-1-0-4)

Level: Post Graduate

Semester: Spring

Pre-requisite: Basic knowledge of mathematics

Objective:

The students will be exposed to various statistical tools required to analyze the experimental data in nutrition and community research

Course Content

UNIT I (10 lectures)

Scientific Approach to Research: Meaning, significance, types of research studies.

Research Process: Formulating the problem, objectives, hypothesis, Experimental design, sample design, collecting data, analysis of data, interpretation, preparation of report.

UNIT II (15 lectures)

Sampling design: Census vs. sample survey. Steps, types.

Scaling techniques: Continuum, Reliability, Validity, Scale construction techniques.

Experimental designs: Randomized Block design

Processing of data: Development of code book.

UNIT III (15 lectures)

Measurements: Nature of measurements, types of measurement scale, Frequency distribution, graphical presentation of data.

Measures of Central Tendency: Computation of mean, median and mode, their uses.

Measures of variability: Computation of mean deviations, Quartile deviation and standard deviation, their uses.

UNIT IV (10 lectures)

Correlation: Regression, Meaning, Spearman and Pearson's techniques of correlation, Linear regression. Chi Square:

UNIT V (10 lectures)

Tests of significance of difference between means: t-test. Analysis of Variance (ANOVA): One way and two ways. Applications to food quality assessments

Reference Books

- Aggarwal BL. 2003. Basic Statistics. New Age.
- Kothari CR. 1989. Research Methodology. Wiley Eastern.
- Gupta SP. 2004. Statistical Methods. S. Chand & Sons.

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Discipline Specific Elective Course FFT 555: Food Additives
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite:A course of unit operations in food processing

Objective: To understand the principles of chemical preservation of foods and to understand the role of different food additives in the processing of different foods and their specific functions in improving the shelf life, quality, texture and other physical and sensory characteristics of foods.

Course Content:

UNIT I

Definition, role of food additives, classification of food additives based on their role, Risks and benefits of food additives. Safety in the use of food additives in foods; regulations and monitoring.

Preservatives – definition; natural preservatives; chemical preservatives; Permitted preservatives in foods, Antioxidants; natural and chemical antioxidants; mechanism of antioxidant function; primary and secondary antioxidants.

Unit II

Permitted Natural and synthetic colors; inorganic pigments; application of colors in food industry; Flavoring agents – concept of flavors in foods; natural flavors; nature identical flavors; artificial flavoring substances.

Unit III

Emulsifiers, Stabilizers and Thickeners: role of emulsifiers, different classes of emulsifiers and their chemical structure, their HLB values and role in emulsion stabilization; role of different stabilizers and other substances in emulsion stability; permitted emulsifiers and stabilizers and food applications. Thickeners – definition, chemical structure, role in food processing and product end characteristics, list of permitted thickeners and food applications.

Unit IV

Natural and chemical sweeteners; nutritive and non-nutritive sweeteners; chemical structure & sweetness; saccharine, acesulfame K, aspartame, sucrolose, Food acids – their function and application in foods; permitted food acids; nutritive additives; enrichment of foods.

Unit V

Other Food Additives and Food Ingredients: Anticaking agents, Antifoaming, Glazing agents, Bulking agents, Humectants, Firming agents, Softening agents, Crystal modifiers, Flour improvers, Flour treatment agents, Dough conditioners, and Enzymes – definition, role and mode of action, permitted list of agents and food application. Proteins, starches and lipids as functional ingredient and their applications in foods.

Reference Books:

- Mahindru, S.N. “Food Additives: Characteristics, Detection and Estimation”. Tata McGraw-Hill, 2000.
- Brennen, Alfred Larry. “Food Additives”. 2nd Edition, CRC Press,
  Clydesdale, Fergus M. “Food Additives- Toxicology Regulation and Properties”. CRC Press, Emerton, Victoria, “Food Colours”. Blackwell Publishing, 2008.
- Wilson, Rachel. “Sweeteners” Blackwell Publising, 2007.
  Hutchings, John B. “Food Color and Appearance”. Aspen Publication,1999.

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Discipline SpecificElective Course FFT 390 : Thesis
Credits: (0-0-10-10)

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SEMESTER-VIII

Discipline Specific Elective Course FFT 390 : Thesis
Credits: (0-0-20-20)

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SEMESTER-IX

Core Course: FFT 503 Instrumentation and Analytical Techniques
Credits: (3-0-1-4)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Graduation in any stream of science.

Objective: To develop an understanding and methodologies of instrumental techniques in food analysis used for objective methods of food quality parameters.

Course Content

UNIT I (6 lectures)

Preparation of chemical solutions: Concept of molar, molal, and normal solutions. pH and Buffers: Importance and measurement of pH.

UNIT II (11 lectures)

Chromatographic techniques: General principles. Partition and adsorption chromatography. Paper, thin layer, gas liquid, ion exchange and affinity chromatography. Gel filtration. Introduction to High Pressure Liquid Chromatography.

UNIT III (8 lectures)

Electrophoretic Techniques: General principles. Paper and gel electrophoresis. Polyacrylamide gel electrophoresis.

UNIT IV (11lectures)

Spectroscopy: Beers and Lambert's Law. Extinction coefficient. General principles of colorimeters and spectrophotometers, Atomic spectroscopy, Emmission spectroscopy, IR spectroscopy.

UNIT V (9 lectures)

Flourimetry: Spectroflourometers. Flame photometry and atomic absorption spectrophotometry.Use of radioisotopes. Microbiological assays. Microscopy

Practical

- Qualitative analysis of compounds by chromatography techniques: Thin layer Chromatography, Paper Chromatography: Descending, Ascending and Circular Paper chromatography.
- Qualitative analysis of compounds By using High Performance Liquid Chromatography.
- Column chromatography: Separation of beta carotene
- Use of electrophoresis in the determination of proteins.
- Determination of Rheological properties by using texture analyzer.
- Learning Outcome: Students will get acquainted with analytical methods used for quality control analysis of raw material and processed food commodities.

Reference Books

- Hand Book of Food Analysis by Nollet &Toldra, CRC publishing ltd.
- Hand Book of Analysis & Quality Control for Fruit & Vegetable Products by Rangana, Tata Mcgraw hill publishing.
- Introduction to the chemical analysis of foods by Nielson, CBS publishing.

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Skill Enhancement Course: FFT 556 Spices and Flavour Technology
Credits: (3-0-0-3)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Graduation in any stream of science.

Objective: To impart basic knowledge about the importance and production technology of spices and to know chemistry and physiology of taste, flavouring compounds in foods

Course Content

Unit I (7 lectures)

Spice processing Introduction, classification, composition and functions. Standards specification of spices and flavours, Spice processing, spice reconditioning, spice grinding, post- processing treatments.

Unit II (7 lectures)

Processing of Major Spices: Pepper, cardamom, ginger, onion, garlic, vanilla, cinnamon, chilli and turmeric – method of manufacture; chemistry of the volatiles; enzymatic synthesis of flavour identical.

Unit III (8 lectures)

Processing of Minor Spices, herbs and leafy vegetables: processing and utilization, All spice, Annie seed, sweet Basil, Caraway seed, Cassia, Cinnamon, Clove, Coriander, cumin, Dill seed Fern seed nutmeg mint marjoram, Rose merry, saffron, sage.

Unit IV (11 lectures)

Spice extractives, Value added spice products: Spice volatile oils, spice oleoresins, Use of spice extractives, replacement of spices with oils and oleoresins, alternative products, Ground spices, processed spices, organic spices, curry powders.Packaging of spices and spice products

Unit V (12 lectures)

Chemistry and physiology of taste, flavouring compounds in foods, Separation, purification and identification of natural flavouring materials& Synthetic flavouring agents and their stability: Processing quality control of Savory, Thyme, Ajowan, Curry leaves, Asafoctida, Tea, Coffee, Cocoa, Vanilla and annatto. Flavours of soft drinks, Baking and confectionery industry.

Learning Outcomes: The students are expected to have learnt importance and production technology of spices and flavours.

Reference Books:

- Spices – vol. II Parry J. W.
- Spice and condiments Pruthi J. S.
- Herbs and spices by Rosemery Hemphill
- The book of spices by Rosen garten, F. and Livington Jr.
- Spices and herbs for the Food Inudstryby Lewies, Y.S.
- Spices Vol. I and II by Tropical Agril. Series. Purseglove, J. W. Brown E. G.,
- Green C. L. And Robbins SRJ. Food Flavourings P. R. Ashust.
- Food Flavouringcomposition,manafacture and uses. by J. Merrory

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Core Course: FFT 509 Food Quality, Safety Standards and Certification
Credits: (3-0-0-3)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Completed basic course on Food Processing

Objective: To acquaint with food quality parameters and control systems, food standards, regulations, specifications.

Course contents:

UNIT I (5 lectures)

Quality Assurance: Introduction, Importance and Difference. Food Quality and Food Safety: Scope and difference.

UNIT II (12 lectures)

Raw materials & Finished product quality: Quality parameters and evaluation procedures: Appearance, color, texture, viscosity, consistency, flavor.

Sensory evaluation: Selection of panel of judges, sensory characteristics of foods, types of tests.

UNIT III (12 lectures)

Food standards and laws: International – Concept of Codex alimentarius, HACCP, GMP, GHP, USFDA, ISO 9000, ISO 22000, ISO 14000. National – Introduction of BIS/IS, Food Safety and standards – 2006, Food Safety and standard regulation 2010, FPO, MPO, MMPO, Agmark. Prevention of food adulteration Act: Food Adulteration: definition, common adulterants in different foods, contamination, methods of detection. Food additives and legislation; coloring matter, preservatives, poisonous metals, antioxidants and emulsifying and stabilizing agents, insecticides and pesticides. PFA specification for food products, Nutritional labeling

UNIT IV (6 lectures)

Quality Certification &Accrediation: Introduction and procedure.

UNIT V (10 lectures)

Water Quality: Water standards and Analysis physical, chemical and microbiological characteristics of water analysis. Waste treatment: Fundamentals of Physical, Biological & Chemical waste treatments

Learning Outcome: The students must have an understanding about food laws and standards, quality parameters and sensory evaluation of food.

Reference Books

Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.

Krammer A & Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ

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Discipline Specific Elective Course FFT 651 : Entrepreneurship in Food Processing
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Completed basic course on Food Processing.

Objective: To enable the student to plan and prepare a project report for food processing unit and to provide capability to execute and evaluate the same and to introduce students to the methodology of project formulations and the implementation procedures and strategic planning of new projects.

Course contents:

UNIT I (6 lectures)

Aggregate Planning-: General design considerations, Financial Analysis, plant location and plant layout, Flowcharts and their design, equipment selection

UNIT II (4 lectures)

Design of service facilities

UNIT III (4 lectures)

Human resource planning: Planning and design of marketing system, worker's safety and plant hygiene

UNIT IV (6 lectures)

Introduction to Marketing and economics: Demand, Supply, Sample survey techniques, marketing information, consumer trends, consumer behavior.

UNIT V (10 lectures)

Introduction to Operations Research: Definition, applications. Inventory control, Linear Programming. Queuing Theory, Transportation and Assignment. Forecasting

Learning Outcome: The students would have been acquainted with designing and planning of food plant layout and operations research.

Reference Books:

- Chandra P. 2005. Project Management. Tata McGraw Hill.
- Gopal Krishan P & Nagarajan K. 2005. Project Management. New Age.
- Hisrich RD & Peters MP. 2002. Entrepreneurship. Tata McGraw Hill.
- Kaplan JM. 2003. Patterns of Entrepreneurship. John Wiley & Sons.
- Nandan H. 2007. Fundamentals of Entrepreneurship Management. Prentice Hall.

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Discipline Specific Elective course: FFT 654 Food Product Development

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Basic knowledge of Food Science.

Objective:

To acquaint the students about the need, types, basic technique and details of food product development to plan nutritious products.

Course Content

UNIT I (6 lectures)

Concept of product development - product success and failure, factors for success, process of product development, managing for product's success. Innovation strategy - possibilities for innovation, building up strategy, product development programme.

UNIT II (5 lectures)

The product development process - product strategy, product design and process development, product commercialization, product launch and evaluation.

UNIT III (6 lectures)

The knowledge base for product development technology - knowledge and the food system, knowledge management, knowledge for conversion of product concept to new product, technological knowledge (product qualities, raw material properties, processing, packaging requirement, distribution and marketing.

UNIT IV (5 lectures)

Role of consumers in product development - consumer behaviour, food preferences, avoiding acceptance, integration of consumer needs in product development and sensory needs.

UNIT V (8 lectures)

Managing the product development process, - principles of product development management, people in product development management, designing the product development process, key decision points, establishing outcomes, budgets and constraints, managing and organizingproduct development process, innovative matrices, striving for continuous improvement, Improving success potential of new products, market exploration and acquisition, Legal aspects of new product launch.

Learning Outcome: The course must have acquainted the students with principles of food product design and development.

Reference Books:

- Clarke & Wright W. 1999. Managing New Product and Process Development. Free Press.
- Earle R, Earle R & Anderson A. 2001. Food Product Development. Woodhead Publ.
- Fuller 2004. New Food Product Development - from Concept to Market Place. CRC.

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Discipline Specific Elective Course (DSE): FFT 658 Food By-Product Management
Credit: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Basic knowledge of Food Science.

Objective:

To acquaint the students about the types food by-products and techniques for their treatment especially from an industrial perspective.

Course Content

UNIT I (6 lectures)

Food industry By-products and Waste:

Introduction, status in India, definition, origin and type of waste and by products, their identification, classification, composition and characterization, need for treatment and utilization, impact on environment, food waste as source of biogenic raw material and energetic utilization .

UNIT II (6 lectures)

Introduction to Food Waste Treatment: Basic unit operations, techniques & equipment for treatment, primary treatments like screening, sedimentation, skimming, floatation coagulation & flocculation, flow equalization, filtration, adsorption, chemical oxidation, membrane separation, ion exchange. Anaerobic & aerobic digestion of organic wastes, activated sludge process, biomass generation & its utilization.

UNIT III (6 lectures)

Food Wastes and By-products Related to Specific Processing Industries: Like fruit and vegetables (apple, orange, mango, potato etc.), dairy industry, oil and oil seeds industry, sugar industry, grains and milling industry, fermentation (alcohol and beer), livestock and poultry, fish, meat.

UNIT IV (6 lectures)

Applications of By-product utilizationinvolving (i) utilization of whey from dairy industry, (ii) Utilization of specific plant by-products for recovery of proteins, pectins, dietary fibres, antioxidants, colorants etc. (iii) Utilization of biomass for production of animal feed, compost and bio-gas.

UNIT V (6 lectures)

Introduction to Food Packaging Waste & Handling and treatment, Farm wastes. Incineration of solid food waste and its disposal. Future Trends: Introduction to legal and statutory requirements for food waste handling, treatment and disposal.

Reference Books:

- Waste Management for the Food Industries, by Ioannis S. Arvanitoyannis, First edition 2008, Elsevier Inc, USA.
- Food and Agricultural Wastewater Utilization and Treatment, Sean X. Liu, First edition 2007 Blackwell Publishing, Iowa 50014, USA.
- Managing Food Industry Waste, ROBERT R. ZALL, First edition, 2004, Blackwell Publishing Professional, Iowa, USA.

Discipline Specific Elective Course (DSE): FFT 653 Food Rheology

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: FFT 508

Objective: To explain the basics of food rheology and to familiarize the students with rheological instruments and their use in relation to food products.

UNIT I (6 lectures)

Food rheology and structure: stress and strain tensors, viscometric properties, shear stress-shear rate relationships, units in rheological measurements, types of fluid flow behaviour, apparent viscosity, intrinsic viscosity, stress-strain behaviour of solid foods, linear viscoelasticity, phase transitions in foods.

UNIT II (6 lectures)

Flow and functional models for rheological properties of fluid foods: Time independent flow behaviour, Apparent viscosity- shear rate relationships of shear- thinning foods, models for timedependent flow behaviour, role of solids fraction in rheology of dispersions, affect of temperature on viscosity, treatment of rheological data using models.

UNIT III (6 lectures)

Tube viscometry, Rotational viscometry: introduction

UNIT IV (6 lectures)

Viscoelasticity: introduction, transient tests for viscoelasticity, oscillatory testing. Rheology of food gum and starch dispersions: effect of heating, effect of sugar and protein, rheological behaviour of starch, rheology of starch- gum dispersions.

UNIT V (6 lectures)

Rheological behaviour of processed fluid, semisolid foods and food gels: rheological tests to evaluate properties of gel systems, gel point and sol-gel transition by rheological measurements. Application of rheology to fluid food handling and processing

Learning Outcome: It is expected that the students would have learnt concepts of rheology and structure of food systems.

Reference Books:

- Bourne MC. 2002. Food Texture and Viscosity: Concept and Measurement. Academic Press
- Deman JM. et al. 1976. Rheology and Texture in Food Quality. AVI Publ.
- Mohsanin NN.1989. Physical Properties of Plant and Animal Material. Vol. I, II. Gordon and Breach Science Publ.
- Steffe JF. 1992. Rheology and Texture in Food Quality. AVI Publ.

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Discipline Specific Elective Course (DSE): FFT 659 :Advanced Food Chemistry

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Basic knowledge of Food Science.

Objective: To go beyond basic chemistry and nutrition in to advances with the aim of developing healthy and nutritious foods for normal and special category of population groups.

Course Content:

Unit I (12 lectures)

Interactions among food components and their effect on sensory, nutritional and processing quality, Natural antioxidants, mechanisms of action and their evaluation techniques, Free radical chemistry, photosensitized oxidation, metal catalyzed reactions. Antioxidants: chemistry and mechanisms of action, techniques of evaluation of antioxidant activity, uses.

Unit II (11 lectures)

Water relationships in foods: water activity and its relevance to deteriorative processes in foods (chemical, enzymic, physical and microbial changes). Glass transitions and molecular mobility in foods, their relevance to quality and stability of food products.

Unit III (12 lectures)

Fragrance and flavouring compounds: essential oils, terpenoids-oleoresins-biochemical pathways for the production of volatile compounds in specific plant species; Biological Interactions among food components and flavours, Interactions

among food flavours and packaging materials, Interactions among food additives and their significance in food processing.

Unit IV (10 lectures)

Food Carbohydrates: structural, analytical, physicochemical, nutritional and functional aspects of small mol. wt. carbohydrates and polysaccharides of plant and microbial origin.

Chemistry of alkaloids, flavonoids and other phenolics.

Learning Outcome: It is expected that the students would have learnt concepts of interactions within Food constituents.

Reference Books:

- Aurand LW, Woods A & Wells MR. 1987. Food Composition and Analysis. AVI Publ.
- Baynes JW, Monnier VM, Ames JM & Suzanne R. 2005. The Maillard Reaction: Chemistry at the
- Interface of Nutrition, Aging, and Disease Thorpe. Annals of the New York Academy of Science.
- Birch GG & Lindley MG.1986. Interactions of Food Components. Elsevier.
- Fennema OR. 1996. Food Chemistry. Marcel Dekker.
- Kumar A & Gaonkar G. 1995. Ingredient Interaction: Effect on Food Quality. Marcel Dekker.

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Discipline Specific Elective Course FFT 553: Speciality Foods

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Basic knowledge of Food Science and Nutrition at undergraduate level.

Objective:

To make students understand the need, importance and process of developing healthy and nutritious foods for special category of population groups.

Course Contents:

UNIT I (6 lectures)

Need and scope of specialty foods: Specialty food based on ease in preparation cost health benefits; Functional foods, Convenience food, Health care and medical benefits, Nutritional status, Low cost foods.

UNIT II (6 lectures)

Specialty foods based on sources; Cereals and millets, Legumes and pulses, Fruits and vegetables, Animal food sources, By product based, Non conventional foods.

UNIT III (6 lectures)

Specialty foods based on process; Innovative process technology, Food additives basis, Bioactive components, Novel nutraceuticals products, Packaging techniques, Adaptable technology basis, Fast and PET foods.

UNIT IV (5 lectures)

Specialty food based on genetics; Genetically modified foods, Transgenic foods, Biotechnological aspects of detoxification. Proprietary foods. Supplementary foods.

UNIT V (7 lectures)

Therapeutic foods; Modification of diets in disorders, feeding purposes, Disease oriented of different organs ex: digestive tract, liver, cardiovascular system, kidney, metabolic disorders, allergy, endocrine disorders.

Specific consumer oriented foods; Defence persons, Space / astronaut, High altitude mountain climbers, Disaster situation – crises, care, maintenance. Specialty foods based on growing condition -organic, inorganic farming.

Learning Outcome: After completion of course the students would have an understanding of various specialty foods and their development based on variation of sources, process and genetics.

Reference Books

- Gibson GR & William CM. 2000. Functional Foods - Concept to Product.
- Robert EC. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.
- Manson P.2001. Dietary Supplements. 2nd Ed. Pharmaceutical Press.
- Bamji MS, Rao NP & Reddy V. 2003. Textbook of Human Nutrition. Oxford & IBH.

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SEMESTER-X

Core Course: FFT 507 Packaging of Food materials

Credits: (3-0-0-3)

Level: Post Graduate

Semester: Spring

Pre-requisite: FFT 501

Objective: To acquaint the students with packaging methods, packaging materials, packaging machineries, modern packaging techniques etc.

Course Content:

UNIT I (11 lectures)

Definitions and functions of packaging and packaging materials. Packaging requirements and selection of packaging materials; Types of packaging materials: paper: pulping, fibrillation and beating, types of paper and their testing methods; Glass: composition, properties, methods of making bottles and jars; Metals: Tin plate containers, tinning process, components of tin plate, tin free steel (TFS), types of cans, aluminum containers, lacquers; Plastics: types of plastic films, laminated plastic materials, coextrusion, edible films and biodegradable plastics.

UNIT II (11 lectures)

Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation; Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods.

Different packaging systems for dehydrated foods, frozen foods, dairy foods, fresh fruits and vegetables, meat, poultry and sea foods.

UNIT III (8 lectures)

Process of Packaging: Material handling, filling, air removal, sealing, retorting, Modified atmosphere packaging, vacuum and gas packaging. Package sterilization techniques, cushioning, unitizing, palletizing, stacking and containerization.

UNIT IV (8 lectures)

Quality Control: Evaluation of Packaging materials, toxicity, corrosion prevention, shelf life testing, minimization of transport losses, Hazards in handling and storage and packaging and their minimization.

UNIT V (7 lectures)

Packaging Laws and Regulations, Standards of Weights and Measures Act, Advancement in packaging Technology: Smart packaging, Active packaging, Anti-microbial packaging etc.

Learning Outcomes: Students will have learnt about packaging materials, methods and their applications in food industry.

Reference Books:

- Coles R, McDowell D and Kirwan MJ, Food Packaging Technology, CRC Press, 2003
- Robertson GL, Food Packaging – Principles and Practice, CRC Press Taylor and Francis Group, 2012
- Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic and Professional, 1992

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Core Course FFT 508: Food Engineering

Credits: (3-1-0-4)

Level: Post Graduate

Semester: Spring

Pre-requisite: B.Sc. with Chemistry as one paper.

Objective: To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I (9 lectures)

Mass, Energy balance and Heat transfer: Steam injection, steam infusion, plate heat exchangers, tubular heat exchangers and scraped surface heat exchangers, Pasteurization: Theory and application, pasteurization of packaged and unpacked foods, pasteurization calculations, equipments. Thermal processing: Death kinetics, thermal death curve, decimal reduction time. Z-factor, heat penetration curve, process time calculations, mathematical curve, process time calculations. Mathematical and graphical solutions

UNIT II (10 lectures)

Size reduction process: Principles, theories and laws, energy considerations, equipments. Mixing and forming, theory and applications, mixing indices, equipments for solid and liquid. Separation processes: Filtration and centrifugation, theories and mathematical descriptions, constant rate and constant pressure filtration, equipment. Membrane Technology- Reverse osmosis and Ultra filtration, Micro filtration

UNIT III (4 lectures)

Fluid flow, laminar, turbulent and transitional ranges, velocity distribution profiles, basic equations, thermal velocity calculations.

UNIT IV (10 lectures)

Evaporation: heat and mass balance, steam economy, heat recovery, efficiency, process calculations,

Food dehydration: constant and falling rate periods, drying rate calculations. Chilling, refrigeration and freezing: theories, characteristics curve, cooling rate calculations.

UNIT V (12 lectures)

Advanced Technologies: Extrusion: Theory and applications, extrusion cookers and cold extrusion, single and twin screw extruders, design considerations., Supercritical gas extraction, Advances in fortification: Synthetic nutrients. Techniques of food fortification. Stability of nutrients in relation to processing. Encapsulations: design and structure of microcapsules, release rate and mechanism. Techniques of micro encapsulation, advantages and application of encapsulation. Non thermal Processing: High pressure processing, Pulsed electric processing, Ohmic heating.

Learning Outcomes: After completing the course the students shall be well acquainted about different food engineering processes and various principles working behind them.

Reference Books:

- S. K. Sharma, S.J.Mulvaney, and S.S.H.Rizvi, Food Process Engineering: Theory and Laboratory Experiments, Wiley and Sons, 2000
- H. Pandey, H.K. Sharma, R.C.Chouhan, B.C. Sarkar and M.C. Bera, Experiments in Food Process Engineering, CBS Publishers and Distributors, 2004
- M.A. Rao, S.S. H.Rizvi and A.K.Dutta, Engineering properties of Foods, 3rd ed., Marcel Dekker, 2005

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Core Course FFT 510 : Advanced Food Microbiology

Credits: (3-0-1-4)

Level: Post Graduate

Semester: Spring

Pre-requisite: Science (Biology) as a subject in Class X.

Objective: To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food.

Course Content:

UNIT I (10 lectures)

General characteristics of microorganisms: Classification and identification of yeasts, molds and groups of bacteria important in food industry. Source of contamination: Air, water, soil, sewage, post processing contamination. Intrinsic and extrinsic factors influencing growth of microorganisms in foods.

UNIT II (8 lectures)

Classification of foods and general principles involved in their preservation. Effects on microbes of: Low temperature preservation, lethal effects of chilling, freezing and thawing; high temperature preservation. Heat resistance of microorganism, heat penetration and thermal processing. Pasteurization, sterilization, canning and dehydration; chemical preservation and its toxic effects; irradiations.

UNIT III (9 lectures)

Food fermentations: Bacterial, yeast and mold cultures; single and mixed cultures, propagation, maintenance and evaluation of cultures; factors affecting activity of cultures, bacteriophages, residual antibiotics and chemicals.

UNIT IV (8 lectures)

Microbiology of fermentation: Fermented milks. Cereal foods, vinegar, oriental foods, alcoholic beverages. Therapeutic value of fermented foods. Food Biotechnology: Use of biotechnologically improved enzymes in food processing industry

UNIT V (10 lectures)

Food spoilage: Spoilage of fresh and processed fruit and vegetables, spoilage of meat, fish, eggs and poultry products. Microbial toxins.

Pathogens in foods: Microbial infections and intoxications. Growth and survival of pathogens in food.

Food borne diseases. Investigation and control

Practical:

- Determination of microbial counts: Total viable, thermophilic, proteolytic, lipolytic and aerobic spore farmers, coliform counts, yeast and mold count.
- Determination of activity of starter cultures used and dairy industry.
- Dye reduction test.
- Determination of thermal resistance of enzymes and microorganisms

Learning Outcomes: After completing the course, the students will have knowledge about different groups of micro-organisms and their beneficial as well as harmful effects related to food.

Reference Books:

- Food microbiology by V. Ramesh, MJP publishing.
- Food microbiology by W.C. Frazier, Ist Edition by Mcgraw Hill Pub. Co. New York.
- Modern Food Microbiology, J.M. Jay. CBS publisher.

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Discipline Specific Elective Course FFT 660: Processing of Fruits and Vegetables
Credits: (1-0-1-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Introduction to Food Processing

Objective: To acquaint with the proper handling technologies of fruits and vegetables to reduce post harvest losses and acquaint with principles and methods of preservation of fruits and vegetables into various products.

Course Content

UNIT I (3 lectures)

Fruits and vegetables as living products: Chemical composition; pre and post harvest changes, maturity standards for storage, desirable characteristics of fruits and vegetables of processing.

Post harvest handling of fresh fruits and vegetables: Role of plants growth regulators in relation to storage; physical and chemical treatment to increase the shelf-life, conditions for transportation and storage, disease and injuries during marketing.

UNIT II (5 lectures)

Storage of fresh fruits and vegetables. Containers: Tin, glass and other packaging materials used in fruits and vegetables preservations. Canning and bottling: quality of raw materials, preparation of materials, preparation of syrups and brines, canning and bottling, effect of canning and bottling on nutritive value, spoilage of canned foods, detection and control.

Fruit and vegetable juices: Preparation of juice, syrups, squashes, cordials, and nectars; concentrations and drying of juice, packaging and storage and concentrations and powders; fortified and soft drinks.

Preparation of preserve and candied fruits

UNIT III (2 lectures)

Preservation by freezing, general methods for freezing of fruits and vegetables; problem relating to storage of frozen products; standards for frozen food products.

Dehydration of fruits and vegetables: Methods; packaging, storage, quality control during and after dehydration.

UNIT IV (3 lectures)

Pickles and chutneys: Preparation of various types of pickles- theory and practice; preparation of sauces and chutneys; problems relating to the shelf life of pickles and chutneys; quality control.

Tomato products: preparation of various tomato products, food standards and quality control.

Pectin: Raw materials; processes and uses of pectin; products based on pectin manufacture and quality control.

UNIT V (2 lectures)

Food additives: Use in fruit and vegetable preservation.

Vinegar: General methods of preparation, food standards and quality control. Uses

Utilization of waste from fruit and vegetables processing plant.

Practical

- Analysis of canned food products for chemical and microbiological spoilage.
- Tin coating test
  - Tin coating weight measurement (Clarke's Test)

  - Determination of the continuity of tin coating
  - Sulphide stain test and corrosion resistance test
- Determination of Ascorbic acid content in food products.
- Determination of lycopene content
- Determination of tannins in food products.
- Dehydration of fruits and vegetables
- Preparation of tomato products like ketchup, puree & past
- Preparation of Jam, Jelly, marmalade, preserve and fruit candy
- Pectin determination in fruits and vegetable products.
- Determination of chemical preservatives in fruits and vegetables products.
- Preparation and analysis of fruits beverages i.e. Squash and cordial.
- Use of flame photometry in the estimation of trace metals like Sodium and Potassium

Learning Outcomes: Students would have learnt different post harvest handling methods of fruits and vegetables.

Reference Books

- Lal G, Siddapa GS & Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.
- Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.
- Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.

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Discipline Specific Elective Course (DSE): FFT 552 : Intellectual Property Rights
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Graduation in any stream.

Objective:

To sensitize the students regarding the essentials of Intellectual Property Rights, its fundamentals, legislations and significance to it in the development of agriculture, food and nutritional security.

Course Content

UNIT I (6 lectures)

Need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement.

UNIT II (7 lectures)

Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties.

UNIT III (5 lectures)

Fundamentals of patents, copyrights, geographical indications, designs and layout, trademarks.

UNIT IV (6 lectures)

Protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection;

UNIT V (6 lectures)

International Treaty on Plant Genetic; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement

Learning Outcome: The course is expected to acquaint the students with different IPR and its their importance in protecting individual rights.

Reference Books:

- Erbisch FH & Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI, Wallingford.
- Ganguli, Prabudha. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill, New Delhi.

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Elective Course FFT 554 : Fundamentals of Nutrition
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: FFT 502

Objective: To acquaint the students about importance of nutrition, balanced diets, therapeutic diets for health and role of food and nutraceuticals in health.

Course Content

UNIT I (7 lectures)

Introduction to human nutrition. Macronutrients and micronutrients - Classification and functions. Digestion, absorption and assimilation of nutrients. Energy metabolism- Components of energy expenditure, Basal Metabolic Requirements and Activity, Recommended Dietary Allowances, Food Groups, Concept of a balanced diet, Methods of evaluation of nutritive value of foods.

UNIT II (5 lectures)

Carbohydrates- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT III (5 lectures)

Proteins- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT IV (5 lectures)

Fat- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT V (8 lectures)

Vitamin- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

Minerals- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

Water and electrolytes- Concept and importance. Nutritional assessment and nutritional policies- Salient features, concept of community nutrition

Learning Outcomes: The students would be well informed about human nutrition concepts and various food groups after completing the course.

Reference books:

- Nutrition Science by B. Srilakshmi
- Fundamentals of Foods & Nutrition by Sumati R. Mudambi
- Textbook of Nutrition : A Life cycle approach by Ravinder Chadha

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Discipline Specific Elective Course (DSE): FFT 652 Food Fermentation and Microbial Technology
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Must have completed one course / paper on Microbiology / Food Microbiology.

Objective: To familiarize about the various microbial processes/systems/activities which have been used for the development of industrially important products/processes.

Course Content

Unit I (6 lectures)

Fermentation: History, definition and types. Study of a Bio fermentor – its design and operation, Down Stream Processing and Product recovery. Its measurement and control in fermentation, Aeration and agitation in fermentation: Oxygen requirement, sterilization of air and media; scale up in fermentation.

Unit II (6 lectures)

Recovery of particulate matter, product isolation, distillation, centrifugation, whole broth processing, filtration, aqueous two-phase separation, solvent extraction, chromatography and electrophoresis.

Unit III (8 lectures)

Production of alcoholic beverages, organic acids, enzymes and immobilization of enzymes. Biological waste treatment.

Unit IV (4 lectures)

Dairy Fermentations-starter cultures and their types, concept of probiotics.

Unit V (6 lectures)

Microbial enzymes, role in various industrial processes, Bio-transformations, Immobilized enzymes based bioreactors; production of antibiotics, vaccines, and biocides; Bioconversion of substrates, anti-nutritional factors present in feeds; Microbial detoxification of aflatoxins; Bioinsecticides; Biofertilizers.

Learning Outcome: The course will make the students learn about fermentation techniques and industrial microbiology.

Reference Books:

- Huffnagle GB & Wernick S. 2007. The Probiotics Revolution: The Definitive Guide to Safe, Natural Health. Bantam Books.
- Nout RMJ, de Vos WM and Zwietering MH. 2005. Food fermentation. Wageningen Academic Publishers, Netherlands.

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Skill Enhancement Course: FFT 641 Seminar
Credits: (2-0-0-2)

Revised Syllabus

M. Sc. Food Technology

Centre of Food Technology
University of Allahabad
Allahabad

Regulations for M.Sc. Degree in Food Technology

1. Eligibility for admission:

The eligibility for entry is: B.Sc. Food Technology / Agriculture/ Home Science with Chemistry/ B.Tech. (Food Tech. or Dairy Tech.) / B.Voc degree in Food Technology (NSQF Level 7) or equivalent degree

2. Duration of Programme:

The M.Sc. programme shall extend over a period of 4 consecutive semesters spread over 2 academic years – two semesters constituting one academic year. The duration of each semester shall normally be 15 - 18 weeks excluding examinations.

Eligibility to appear in end semester examination: 75% attendance is compulsory with a provision of relaxation of attendance up to 20% in a paper based on the specific recommendations of the Head of the department/ Dean in case of ill health/ Sports/ NCC/ NSS.

3. Examination and Assessment

(a) The performance of the students will be evaluated on a comprehensive system of continuous evaluation.

(b) The award list along with answer sheets of End Semester examination shall be submitted by the Course Coordinator to the Controller of Examinations for consolidation and publication of results.

(c) There shall be 40% sessional marks and 60% for the end-Semester examination in each theory paper and practical.

(d) The sessional assessment will be based on tests / assignment / presentations / quiz etc. The best two out of the three tests will be taken for computing the sessional marks.

(e) The aggregate marks of Sessional and End Semester examination of each paper shall be communicated to the Controller of Examinations.

(f) For the conduct of the Practical Examination, there shall be a Board comprising of two internal examiners.

(g) For the conduct of Project/Thesis evaluation, there shall be a Board comprising of external and internal examiners.

(h) The implementation of the evaluation process shall be monitored by the Departmental Examination Committee.

4. Assessment and evaluation:

a) Choice Based Credit System of the University of Allahabad will be adopted for assessment and evaluation.

b) The evaluation of the continuous assessment for each semester shall be made on the basis of credit hour earn by the student.

c) One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week. Accordingly, one Credit would mean equivalent of 15-18 periods of 60 minutes each or 30-36 hrs of workshops/labs.

5. Revision of Regulations and Curriculum:

The syllabi and course structure of each course shall be developed and formulated by the Programme Committee (PC) of the Centre which shall be free to modify and update the courses from time to time and to amend the Regulations. The changes made by the PC shall be reported to the higher bodies of the university.

Programme Objectives

- To develop knowledge, understanding and skills in areas of Food Technology required to work independently in research and development or equally qualified employment in food technology
- To develop ability to analyze and evaluate critically various technical solutions in the field for establishing own enterprise.
- To demonstrate an ability to acquire new knowledge in the field and to integrate this with existing knowledge.
- To develop ability to choose and design technologies for the industrial manufacture of food products and processes , with regard to raw materials, energy, economics and sustainability in the system of industrial food technology.

M.Sc in Food Technology

Course Structure

Semester	Paper Code		Title of paper	Credits			
				L	**T**	**P**	**Total (C)**
I	**FFT 501**		Principles of Food Processing	3	1	0	4
	FFT 502		Food Chemistry	3	0	1	4
	FFT 503		Instrumentation and Analytical Techniques	3	0	1	4
	FFT 504		Research Methodology and Statistics	3	1	0	4
	FFT 591		Communication Skills	1	0	1	2
	FFT 592		Basics of Computer Application	1	0	1	2
			TOTAL	**14**	**2**	**4**	**20**
II	**FFT 505**		Post Harvest Technology of Horticulture Crops	2	0	1	3
	FFT 506		Food Microbiology	3	0	1	4
	FFT 507		Packaging of Food Materials	3	0	0	3
	FFT 508		Food Engineering	3	1	0	4
	Elective- I (Any two)	**FFT 551**	Processing of Meat, Fish and Poultry Products	2	0	0	2
		FFT 552	Intellectual Property Rights				
		FFT 553	Specialty Foods				
		FFT 554	Fundamentals of Nutrition				
		FFT 557	Spices and Flavour Technology				
	FFT 593		Communication skills and Scientific writing	1	0	1	2
			TOTAL	**16**	**1**	**3**	**20**
III	**FFT 601**		Processing of Cereals, Pulses and Oilseeds	3	0	1	4
	FFT 602		Processing of Milk and Milk Products	3	0	1	4
	FFT 603		Quality Control, Food Standards and Food laws	3	0	0	3
	Elective- II (Any two)	**FFT 651**	Entrepreneurship in Food Processing	2	0	0	2
		FFT 652	Food Fermentation and Microbial Technology				
		FFT 653	Food Rheology				
		FFT 654	Food Product Development				
		FFT 655	Advanced Food Analysis	1	0	1	2
	FFT 691		Workplace Skills	1	0	1	2
	FFT 604		Training and Workshop	0	0	2	2*
	FFT 641		Seminar	0	0	1	1
			TOTAL	**14**	**0**	**6**	**20**
IV	**FFT 646**		Thesis	**0**	**0**	**20**	**20**
			Total Credits	**44**	**3**	**33**	**80**

*Non Credit Requirement

SEMESTER I

Core Course: FFT 501 Principles of Food Processing
Credits: (3-1-0-4)

Level: Post Graduate

Semester: Autumn

Pre-requisite: B.Sc. with Chemistry / Biochemistry as one of the paper/course.

Objective:
To acquaint with principles of different techniques used in processing and preservation of foods.

Course Content

UNIT I (5 lectures)
Introduction: Definition and scope of Food Science and Technology, historical development of food processing and preservation, general principles of food preservation.

UNIT II (15 lectures)
Preservation by heating: Principles of the method, Types of microorganisms, bacterial load, sterilization and commercial sterility, thermal resistance of the microorganisms and enzymes..
Canning and bottling: General aspects of canning and bottling, processing operations exhausting and sealing, retorting, ultra-high temperature processes, determination of thermal process time, processing equipments, canning/ bottling of various food products.
Chemical preservation: Preservation of foods by use of sugar, salt, chemicals and antibiotics and by smoking. Effect of various food processing operations on the nutrients of foods.

UNIT III (15 lectures)
Refrigeration and freezing preservation: Refrigeration and storage of fresh foods, major requirements of a refrigeration plant, controlled atmospheric storage, refrigerated storage of various foods, freezing point of selected foods, influence of freezing and freezing rate of the quality of food products, methods of freezing, storage and thawing of frozen foods.

UNIT IV (13 lectures)
Drying and dehydrations: Sun drying of various foods, water activity and its effect on the keeping quality, sorption isotherms and their use. Characteristics of food substances related to their dehydration behavior, drying phenomenon, factors affecting rate of drying, methods of drying of various food products, type of driers and their suitability for different foods; intermediate moisture foods.
Concentration (Evaporation): Application in food industry, processes and equipment for manufacture of various concentrated foods and their keeping quality, Properties of liquid, single and multiple effect evaporation,

UNIT V (12 lectures)
Radiations: Sources of radiations, effect on microorganisms and different nutrients; Radiation units and doses for foods, dose requirements for radiation preservation of foods, safe limits, irradiation mechanism and survival curve, irradiation of packaging materials. Microwave Heating: Principles and application in food processing.

Learning Outcomes: The students will have knowledge about different processing and preservation methods and principles involved.

Reference Books

- Food Processing Technology by P.J. Fellows, Woodhead publishing ltd.
- Food Science by N.N. Potter, CBS publishing.
- Physical principles of Food Preservation. Vol. II by M. Karel, O.R. Fenema and D.B. Lurd, Maroel, Dekker Inc. New York.

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Core Course: FFT 502 Food Chemistry
Credits: (3-0-2-4)

Level: Post Graduate

Semester: Autumn

Pre-requisite: B.Sc. with Chemistry as one paper / course.

Objective: To acquaint with properties and role of various constituents in foods, interaction and changes during processing.

Course Content

UNIT I (4 lectures)
Water: properties, bonding and chemistry.

UNIT II (8 lectures)
Carbohydrates: Classification, structure and properties of carbohydrates. Role of carbohydrates in food industry. Sugar, starch, cellulose, glucans, hemicelluloses, gums, pectic substances, polysaccharides. Browning reaction in foods: Enzymatic and non-enzymatic browning in foods of vegetable and animal origin during storage and processing of foods.

UNIT III (12 lectures)
Proteins: Classification, structure, properties, purification and denaturation of proteins. Protein interaction and degradation, protein-protein interaction, protein-lipid complexes and protein-carbohydrate complex. Major protein systems and factors affecting them, the nature of interaction in proteins derived from milk. Egg proteins, meat proteins, fish muscle proteins, oil seed proteins and cereal proteins.
Enzymes: Nature, classification and properties of food enzyme, enzyme activity in different food systems, commercial availability. Food enzyme technology. Immobilization of enzymes, removal of toxicants through enzymes, flavor production by enzymes.

UNIT IV (10 lectures)
Lipids: Classification and physico-chemical properties of food lipids. Refining of crude oils, hydrogenation and winterization. Vegetable and animal fat, margarine, lard, butter. Frying and shortening. Flavor changes in fats and oils, lipid oxidation, factors affecting lipid oxidation, auto-oxidation, biological significance of auto-oxidation of lipids.

UNIT V (11 lectures)
Vitamins: Role of vitamins in food industry, effect of various processing treatments and fortification of foods. Minerals: Role of minerals in food industry, effects of various processing treatments.
Biological changes in foods: Plant pigments and their roles in food industry. Bitter substance and tannins. Flavour Composition of Foods and beverages. Emulsion: Definition, Theory, Emulsifiers: Properties, role & action in stabilizing an emulsion.

Practical

- Preparation of standard solutions for the chemical analysis i.e. HCl, H_2SO_4, $KmnO_4$, Sodium Thiosulphate and Iodine.
- Determination of pH and acidity of foods
- Determination of proximate composition of Foods: Moisture, Protein, Fat, Total ash, Crude fibre, Carbohydrate, Calorific Value
- Determination of minerals in food products: Calcium by Titration, Phosphorus by Spectrophotometer, Iron by Spectrophotometer
- Estimation of reducing, non-reducing, total sugars in cereals and fruits & vegetable products.
- Determination of starch content in food products.
- Estimation of fats & Oils: Free fatty acid, Peroxide value, Saponification value, RM Number, TBA test, Iodine value, Fat adulteration test
- Determination of NaCl content in food products.
- Determination of trypsin inhibitors.

Learning Outcome: The students will gain information about various food constituents, and changes that occur in them during food processing.

Reference Books

- Belitz HD.1999. Food Chemistry. Springer Verlag.
- DeMan JM. 1976. Principles of Food Chemistry. AVI.
- Fennema OR.1996. Food Chemistry. Marcel Dekker.
- Meyer LH. 1987. Food Chemistry. CBS

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Core Course: FFT 503 Instrumentation and Analytical Techniques
Credits: (3-0-2-4)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Graduation in any stream of science.

Objective: To develop an understanding and methodologies of instrumental techniques in food analysis used for objective methods of food quality parameters.

Course Content

UNIT I (3 lectures)
Preparation of chemical solutions: Concept of molar, molal, and normal solutions. pH and Buffers: Importance and measurement of pH.

UNIT II (8 lectures)
Chromatographic techniques: General principles. Partition and adsorption chromatography. Paper, thin layer, gas liquid, ion exchange and affinity chromatography. Gel filtration. Introduction to High Pressure Liquid Chromatography.

UNIT III (5 lectures)
Electrophoretic Techniques: General principles. Paper and gel electrophoresis. Polyacrylamide gel electrophoresis.

UNIT IV (8 lectures)
Spectroscopy: Beers and Lambert's Law. Extinction coefficient. General principles of colorimeters and spectrophotometers, Atomic spectroscopy, Emmission spectroscopy, IR spectroscopy.

UNIT V (6 lectures)
Flourimetry: Spectroflourometers. Flame photometry and atomic absorption spectrophotometry.
Use of radioisotopes. Microbiological assays. Microscopy

Practical

- Qualitative analysis of compounds by chromatography techniques: Thin layer Chromatography, Paper Chromatography: Descending, Ascending and Circular Paper chromatography.
- Qualitative analysis of compounds By using High Performance Liquid Chromatography.
- Column chromatography: Separation of beta carotene
- Use of electrophoresis in the determination of proteins.
- Determination of Rheological properties by using texture analyzer.

Learning Outcome: Students will get acquainted with analytical methods used for quality control analysis of raw material and processed food commodities.

Reference Books

- Hand Book of Food Analysis by Nollet & Toldra, CRC publishing ltd.
- Hand Book of Analysis & Quality Control for Fruit & Vegetable Products by Rangana, Tata Mcgraw hill publishing.
- Introduction to the chemical analysis of foods by Nielson, CBS publishing.

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Core Course FFT 504 : Research Methodology and Statistics
Credits: (3-1-0-4)

Level: Post Graduate
Semester: Spring
Pre-requisite: Basic knowledge of mathematics
Objective:
The students will be exposed to various statistical tools required to analyze the experimental data in Food Technology.
Course Content
UNIT I 11 lectures
Introduction to Research; Types of Research: (Basic & Applied) and their applications. Formulating a Research Problem; Research Design: Definition, Characteristics & Components. Research Questions, Objectives & Assumptions. Generation of Hypothesis. Data Collection: Tools, Primary & Secondary methods of Data collection.

UNIT II 12 lectures

Sampling methods: Rationale & Characteristics. Types of Sampling: Probability & Non-probability sampling. General consideration in and Scaling Techniques. Consideration and Calculation of Sample Size.
Data management & Analytics: Editing & Coding of Data, Tabulation & Graphical Representation of Research Data using MS Excel & Statistical software.

UNIT III 10 lectures

Design of Experiments (DOE): Applications of Randomized Block Design (RBD) and its types, Factorial Design, Fractional Factorial Design, Latin Square Design (LSD), Critical Difference (CD), Split Plot Design.

UNIT IV 15 lectures

Descriptive Statistics: Measures of Central Tendency – (Mean, Mode, and Mode for Grouped and Ungrouped Data). Measures of Variability – Range, Variance, Standard Deviation and Standard Error. Measures of Relative Positions - Sigma Scores, Standard Scores, Percentiles, Percentile Ranks. Measures of Relationships (Correlation and Regression Analysis). Normal Distribution & its applications; Measures of Shape – (Skewness, Kurtosis). Calculations and Interpretation of Statistical Procedures

UNIT V 12 lectures

Hypothesis Testing in Research: Confidence Intervals and Levels of Significance. Degrees of Freedom Tests of Significance . Parametric Tests – Z-test, t-Test, and F-test, ANOVA (One way & Two Way) . Non-Parametric Tests – Chi-Square. Calculations and Interpretation of Parametric and Non-Parametric Tests – use of statistical software.

Learning Outcomes: The students are expected to have learnt statistical tools for analyzing data.

Reference Books

- Jackson SL. 2012. Research Methods and Statistics: A Critical Thinking Approach. Fourth Edition. Wadsworth Cengage Learning.
- Krishnan V. 2011. Statistics for Beginners. Atlantic Publishers and Distributors (P) Ltd.
- Singh YK. 2006. Fundamentals of Research Methodology and Statistics. New Age International Publishers.
- Aggarwal BL. 2003. Basic Statistics. New Age.
- Kothari CR. 1989. Research Methodology. Wiley Eastern.
- Gupta SP. 2004. Statistical Methods. S. Chand & Sons.

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Foundation Course: FFT 591 Communication Skills
Credits: (1-0-2-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: English as a subject at secondary level.

Objective: To equip the students with skills to write, communicate and articulate in English (verbal as well as written).

Course Content

Unit I 2 lectures

Introduction to communication – Definition, Purpose, Basic communication model, need for effective communication, process & barriers to communication

Unit II 4 lectures

Grammar - Noun, Articles, Adjective & Degrees of comparisons, Preposition, Subject-verb agreement, Present, past & future Tense, Modals & Moods, Active & passive voice, Reported speech

Unit III 4 lectures

Oral Communication –Identification of sounds (Phonetics), Consonant & Vowel sounds, Indianism, Syllable & Syllable Stress, Intonation & modulation, Word stress, Development of Speaking Skills

Unit IV 3 lectures

Written Communication –Formal & informal letter writing, Introduction to Essay writing,

Unit V 2 lectures

Vocabulary building - Learning new words, Synonyms, Antonyms, use of suffix/prefix.

Practical:

- Ice breaker session
- creating new words
- exercise on picture description
- story completion
- oral practice of vowel sounds and syllable stress (phonetics)
- Comprehension Practical
- Dictionary Quiz
- Paragraph writing
- Vocabulary building exercises
- Paragraph Reading

Learning Outcomes: The students are expected to be able to communicate effectively in English after completing the course.

Reference books:

- English Grammar Composition & Usage. J C Nesfield
- Essential Grammar in Use, Raymond Murphy, Cambridge
- Oxford English Grammar , Sidney Greenbaum, Oxford University Press

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Foundation Course FFT 592: Basics of Computer Application

Credits: (1-0-2-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Graduation in any stream.

Objective: To educate students about the basic use, applications and web applications so as to facilitate learning**.**

Course Content

UNIT I (2 lectures)
Introduction to Computer (Hardware / Software) (2 lectures)
UNIT II
Microsoft Word and its applications (Documentation and Formatting) (4 lectures)
UNIT III
MS Excel and its applications (Making Tabular data, charts & formatting, Use of general functions & formulae) (4 lectures)
UNIT IV
MS PowerPoint and its applications (Creating own design, design & formatting of a presentation, Use of Image, audio, video in the presentation) (3 lectures)
UNIT V
Use of Internet & Web Applications and Email Services, Industry customer approach.

Practical

- Basics of Computers, usage of short cut keys, taking out print outs, page set ups.
- Making of Power point Presentation
- E- Mail (Subject line, salutation, subscription, how to mark cc, drafting, sending of mails, reverts, forwarding of mails, attaching pictures and documents, attaching ppts
- Differentiation between hardware and software and practical usage of both.
- Diagrammatic representation of pie-charts, tabular presentation of data/info, Etc
- Basic use of MS Excel/Spread Sheets

Learning Outcomes: Learning of basic computer applications and use of web services will be completed after studying the course.

Reference Books

- Fundamentals of Computers by E. Balagurusamy (Author) Publisher: McGraw Hill Education (India) Private Limited
- Ms Office 2007 in a Nutshell by S. Saxena (Author) Publisher: S.Chand (G/L) & Company Ltd

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SEMESTER II

Core Course: FFT 505 Post Harvest Technology of Horticultural Crops

Credits: (2-0-2-3)

Level: Post Graduate

Semester: Spring

Pre-requisite: FFT 501

Objective: To acquaint with the proper handling technologies of fruits and vegetables to reduce post harvest losses and acquaint with principles and methods of preservation of fruits and vegetables into various products.

Course Content

UNIT I (4 lectures)

Fruits and vegetables as living products: Chemical composition; pre and post harvest changes, maturity standards for storage, desirable characteristics of fruits and vegetables of processing.

Post harvest handling of fresh fruits and vegetables: Role of plants growth regulators in relation to storage; physical and chemical treatment to increase the shelf-life, conditions for transportation and storage, disease and injuries during marketing.

UNIT II (8 lectures)

Storage of fresh fruits and vegetables. Containers: Tin, glass and other packaging materials used in fruits and vegetables preservations. Canning and bottling: quality of raw materials, preparation of materials, preparation of syrups and brines, canning and bottling, effect of canning and bottling on nutritive value, spoilage of canned foods, detection and control.

Fruit and vegetable juices: Preparation of juice, syrups, squashes, cordials, and nectars; concentrations and drying of juice, packaging and storage and concentrations and powders; fortified and soft drinks.

Preparation of preserve and candied fruits

UNIT III (4 lectures)

Preservation by freezing, general methods for freezing of fruits and vegetables; problem relating to storage of frozen products; standards for frozen food products.

Dehydration of fruits and vegetables: Methods; packaging, storage, quality control during and after dehydration.

UNIT IV (8 lectures)

Pickles and chutneys: Preparation of various types of pickles- theory and practice; preparation of sauces and chutneys; problems relating to the shelf life of pickles and chutneys; quality control.

Tomato products: preparation of various tomato products, food standards and quality control.

Pectin: Raw materials; processes and uses of pectin; products based on pectin manufacture and quality control.

UNIT V (6 lectures)

Food additives: Use in fruit and vegetable preservation.

Vinegar: General methods of preparation, food standards and quality control. Uses

Utilization of waste from fruit and vegetables processing plant.

Practical

- Analysis of canned food products for chemical and microbiological spoilage.
- Tin coating test
  - Tin coating weight measurement (Clarke's Test)
  - Determination of the continuity of tin coating
  - Sulphide stain test and corrosion resistance test
- Determination of Ascorbic acid content in food products.
- Determination of lycopene content
- Determination of tannins in food products.
- Dehydration of fruits and vegetables
- Preparation of tomato products like ketchup, puree & past

- Preparation of Jam, Jelly, marmalade, preserve and fruit candy
- Pectin determination in fruits and vegetable products.
- Determination of chemical preservatives in fruits and vegetables products.
- Preparation and analysis of fruits beverages i.e. Squash and cordial.
- Use of flame photometry in the estimation of trace metals like Sodium and Potassium

Learning Outcomes: Students would have learnt different post harvest handling methods of fruits and vegetables.

Reference Books

- Lal G, Siddapa GS & Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.
- Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.
- Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.

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Core Course FFT 506 : Food Microbiology
Credits: (3-0-2-4)

Level: Post Graduate

Semester: Spring

Pre-requisite: Science (Biology) as a subject in Class X.

Objective: To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food.

Course Content

UNIT I (10 lectures)
General characteristics of microorganisms: Classification and identification of yeasts, molds and groups of bacteria important in food industry. Source of contamination: Air, water, soil, sewage, post processing contamination. Intrinsic and extrinsic factors influencing growth of microorganisms in foods.

UNIT II (8 lectures)
Classification of foods and general principles involved in their preservation. Effects on microbes of: Low temperature preservation, lethal effects of chilling, freezing and thawing; high temperature preservation. Heat resistance of microorganism, heat penetration and thermal processing. Pasteurization, sterilization, canning and dehydration; chemical preservation and its toxic effects; irradiations.

UNIT III (9 lectures)
Food fermentations: Bacterial, yeast and mold cultures; single and mixed cultures, propagation, maintenance and evaluation of cultures; factors affecting activity of cultures, bacteriophages, residual antibiotics and chemicals.

UNIT IV (8 lectures)
Microbiology of fermentation: Fermented milks. Cereal foods, vinegar, oriental foods, alcoholic beverages. Therapeutic value of fermented foods. Food Biotechnology: Use of biotechnologically improved enzymes in food processing industry

UNIT V (10 lectures)
Food spoilage: Spoilage of fresh and processed fruit and vegetables, spoilage of meat, fish, eggs and poultry products. Microbial toxins.
Pathogens in foods: Microbial infections and intoxications. Growth and survival of pathogens in food.
Food borne diseases. Investigation and control

FFT 605 Food Microbiology Practical

- Determination of microbial counts: Total viable, thermophilic, proteolytic, lipolytic and aerobic spore farmers, coliform counts, yeast and mold count.
- Determination of activity of starter cultures used and dairy industry.
- Dye reduction test.
- Determination of thermal resistance of enzymes and microorganisms

Learning Outcomes: After completing the course, the students will have knowledge about different groups of micro-organisms and their beneficial as well as harmful effects related to food.

Reference Books

- Food microbiology by V. Ramesh, MJP publishing.

- Food microbiology by W.C. Frazier, Ist Edition by Mcgraw Hill Pub. Co. New York.
- Modern Food Microbiology, J.M. Jay. CBS publisher.

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Core Course: **FFT 507 Packaging of Food materials**

Credits: (3-0-0-3)

Level: Post Graduate

Semester: Spring

Pre-requisite: FFT 501

Objective: To acquaint the students with packaging methods, packaging materials, packaging machineries, modern packaging techniques etc.

Course Content

UNIT I (11 lectures)
Definitions and functions of packaging and packaging materials. Packaging requirements and selection of packaging materials; Types of packaging materials: paper: pulping, fibrillation and beating, types of paper and their testing methods; Glass: composition, properties, methods of making bottles and jars; Metals: Tin plate containers, tinning process, components of tin plate, tin free steel (TFS), types of cans, aluminum containers, lacquers; Plastics: types of plastic films, laminated plastic materials, coextrusion, edible films and biodegradable plastics.

UNIT II (11 lectures)
Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation; Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods.
Different packaging systems for dehydrated foods, frozen foods, dairy foods, fresh fruits and vegetables, meat, poultry and sea foods.

UNIT III (8 lectures)
Process of Packaging: Material handling, filling, air removal, sealing, retorting, Modified atmosphere packaging, vacuum and gas packaging. Package sterilization techniques, cushioning, unitizing, palletizing, stacking and containerization.

UNIT IV (8 lectures)
Quality Control: Evaluation of Packaging materials, toxicity, corrosion prevention, shelf life testing, minimization of transport losses, Hazards in handling and storage and packaging and their minimization.

UNIT V (7 lectures)
Packaging Laws and Regulations, Standards of Weights and Measures Act, Advancement in packaging Technology: Smart packaging, Active packaging, Anti-microbial packaging etc.

Learning Outcomes: Students will have learnt about packaging materials, methods and their applications in food industry.

Reference Books

- Coles R, McDowell D and Kirwan MJ, Food Packaging Technology, CRC Press, 2003
- Robertson GL, Food Packaging – Principles and Practice, CRC Press Taylor and Francis Group, 2012
- Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic and Professional, 1992

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Core Course FFT 508: Food Engineering

Credits: (3-1-0-4)

Level: Post Graduate

Semester: Spring

Pre-requisite: B.Sc. with Chemistry as one paper.

Objective: To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I (9 lectures)

Mass, Energy balance and Heat transfer: Steam injection, steam infusion, plate heat exchangers, tubular heat exchangers and scraped surface heat exchangers, Pasteurization: Theory and application, pasteurization of packaged and unpacked foods, pasteurization calculations, equipments. Thermal processing: Death kinetics, thermal death curve, decimal reduction time. Z-factor, heat penetration curve, process time calculations, mathematical curve, process time calculations. Mathematical and graphical solutions

UNIT II (10 lectures)

Size reduction process: Principles, theories and laws, energy considerations, equipments. Mixing and forming, theory and applications, mixing indices, equipments for solid and liquid. Separation processes: Filtration and centrifugation, theories and mathematical descriptions, constant rate and constant pressure filtration, equipment. Membrane Technology- Reverse osmosis and Ultra filtration, Micro filtration

UNIT III (4 lectures)

Fluid flow, laminar, turbulent and transitional ranges, velocity distribution profiles, basic equations, thermal velocity calculations.

UNIT IV (10 lectures)

Evaporation: heat and mass balance, steam economy, heat recovery, efficiency, process calculations,
Food dehydration: constant and falling rate periods, drying rate calculations. Chilling, refrigeration and freezing: theories, characteristics curve, cooling rate calculations.

UNIT V (12 lectures)

Advanced Technologies: Extrusion: Theory and applications, extrusion cookers and cold extrusion, single and twin screw extruders, design considerations., Supercritical gas extraction, Advances in fortification: Synthetic nutrients. Techniques of food fortification. Stability of nutrients in relation to processing. Encapsulations: design and structure of microcapsules, release rate and mechanism. Techniques of micro encapsulation, advantages and application of encapsulation. Non thermal Processing: High pressure processing, Pulsed electric processing, Ohmic heating.

Learning Outcomes: After completing the course the students shall be well acquainted about different food engineering processes and various principles working behind them.

Reference Books

- S. K. Sharma, S.J.Mulvaney, and S.S.H.Rizvi, Food Process Engineering: Theory and Laboratory Experiments, Wiley and Sons, 2000
- H. Pandey, H.K. Sharma, R.C.Chouhan, B.C. Sarkar and M.C. Bera, Experiments in Food Process Engineering, CBS Publishers and Distributors, 2004
- M.A. Rao, S.S. H.Rizvi and A.K.Dutta, Engineering properties of Foods, 3rd ed., Marcel Dekker, 2005

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Elective Course FFT 551 : Technology of Meat and meat Products

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Graduate in Science and must have completed a course Food Science / Food Chemistry.

Objective: To provide an understanding of the technology for handling, processing, preservation and bi-product utilization of meat, poultry and fish products processing.

Course Content

UNIT I (8 lectures)

Scope of meat & meat products industry in India. Structure of meat tissue. Chemical composition and nutritive value of meat Mechanism of muscle contraction and relaxation.
Postmortem changes-factor affecting post-mortem changes, thaw rigor and cold shortening Properties of fresh meat. Meat carcass grading and cuts. Restructured meat products, Pre rigor processing of meat. Meat tenderization -and its techniques.

UNIT II (6 lectures)

Preservation of meat & poultry- chilling, freezing, curing, smoking, canning, dehydration, irradiation, freeze drying, antibiotics, microwave, chemicals

UNIT III (2 lectures)
Utilization of meat industry by-products.
UNIT IV (10 lectures)
Eggs - structure, composition, nutritive value and functional properties of eggs. Internal quality of eggs- evaluation, quality troubleshooters in eggs, egg grading. Preservation and maintenance of internal quality of eggs, Egg products-Egg powders, frozen eggs, egg foams, factors influencing foaming.
Poultry -types, factors affecting quality, chemical composition and nutritive value of poultry meat
Poultry dressing - ante and postmortem examination, methods of stunning, slaughter, scalding & dressing. Tenderness of poultry, problem factors in poultry meat. Utilization of poultry industry by-products.
UNIT V (4 lectures)
Fish structure and composition. Cold storage, freezing preservation and canning of fish. Picking of fish, fish protein concentrates, fish meal and by products of fish processing industry

Learning Outcome: Students will have learnt about chemistry of meat and various processing methods used for meat, fish, poultry and eggs.

Reference Books

- Govindan TK. 1985. Fish Processing Technology. Oxford & IBH.
- Hui YH. 2001. Meat Science and Applications. Marcel Dekker. 32
- Kerry J. et al. 2002. Meat Processing. Woodhead Publ. CRC Press.
- Pearson AM & Gillett TA. 1996. Processed Meat. 3rd Ed. Chapman & Hall.

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Elective Course FFT 552 : Intellectual Property Rights

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Graduation in any stream.

Objective:

To sensitize the students regarding the essentials of Intellectual Property Rights, its fundamentals, legislations and significance to it in the development of agriculture, food and nutritional security.

Course Content

UNIT I (6 lectures)
Need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement.

UNIT II (7 lectures)
Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties.

UNIT III (5 lectures)
Fundamentals of patents, copyrights, geographical indications, designs and layout, trademarks.

UNIT IV (6 lectures)
Protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection;

UNIT V (6 lectures)
International Treaty on Plant Genetic; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement

Learning Outcome: The course is expected to acquaint the students with different IPR and its their importance in protecting individual rights.

Reference Books

- Erbisch FH & Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI, Wallingford.
- Ganguli, Prabudha. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill, New Delhi.

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Elective Course FFT 553 : Specialty Foods
Credits: (2-0-0-2)

Level: Post Graduate
Semester: Spring

Pre-requisite: Basic knowledge of Food Science and Nutrition at undergraduate level.

Objective:
To make students understand the need, importance and process of developing healthy and nutritious foods for special category of population groups.

Course Contents

UNIT I (6 lectures)
Need and scope of specialty foods: Specialty food based on ease in preparation cost health benefits; Functional foods, Convenience food, Health care and medical benefits, Nutritional status, Low cost foods.

UNIT II (6 lectures)
Specialty foods based on sources; Cereals and millets, Legumes and pulses, Fruits and vegetables, Animal food sources, By product based, Non conventional foods.

UNIT III (6 lectures)
Specialty foods based on process; Innovative process technology, Food additives basis, Bioactive components, Novel nutraceuticals products, Packaging techniques, Adaptable technology basis, Fast and PET foods.

UNIT IV (5 lectures)
Specialty food based on genetics; Genetically modified foods, Transgenic foods, Biotechnological aspects of detoxification. Proprietary foods. Supplementary foods.

UNIT V (7 lectures)
Therapeutic foods; Modification of diets in disorders, feeding purposes, Disease oriented of different organs ex: digestive tract, liver, cardiovascular system, kidney, metabolic disorders, allergy, endocrine disorders.

Specific consumer oriented foods; Defence persons, Space / astronaut, High altitude mountain climbers, Disaster situation – crises, care, maintenance. Specialty foods based on growing condition -organic, inorganic farming.

Learning Outcome: After completion of course the students would have an understanding of various specialty foods and their development based on variation of sources, process and genetics.

Reference Books

- Gibson GR & William CM. 2000. *Functional Foods - Concept to Product.*
- Robert EC. 2006. *Handbook of Nutraceuticals and Functional Foods*. 2nd Ed. Wildman.
- Manson P.2001. Dietary Supplements. 2nd Ed. Pharmaceutical Press.
- Bamji MS, Rao NP & Reddy V. 2003. Textbook of Human Nutrition. Oxford & IBH.

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Elective Course FFT 554 : Fundamentals of Nutrition

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: FFT 502

Objective: To acquaint the students about importance of nutrition, balanced diets, therapeutic diets for health and role of food and nutraceuticals in health.

Course Content

UNIT I (7 lectures)
Introduction to human nutrition. Macronutrients and micronutrients - Classification and functions. Digestion, absorption and assimilation of nutrients. Energy metabolism- Components of energy expenditure, Basal Metabolic Requirements and Activity, Recommended Dietary Allowances, Food Groups, Concept of a balanced diet, Methods of evaluation of nutritive value of foods.

UNIT II (5 lectures)
Carbohydrates- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT III (5 lectures)

Proteins- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT IV (5 lectures)

Fat- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT V (8 lectures)

Vitamin- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

Minerals- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

Water and electrolytes- Concept and importance. Nutritional assessment and nutritional policies- Salient features, concept of community nutrition

Learning Outcomes: The students would be well informed about human nutrition concepts and various food groups after completing the course.

Reference books

- Nutrition Science by B. Srilakshmi
- Fundamentals of Foods & Nutrition by Sumati R. Mudambi
- Textbook of Nutrition : A Life cycle approach by Ravinder Chadha

Elective Course: FFT 557 Spices and Flavour Technology
Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: FFT 502.

Objective: To impart basic knowledge about the importance and production technology of spices and to know chemistry and physiology of taste, flavouring compounds in foods

Course Content

Unit I (5 lectures)

Spice processing Introduction, classification, composition and functions. Standards specification of spices and flavours, Spice processing, spice reconditioning, spice grinding, post- processing treatments.

Unit II (7 lectures)

Processing of Major Spices: Pepper, cardamom, ginger, onion, garlic, vanilla, cinnamon, chilli and turmeric – method of manufacture; chemistry of the volatiles; enzymatic synthesis of flavour identical.

Unit III (5 lectures)

Processing of Minor Spices, herbs and leafy vegetables: processing and utilization, All spice, Annie seed, sweet Basil, Caraway seed, Cassia, Cinnamon, Clove, Coriander, cumin, Dill seed Fern seed nutmeg mint marjoram, Rose merry, saffron, sage.

Unit IV (5 lectures)

Spice extractives, Value added spice products: Spice volatile oils, spice oleoresins, Use of spice extractives, replacement of spices with oils and oleoresins, alternative products, Ground spices, processed spices, organic spices, curry powders.Packaging of spices and spice products

Unit V (8 lectures)

Chemistry and physiology of taste, flavouring compounds in foods, Separation, purification and identification of natural flavouring materials& Synthetic flavouring agents and their stability: Processing quality control of Savory, Thyme, Ajowan, Curry leaves, Asafoctida, Tea, Coffee, Cocoa, Vanilla and annatto. Flavours of soft drinks, Baking and confectionery industry.

Learning Outcomes: The students are expected to have learnt importance and production technology of spices and flavours.

Reference Books:

- Spices – vol. II Parry J. W.
- Spice and condiments Pruthi J. S.
- Herbs and spices by Rosemery Hemphill
- The book of spices by Rosen garten, F. and Livington Jr.
- Spices and herbs for the Food Inudstry by Lewies, Y.S.
- Spices Vol. I and II by Tropical Agril. Series. Purseglove, J. W. Brown E. G.,

- Green C. L. And Robbins SRJ. Food Flavourings P. R. Ashust.
- Food Flavouring composition,manafacture and uses. by J. Merrory

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Foundation Course: FFT 593 Communication Skills & Scientific Writing

Credits: (1-0-2-2)

Level: Post Graduate

Semester: Spring

Pre-requisite: Knowledge of basics of communication skills.

Objective:

To educate the students about kinds of communication, enhance their vocabulary and teach them types of formal writing used in academic research.

Course Content

Unit I 3 lectures

Advance Communication- Types of communication, Mass Communication, Levels of professional communication, Role of newspapers, radio, Cinema and TV, role of social media and networking

Unit II 2 lectures

Audio Visual Communication – Nature and scope of visual aids, use of Power Presentations in professional life

Unit III 3 lectures

Grammar usage and Word power – Phrase and Clauses, Idioms, Proverbs, Homophones, Homonyms, Reading and Comprehension.

Un**it IV** 2 lectures

Advance writing skills – Movie review, Book review

Unit V 5 lectures

Scientific Writing – Introduction to Technical writing, definition, types, characteristics, Report Writing, CV & Resume making, plagiarism

Practical:

- Sentence framing exercises - revision
- Writing descriptive paragraphs
- Dictionary consulting activities-Spell bee,
- Role Plays
- Movie viewing Sessions
- Book Reading sessions
- Impromptu Presentations
- Listening Practice
- Creating audio visual (AVs) using photographs
- Reading Scientific Texts
- Outlining a research

Learning Outcome: The course would have equipped the students with advance communication skills and basics of technical writing.

Reference Books

- Test your English Vocabulary in use, Michael McCarthy, Felicity O'Dell, Cambridge
- Wren &Martin, High School English Grammar and Composition, S.Chand, Paperback, 2005
- Oxford English Grammar Use, Micheal Swan & Catheirne Walter, Oxford University Press
- Using English in Science & Technology, Singh, R.K., Prakash Book Depot, Bareilly, 2000.

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SEMESTER III

Core Course FFT 601 : Processing of Cereals, Pulses and Oilseeds

Credits: (3-0-2-4)

Level: Post Graduate

Semester: Autumn

Pre-requisite: FFT 501 and FFT 502

Objective: To acquaint with production and consumption trends, structure, composition, quality evaluation, and processing technologies for product development and value addition of various cereals, pulses and oilseeds.

Course Contents:

UNIT I (8 lectures)
Wheat Technology: Composition of grain and environmental effects on its processing quality, enzymes of wheat and their role in the manufacture of wheat products; principles of wheat milling and its effect on composition of flour, aging of flour, byproducts, chemical improvers- bleaching and maturing agents, property of dough and its rheology, manufacture of wheat products bread, biscuits etc.; formulation of premixes for bakery products; pasta goods and processed cereal foods for infants.

UNIT II (10 lectures)
Rice Technology: Composition, type of proteins, starch content, amylose and amylopectin fractions; presence and effect of lipases; distribution of vitamins; minerals, and proteins in rice grain and its relation to milling; rice milling operations and its effect on nutritive value; cooking quality; byproducts of rice milling and their utilization; processed and prepared mixes based on rice.

UNIT III (8 lectures)
Legumes: Composition, anti-nutritional factors, processing methods, methods of cooking.

UNIT IV (10 lectures)
Corn Technology: Composition, processing of corn for manufacture of corn grits, meal and flour; manufacture of corn flakes, corn syrup, cornstarch, corn steep liquor, corn oil and canned corn.Composition and Processing of millets like barley, sorghum, oats etc.

UNIT V (9 lectures)
Oilseeds: Composition, processing of oilseeds as protein concentrations, properties and uses of oilseeds meals, technology vegetable protein isolates; Barrier compounds in the utilization of oil seed proteins. Low cost protein foods from oilseeds.

Practical

- Physico-chemical and rheological examination of wheat and its products test weight, kernel hardness, gluten content, milling tests.
- Evaluation of rice amylose and amylopectin determination, geletinization temperature, water absorption tests.
- Experimental parboiling and assessment of degree of polishing.
- Experimental baking of selected cereals products bread, biscuits.
- Preparation of protein concentrates and isolates and their evaluation for protein content and solubility.
- Determination of Yeast activity used in fermented cereal products.
- Quality test for wheat flour used in the baked products.
    - Maltose Number
    - Water Absorption
    - Sedimentation value
    - Alcohol Acidity
- Texture profile analysis of baked cereal food products by texture analyzer.

Learning Outcome: The students will have learnt about composition and processing of various cereals, pulses and oilseeds.

Reference Books

- Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.
- Dendy DAV & Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
- Hamilton RJ & Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.
- Hoseney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed. AACC.

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Core Course FFT 602 : Processing of Milk and Milk Products
Credits: (3-0-2-4)

Level: Post Graduate
Semester: Autumn

Pre-requisite: FFT 501

Objective: To acquaint with techniques and technologies of testing and processing of milk into various products and by products.

Course Contents:

UNIT I (12 lectures)

Introduction: Physicochemical properties of milk, Platform tests, Chemical composition and nutritive value of milk, Factors affecting composition of milk. Importance of milk industry in India: Collection, chilling, transportation, cream separation, standardization, pasteurization, sterilization, homogenization, packaging, storage and distribution of fluid milk, Ultrahigh temperature processed milk.

Preparation of various types of milks: Toned, homogenized, fortified, reconstituted and flavored milk.

UNIT II (12 lectures)

Technology of fermented milk products: Principles and practices of manufacture, packaging, storage and marketing of Dahi, cultured butter milk, acidophilus milk etc. Preparation of soft curd milk, vitaminized milk, standardized milk, filled milk and imitation milk.

Cheese: Manufacture of hard, semi hard, soft and processed cheeses. Storage, grading and marketing of cheese, cheese defects and their control. Butter: Manufacture, packaging, storage and marketing of butter; butter defects and their control, margarine.

UNIT III (8 lectures)

Technology of frozen milk products: Classification, manufacture, packaging, storage and marketing of ice cream, ices, sherbets etc. defects of frozen products and their control. Technology of evaporated and dried milk: Manufacture of evaporated milks and milk powders. Packaging storage defects and their control.

Technology of condensed milk: Manufacture of condensed milks, Packaging storage defects and their control.

UNIT IV (8 lectures)

Technology of dairy by products: Utilization of skim milk, buttermilk and whey for the manufacture of casein, lactose etc. Technology of indigenous milk products: Principles and practices of manufacture, packaging, storage and marketing of ghee, Khoa, Chhena, shrikhand, paneer, rasogulla, gulabjamun and Milk based foods.

UNIT V (5 lectures)

Sanitary aspects: of dairy plant building, equipment and their maintenance. Disposal of dairy plant waste. Application of membrane technology in dairy industry.

Practical

- Plat form test for raw milk
- Determination of moisture content in milk
- Determination of fat content in Milk powders and ice-cream products.
- Determination of Milk adulterants: Starch, Urea, Formaldehyde and Sugar,
- Hydrogen peroxide, salt and detergent
- Operation, cleaning and sterilizaiton of dairy plant machinery involved in fluid milk processing
- Preparation of toned, homogenized, fortified, reconstituted and flavored milks
- Manufacture of fermented milks.
- To study the kinetics of enzymes and manufacture of cheeses.
- Manufacture of butter
- Manufacture of ice- cream, ices, sherbets.
- Manufacture of casein, ghee, khoa, chhena.
- Sensory analysis of food products: Paired comparison test, Duo-trio test, Hedonic test, Triangle test, Ranking test, Single sample test, Composite scoring test,
- Analysis of water used in food industries i.e. Alkalinity, Acidity, Hardness, pH, TPC and Coliform count

Learning Outcomes: After completion of course students are expected to have an understanding of processing methods of milk in a dairy industry and manufacturing of dairy products.

Reference Books

- Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. Technology of Indian Milk Products. Dairy India Publ.
- De S.1980. Outlines of Dairy Technology. Oxford Univ. Press.
- Rathore NS et al. 2008. Fundamentals of Dairy Technology - Theory & Practices. Himanshu Publ.

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Core Course: FFT 603 Quality control Food Standards and Food Laws
Credits: (3-0-0-3)

Level: Post Graduate
Semester: Autumn

Pre-requisite: FFT 601

Objective: To acquaint with food quality parameters and control systems, food standards, regulations, specifications.

Course contents:

UNIT I (5 lectures)
Quality Assurance: Introduction, Importance and Difference. Food Quality and Food Safety: Scope and difference.

UNIT II (12 lectures)
Raw materials & Finished product quality: Quality parameters and evaluation procedures: Appearance, color, texture, viscosity, consistency, flavor.
Sensory evaluation: Selection of panel of judges, sensory characteristics of foods, types of tests.

UNIT III (12 lectures)
Food standards and laws: International – Concept of Codex alimentarius, HACCP, GMP, GHP, USFDA, ISO 9000, ISO 22000, ISO 14000. National – Introduction of BIS/IS, Food Safety and standards – 2006, Food Safety and standard regulation 2010, FPO, MPO, MMPO, Agmark. Prevention of food adulteration Act: Food Adulteration: definition, common adulterants in different foods, contamination, methods of detection. Food additives and legislation; coloring matter, preservatives, poisonous metals, antioxidants and emulsifying and stabilizing agents, insecticides and pesticides. PFA specification for food products, Nutritional labeling

UNIT IV (6 lectures)
Quality Certification & Accrediation: Introduction and procedure.

UNIT V (10 lectures)
Water Quality: Water standards and Analysis physical, chemical and microbiological characteristics of water analysis. Waste treatment: Fundamentals of Physical, Biological & Chemical waste treatments

Learning Outcome: The students must have an understanding about food laws and standards, quality parameters and sensory evaluation of food.

Reference Books

- Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Krammer A & Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ

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Elective Course FFT 651 : Entrepreneurship in Food Processing
Credits: (2-0-0-2)

Level: Post Graduate
Semester: Autumn

Pre-requisite: Completed basic course on Food Processing.

Objective: To enable the student to plan and prepare a project report for food processing unit and to provide capability to execute and evaluate the same and to introduce students to the methodology of project formulations and the implementation procedures and strategic planning of new projects.

Course contents:

UNIT I (6 lectures)
Aggregate Planning-: General design considerations, Financial Analysis, plant location and plant layout, Flowcharts and their design, equipment selection

UNIT II (4 lectures)

Design of service facilities

UNIT III (4 lectures)

Human resource planning: Planning and design of marketing system, worker's safety and plant hygiene

UNIT IV (6 lectures)

Introduction to Marketing and economics: Demand, Supply, Sample survey techniques, marketing information, consumer trends, consumer behavior.

UNIT V (10 lectures)

Introduction to Operations Research: Definition, applications. Inventory control, Linear Programming. Queuing Theory, Transportation and Assignment. Forecasting

Learning Outcome: The students would have been acquainted with designing and planning of food plant layout and operations research.

Reference Books

- Chandra P. 2005. Project Management. Tata McGraw Hill.
- Gopal Krishan P & Nagarajan K. 2005. Project Management. New Age.
- Hisrich RD & Peters MP. 2002. Entrepreneurship. Tata McGraw Hill.
- Kaplan JM. 2003. Patterns of Entrepreneurship. John Wiley & Sons.
- Nandan H. 2007. Fundamentals of Entrepreneurship Management. Prentice Hall.

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Elective Course: FFT 652 Food Fermentation and Microbial Technology

Credits: (2-0-0-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Must have completed one course / paper on Microbiology / Food Microbiology.

Objective: To familiarize about the various microbial processes/systems/activities which have been used for the development of industrially important products/processes.

Course Content

Unit I (6 lectures)

Fermentation: History, definition and types. Study of a Bio fermentor – its design and operation, Down Stream Processing and Product recovery. Its measurement and control in fermentation, Aeration and agitation in fermentation: Oxygen requirement, sterilization of air and media; scale up in fermentation.

Unit II (6 lectures)

Recovery of particulate matter, product isolation, distillation, centrifugation, whole broth processing, filtration, aqueous two-phase separation, solvent extraction, chromatography and electrophoresis.

Unit III (8 lectures)

Production of alcoholic beverages, organic acids, enzymes and immobilization of enzymes. Biological waste treatment.

Unit IV (4 lectures)

Dairy Fermentations-starter cultures and their types, concept of probiotics.

Unit V (6 lectures)

Microbial enzymes, role in various industrial processes, Bio-transformations, Immobilized enzymes based bioreactors; production of antibiotics, vaccines, and biocides; Bioconversion of substrates, anti-nutritional factors present in feeds; Microbial detoxification of aflatoxins; Bioinsecticides; Biofertilizers.

Learning Outcome: The course will make the students learn about fermentation techniques and industrial microbiology.

Reference Books

- Huffnagle GB & Wernick S. 2007. The Probiotics Revolution: The Definitive Guide to Safe, Natural Health. Bantam Books.
- Nout RMJ, de Vos WM and Zwietering MH. 2005. Food fermentation. Wageningen Academic Publishers, Netherlands.

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Elective Course: FFT 653 Food Rheology
Credits: (2-0-0-2)

Level: Post Graduate
Semester: Autumn

Pre-requisite: FFT 508

Objective: To explain the basics of food rheology and to familiarize the students with rheological instruments and their use in relation to food products.

UNIT I (6 lectures)

Food rheology and structure: stress and strain tensors, viscometric properties, shear stress-shear rate relationships, units in rheological measurements, types of fluid flow behaviour, apparent viscosity, intrinsic viscosity, stress-strain behaviour of solid foods, linear viscoelasticity, phase transitions in foods.

UNIT II (6 lectures)

Flow and functional models for rheological properties of fluid foods: Time independent flow behaviour, Apparent viscosity- shear rate relationships of shear- thinning foods, models for timedependent flow behaviour, role of solids fraction in rheology of dispersions, affect of temperature on viscosity, treatment of rheological data using models.

UNIT III (6 lectures)

Tube viscometry, Rotational viscometry: introduction

UNIT IV (6 lectures)

Viscoelasticity: introduction, transient tests for viscoelasticity, oscillatory testing. Rheology of food gum and starch dispersions: effect of heating, effect of sugar and protein, rheological behaviour of starch, rheology of starch- gum dispersions.

UNIT V (6 lectures)

Rheological behaviour of processed fluid, semisolid foods and food gels: rheological tests to evaluate properties of gel systems, gel point and sol-gel transition by rheological measurements.
Application of rheology to fluid food handling and processing

Learning Outcome: It is expected that the students would have learnt concepts of rheology and structure of food systems.

Reference Books

- Bourne MC. 2002. Food Texture and Viscosity: Concept and Measurement. Academic Press
- Deman JM. et al. 1976. Rheology and Texture in Food Quality. AVI Publ.
- Mohsanin NN.1989. Physical Properties of Plant and Animal Material. Vol. I, II. Gordon and Breach Science Publ.
- Steffe JF. 1992. Rheology and Texture in Food Quality. AVI Publ.

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Elective course: FFT 654 Food Product Development
Credits: (2-0-0-2)

Level: Post Graduate
Semester: Autumn

Pre-requisite: Basic knowledge of Food Science.

Objective:

To acquaint the students about the need, types, basic technique and details of food product development to plan nutritious products.

Course Content

UNIT I (6 lectures)

Concept of product development - product success and failure, factors for success, process of product development, managing for product's success. Innovation strategy - possibilities for innovation, building up strategy, product development programme.

UNIT II (5 lectures)

The product development process - product strategy, product design and process development, product commercialization, product launch and evaluation.

UNIT III (6 lectures)

The knowledge base for product development technology - knowledge and the food system, knowledge management, knowledge for conversion of product concept to new product, technological knowledge (product qualities, raw material properties, processing, packaging requirement, distribution and marketing.

UNIT IV (5 lectures)

Role of consumers in product development - consumer behaviour, food preferences, avoiding acceptance, integration of consumer needs in product development and sensory needs.

UNIT V (8 lectures)

Managing the product development process, - principles of product development management, people in product development management, designing the product development process, key decision points, establishing outcomes, budgets and constraints, managing and organizing

product development process, innovative matrices, striving for continuous improvement, Improving success potential of new products, market exploration and acquisition, Legal aspects of new product launch.

Learning Outcome: The course must have acquainted the students with principles of food product design and development.

Reference Books:

- Clarke & Wright W. 1999. Managing New Product and Process Development. Free Press.
- Earle R, Earle R & Anderson A. 2001. Food Product Development. Woodhead Publ.
- Fuller 2004. New Food Product Development - from Concept to Market Place. CRC.

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Elective Course: FFT 655 Advanced Food Analysis

Credits: (1-0-1-2)

Level: Post Graduate

Semester: Autumn

Pre-requisite: Must have completed one course / paper on Basic Food Analysis.

Objective: To develop an understanding of instrumental techniques in food analysis used for determination of food quality parameters.

Course Content

Unit I (2 lectures)

Concepts of food analysis. Rules and regulations of food analysis.Sample preparation for food analysis.Measurement of colour and water activity of raw and processed foods.

Unit II (3 lectures)

Determination of browning reaction in foods, food additives, residues and deleterious factors in raw and processed foods. Measurement of enzymatic changes in foods. Sugar profiling of foods through Bioscan.

Unit III (3 lectures)

Measurement of viscosity/texture in food products. Rheological techniques and instrumentation in food. Microscopic, Fluorimetric and polarimetric techniques in food analysis.

Unit IV (4 lectures)

Application and operating parameters of spectrophotometer, AAS (Atomic absorption spectroscopy), Inductively coupled plasma optical emission spectroscopy (ICP-OES), NMR (nuclear magnetic resonance), FTIR (Fourier transform infrared spectroscopy)

Unit V (3 lectures)

Application and operating parameters of GC (Gas chromatography), HPLC (high performance liquid chromatography),GC-MS (gas chromatography- mass spectroscopy), LC-MS (liquid chromatography-mass spectroscopy).

Practical

- Sample preparation of food analysis
- Measurement of enzymatic changes in foods
- Sugar profiling of foods through Bioscan.
- Determination of Rheological properties by using texture analyzer

- Pasting properties of foods through RVA
- Working and operation of UV Visible Spectrophotometer
- Determination of Minerals through AAS
- Determination of heavy metals through ICP-OES
- Working and operation of HPLC, GC
- Qualitative analysis of compounds by chromatography techniques: Thin layer Chromatography, Paper Chromatography

Learning Outcome: The students would have been acquainted with application and working of Advance food analysis techniques.

Reference Books:

1. Nielson S S(2017). Food Analysis.Fifth edition. Springer, New York.
2. Clifton M and Pomeranz Y (1988)Food Analysis - Laboratory Experiments. AVI Publ.
3. Leenheer AP, Lambert WE and van Bocxlaer JF (2000)Modern Chromatographic Analysis of Vitamins. 3rd Ed. Marcel Dekker, New York.
4. Nollet LML (2004) Handbook of Food Analysis. Vol. I. Marcel Dekker, Switzerland.
5. Handbook of Analytical Techniques by Helmut Gunzler and Alex Williams
6. The Chemical Analysis of Foods and Food products By Morris b. Jacobs

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Foundation Course: FFT 691 Workplace Skills
Credits: (1-0-2-2)

Level: Post Graduate
Semester: Autumn

Pre-requisite: Understanding of basics of communication skills.

Objective: To enable students to have firm grounding in English to be able to use it effectively in professional as well as social contexts and have good job seeking skills to work in the fiercely competitive job market.

Course Content:

Unit I 3 lectures

Business communication - Job Application, Business Letters, Cover letter, Writing Emails, Minutes writing, Project report

Unit II 2 lectures

Effective job seeking skills - Needed documentation, Application process, Preparing for the interview, Post interview process, Job interview question model,.

Unit III 3 lectures

Professional Practices and Ethical Codes- Work Ethics, Code of Conduct, Protocol, Motivation, Leadership, Formal writing

Unit IV 2 lectures

Presentation & public speaking skills – The art of listening, active listening**,** Presentation skills, public speaking

Unit V 5 lectures

Behavioral skills – Teamwork, Time management, Problem-solving Skills, Interpersonal & negotiation skills, building customer relations, Body language, Stress & Anger management

Practical:

- Oral presentations
- Using visual aids while presentations
- Critical Reading & Writing
- Mock interview
- Group discussions
- Team building exercises
- Proofreading and editing emails
- Cover letter drafting
- Resume-making
- Drafting reports

Learning Outcome: The course must have acquainted the students with communication and public speaking skills specially for interviews and group discussions.

Reference Books

- Barun K Mitra, Personality Development and Soft Skills, Oxford Higher Education
- Gopalawamy Ramesh and Mahadevan Ramesh, The Ace of Soft Skills, Pearson Education
- T. Anchukandam and J. Kuttainimathathil (Ed) Grow Free Live Free, Krisitu Jyoti Publications, Bangalore (1995)
- Mani Jacob (Ed) Resource Book for Value Education, Institute for Value Education, New Delhi 2002.
- T.N. & L.A. Olson Technical Writing & Professional Communication for Non-native speakers of English, McGraw-Hill, NY, 1991.

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Core Course FFT 604 Training and Workshop
Credits: (0-0-4-2)*

Level: Post Graduate
Semester: Autumn

Pre-requisite: Completed basic course in Food processing
*** Non Credit requirement**

FFT 641 Seminar (0-0-2-1)

SEMESTER IV

FFT 646 Thesis (0-0-40-20)

Revised

Syllabus

of

B. Voc.in Food Processing and Technology

Centre of Food Technology

Institute of Professional Studies

University of Allahabad

Revised November 2022

Revised Course Structure of B.Voc.in Food Processing & Technology

Semesters	Paper Code		Title of Paper	Skill/ General Education Courses	Credits			
					L	T	P	Total
Sem I	**FFT 121**		Introduction to Food Processing	Skill	3	0	2	5
	FFT 122		Food Science	Skill	3	0	2	5
	FFT 128		Food Quality and Analysis- I	Skill	3	0	2	5
	FFT 124		Food Hygiene and Sanitation	Skill	3	0	2	5
	FFT 101		Communication and Documentation Skills	Gen Ed.	3	0	1	5
	FFT 152		Introduction to Biosciences	Gen Ed.	3	1	0	5
	FFT 107		Basic Concepts in Laboratory Techniques	Gen Ed.	0	0	2	2
	QP-FIC/Q7601		**Assistant Lab Technician**	**NSQF-4**				*
			TOTAL		**18**	**1**	**11**	**30**
Sem II	**FFT 123**		Introduction to Food Microbiology	Skill	3	0	2	5
	FFT 125		Food Processing Equipment	Skill	3	0	2	5
	FFT 126		Technology of Processed and Preserved Foods	Skill	2	0	2	4
	FFT 127		Introduction to Food Quality Management	Skill	3	0	1	4
	FFT 102		Environmental Studies-I	Gen Ed.	2	0	1	3
	FFT 104		Introduction to Computer Application	Gen Ed.	2	0	1	3
	FFT 206		General Biochemistry	Gen Ed.	3	0	1	4
	FFT 130		Industrial Training-I for 15 days	Skill	0	0	2	2
	QP-FIC/Q7605		**Technical Lead - Food Analysis**	**NSQF-5**				*
			TOTAL		**18**	**0**	**12**	**30**
Sem III	**FFT 221**		Unit Operations in Food Processing	Skill	3	1	0	4
	FFT 222		Basic Food Chemistry	Skill	2	0	2	4
	FFT 223		Food Quality and Analysis- II	Skill	2	0	2	4
	FFT 224		Cereals, Pulses and Oilseed Technology	Skill	3	0	2	4
	FFT 229		Bakery and Confectionery Products	Skill	3	0	1	4
	FFT 203		Communication Skills and Technical Writing	Gen Ed.	3	2	0	4
	FFT 205		Environmental Studies - II	Gen Ed.	3	1	0	4
			TOTAL		**19**	**4**	**7**	**30**
Sem IV	**FFT 225**		Human Nutrition	Skill	3	1	0	4
	FFT 226		Fruits and Vegetable Technology	Skill	2	0	2	4
	FFT 227		Introduction to Food Packaging	Skill	2	0	1	3
	FFT 228		Dairy Technology	Skill	2	0	1	3
	ELECTIVE-II (Any One)	**FFT 251**	Technology of Meat, Fish and Poultry	Skill	3	0	1	4
		FFT 252	Flavour Technology					
		FFT 253	Fermentation Technology					
	FFT 201		Crop Production: Concepts and Practices	Gen Ed.	3	0	0	3
	FFT 202		Food Business Management	Gen Ed.	3	0	0	3
	FFT 207		Statistics and Data Analysis	Gen Ed.	3	1	0	4
	FFT 230		Industrial Training-II for 15 days	Skill	0	0	2	2
	QP-FIC/ Q7007		**Quality Assurance Manager**	**NSQF-6**				
			TOTAL		**21**	**2**	**7**	**30**
Sem V	**FFT 321**		Principles of Food Engineering	Skill	1	2	1	4
	ELECTIVE-III (Any One)	**FFT 351**	Post-Harvest Management of Fruits and Vegetables /	Skill	2	0	1	3
		FFT 352	Food Beverage Technology /	Skill				
		FFT 353	Technology of Indigenous milk Products	Skill				
		FFT 354	New Product Development and Sensory Science	Skill				
	FFT 322		Waste Management and Effluent Treatment	Skill	3	1	0	4
	FFT 323		Food Laws and Regulations	Skill	3	1	0	4
	FFT 324		Food Plant Design and Layout	Skill	3	1	0	4
	FFT 301		Disaster Management	Gen Ed.	3	2	0	5
	FFT 303		Introductory Biotechnology	Gen Ed.	3	0	1	4
	FFT 330		Seminar	Skill	0	0	2	2
			TOTAL		**18**	**7**	**5**	**30**
Sem VI	**FFT 325**		Quality Assurance and Certification	Skill	3	0	0	3
	FFT 306		Human Values and Ethics	Gen Ed.	4	0	0	4
	FFT 307		Project Management and Entrepreneurship	Gen Ed.	3	2	0	5
	FFT 340		Project Work for 3 months	Skill	0	0	18	18
	QP-FIC/ Q9002		**Food Regulatory Affairs Manager**	**NSQF-7**				
			TOTAL		**10**	**2**	**18**	**30**
			G. TOTAL		**103**	**16**	**61**	**180**

*** Non-credit requirement; Qualification Pack (QP) as recommended by Sector Skill Council (FICSI).**

SEM-I

Skill Course FFT 121:Introduction to Food Processing

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint with principles of different techniques used in processing and preservation of foods.

Course Content

UNIT I 5 lectures

Introduction: Definition and scope of Food Science and Technology, Sources of food, scope and benefit of industrial food preservation, perishable, non perishable food, causes of food spoilage.

UNIT II 15 lectures

Thermal processing methods of preservation: Principle: Canning, blanching, pasteurization, sterilization, evaporation.

Use of low temperature: Principle and effect on quality. Chilling, cold storage, freezing.

Preservation by drying dehydration and concentration: Principle, Methods and effect on quality.

Preservation by radiation: Definition, Methods of Irradiation, Direct & Indirect effect, measurement of radiation dose, dose distribution, effect on microorganisms.

UNIT III 5 lectures

Presentation of foods by Preservatives: chemicals, antioxidants, mould inhibiters, antibodies, acidulates etc.

Preservation by salt & sugar: Principle, Method and effect on food quality.

UNIT IV 5 lectures

Preservation by fermentation: Definition, Advantages, disadvantages.

UNIT V 15 lectures

Recent methods in preservation: Pulsed electric field processing, High pressure processing, processing using ultrasound, dielectric, ohmic and infrared heating.

Practical

- Introduction to food laboratory.
- To study the effect of enzymatic browning in fruits and vegetables.
- To study different types of blanching of fruits and vegetables.
- Preservation of food by canning.
- To perform cut out analysis of caned product.
- Preservation of food by high concentration of sugar i.e. jam.
- Preservation of food by high concentration of salt/acid i.e. pickle.
- Preservation of food by addition of chemicals i.e. tomato ketchup.
- Preservation of food by drying in a cabinet drier.
- Preservation of fruits & vegetables by freezing.
- Preservation of milk by pasteurization and sterilization.

Reference Books:

- Food Processing Technology by P.J.Fellows, Woodhead publishing ltd.
- Food Science by N.N. Potter, CBS publishing.
- Physical principles of Food Preservation. Vol. II by M. Karel, O.R. Fenema and D.B. Lurd,Maroel, Dekker Inc. New York.
- The technology of food preservation by N.W.Desrosier and J.N. Desrosier, CBS publishing.

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Skill Course FFT 122 : Food Science

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To impart knowledge of various areas related to Food science and technology.

Course Content

UNIT I 14 lectures

Introduction to Food Science*:* Historical development of food science and technology, Evolution of Food Processing from prehistoric times till date, Introduction to various branches of Food Science and Technology

Cereals and Millets: Wheat- structure and composition, types (hard, soft/ strong, weak). Process of malting, Gelatinization of starch, types of browning. Rice- Composition of rice obtained by different dehusking methods, parboiling of rice- advantages and disadvantages. Millets -Varieties, composition and uses of maize, sorghum, barley, rye, oats, triticale, pearl millet and finger millet.

Pulses: Introduction, common names and scientific names of different pulses. Chemical composition of pulses, processing of pulses- soaking, germination, decortications, cooking and fermentation.Toxic constituents in pulses and its detoxification processes.

UNIT II 6 lectures

Fats and Oils: Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids. Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, and hydrogenation. Rancidity - hydrolytic and oxidative rancidity and its prevention. Definition margarine, butter, hydrogenated vegetable oil, lard.

UNIT III 8 lectures

Fruits and Vegetables: Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments. Post harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes during the storage of fruits and vegetables.

UNIT IV 12 lectures

Flesh Foods - Meat, Fish, Poultry: Meat - Definition of carcass, composition of meat, concept of red meat and white meat. Fish - Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish, spoilage of fish. Poultry - Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality.

Milk and Milk Products: Definition of milk, typical chemical composition of milk of different species i.e. buffalo, cow, goat. Composition of milk, its constituents, various steps in processing of milk. An overview of types of market milk and milk products-cheese, paneer, ice cream, ghee, butter, flavoured milk, imitation milk.

Condiments and spices: Composition and importance of spices.

UNIT V 5 lectures

Sensory evaluation of food: Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duo-trio test, triangle test, hedonic scale, chemical dimension of basic tastes.

Practical

- To study the gelatinization temperature range and % sag of various cereal starches.
- To study the factors affecting gelatinization of cereal starches.
- To study germination of whole pulses and legumes.
- To study fermentation in cereals and pulses.
- To study non-enzymatic browning; caramelization in various sugars.
- To detect the adulteration in fats and oils by qualitative tests.
- To detect the presence of adulterants in milk.
- To perform the recognition test for the four basic tastes.
- To perform the sensitivity / threshold tests for four basic tastes.
- To recognize few odors and to learn to memorize them.

Reference Books:

- Food Science by B. Srilakshmi, publishing, New Age International (P) ltd. publications.
- Food Science by N.N. Potter, CBS publishing.
- Food Science by S. Manay, New Age International (P) ltd. publications.

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Skill Course FFT 128 : Food Quality and Analysis I

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Spring

Pre-requisite: Course in Food processing

Objective:

To learn about physical and chemical contaminants in foods.

Course Content:

UNIT I 5 lectures

Introduction to food quality: Definition, quality concepts, quality attributes (safety, sensory, shelf life, convenience, extrinsic attributes), factors affecting food behaviour.

Sampling techniques of food and water

UNIT II 15 lectures

Methods for food analysis: Estimation of carbohydrates, protein, fat, vitamins and minerals

Contamination in Food- : Physical, chemical (heavy metals, pesticide residues, antibiotics, veterinary drug residues, dioxins, environmental pollutants, radionucleocides, solvent residues, chemicals)

UNIT III 5 lectures

Natural toxins. Contaminants formed during processing – nitrosamines, acrylamide etc. natural food contaminants and contaminants form packaging materials.

UNIT IV 15 lectures

Food Additives: Introduction, need of food additives in food processing and preservation. Characteristics and classification of food additives.Safety and quality evaluation of additives and contaminants, Acute and chronic studies, NOEL, ADI, LD50.Colour:Introduction, importance, classification- artificial and natural. Use of plant tissue culture, polymeric colorsetc for color.

Sweeteners- Introduction, importance, classification- natural and artificial, chemistry, technology and toxicology, consideration for choosing sweetening agents.

Antimicrobial agents. -Nitrites, sulphides, sulphur-di-oxide, sodium chloride, hydrogen peroxide.

Antioxidants - Introduction, mechanism of action, natural and synthetic anti-oxidants, technological aspect of antioxidants.

UNITV 5 lectures

Food Adulteration: Definition, types of adulterants and their detection.

Practical

- Preparation of standard solutions for the chemical analysis i.e. HCl, H_2SO_4, $KMnO_4$, Sodium Thiosulphate and Iodine.
- Determination of proximate composition of food- moisture, protein, crude fat, crude fiber, ash, total carbohydrates and Calorific Value by standard AOAC procedures
- Determination of minerals in food products: Calcium by Titration, Phosphorus by Spectrophotometer, Iron by Spectrophotometer,
- Determination of pH and total acidity of various food samples.
- Determination of total sugars, reducing and non-reducing sugars in various food samples.
- Detection of adulterants in various food(turmeric, red chilli, coffee, honey, flour)etc.

Reference Books:

- Hand Book of Food Analysis by Nollet&Toldra, CRC publishing ltd.
- Hand Book of Analysis & Quality Control for Fruit & Vegetable Products by Rangana, Tata Mcgraw hill publishing.
- Introduction to the chemical analysis of foods by Nielson, CBS publishing.

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Skill Course: FFT 124Food Hygiene and Sanitation

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

The knowledge and skills required to produce healthy meals for the family with regard to safety, effective organisation and management of family resources, and the needs and lifestyles of family members

Course Content

UNIT I 5 lectures

Principles of hygiene and its relation to food preparation.

UNIT II 10 lectures

General hygienic and sanitary practices to be followed by different food business operators - fruits and vegetable, milk and milk product, meat and meat product, catering etc.

UNIT III 10 lectures

General hygienic and sanitary requirements for different areas - location and surroundings, layout and design of food establishment premises, equipment & containers, facilities, food operations and controls, management and supervision, food testing facilities, audit, documentation and records, sanitation and maintenance of establishment premises, personal hygiene, product information and consumer awareness, training.

UNIT IV 10 lectures

Water quality - water standards and analysis of physical, chemical and microbiological characteristics of water.

UNIT V 10 lectures

Waste treatment - fundamentals of physical, biological & chemical waste treatments.

Practical

- Analysis of water used in food industries
  - Determination of acidity of the given sample of water.
  - Determination of alkalinity of the given sample of water.
  - Determination of the total hardness of Water.
  - Determination of pH of the given sample of Water.
  - Determination of Conductivity of the given sample of Water.
  - Determination of Total Solids of the given sample of Water.
  - Determination of Total Dissolved Solids of the given sample of Water.
  - Determination of Turbidity of the given sample of Water.
- Assessment of surface sterilization using swab and rinse method.
- Case Study of food hygiene and sanitation (GMP/GHP) of a food industry.
- Preparation of HACCP Plan

Reference Books:

- Food plant sanitation – Packer and Litchfield (Reinhold Publ.)
- Handbook of analysis and quality control for fruits and vegetables products by S. Ranganna, Mcgraw Hill Pub. Co. New York.

***

General Education Course FFT 101 :Communication and Documentation Skills

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: Basic knowledge of English

Objective

To equip the students with skills to write to communicate and articulate in English (verbal as well as writing) and to acquaint the students with the knowledge and use of computers and to introduce the basic principles, organization and operational aspects of computers.

Course Content

UNIT I 10 lectures

Introduction to Communication & Grammar : Consonant & Vowel Sounds, Indianism, Syllable & Syllable Stress, Determiners, Articles, Tense & Time, Preposition, Prepositional Phrases, Subject-Verb Agreement, Active – Passive Voice, Intonation & Modulation, Conjunctions

UNIT II 10 lectures

Formal Writing Skills: Composition Writing: Business Letters (Functions of a Business Letter, Layout of a Business Letter, Salient Features of a Business Letter, Kinds of Business Letter, Application Writing)

UNIT III 10lectures

Conversation Skills: Nature of Conversation, Purpose of Conversation, Guidelines for Effective Conversation Skills, Proverbs used in Everyday Conversation with their Meanings/Explanations

UNIT IV 5 lectures

Documentation Skills: Introduction to Documentation: Meaning, Purpose, Need.

UNIT V 10 lectures

A short introduction to Computers, digitalized era, global connection via net, Drafting of Text, Excel, E Mails, Making Presentations, MS Word

Practical

Communication Skills

- Verbal & Non Verbal Communication
  Verbal Communication - Extempore, Just a Minute, Declamation, Dialogue, Monologue
  Non verbal Communication - Guess the Mime, Dumb Charades, Formal & Informal Writing, Facial Expressions, Dressing & Clothing
- Oral Communication - Day to today talk, formal talk, informal talk, conversation
- Body Language
  Right body postures, Eye Contact, Pet Fiddles, how to walk, talk and present oneself.
- Group Discussion Skills(Meaning, Characteristic, Do's & Don'ts, Relevance, Moderating a group Discussion
- Presentation Skills - Confidence, Effective Delivery of ideas, Convincing the audience, basic courtesies
- Public Speaking - Oration, Debates
- English Movie Sessions

Documentation Skills

- Basics of Computers, usage of short cut keys, taking out print outs, page set ups.
- Making of Power point Presentation
- E- Mail (Subject line, salutation, subscription, how to mark cc, drafting, sending of mails, reverts, forwarding of mails, attaching pictures and documents, attaching ppts
- Differentiation between hardware and software and practical usage of both.
- Diagrammatic representation of pie-charts, tabular presentation of data/info, Etc
- Basic use of MS Excel/Spread Sheets

Reference Books:

- High School English Grammar and Composition - Wren & Martin, Publisher - Churchill Livingstone
- Anthology of English Language and Communication Skills - Sharma S R, Jacob, Mark Publications
- Language and Communication Skills - Shastri, Rameshchandra, ABD Publications
- A Course in Academic Writing - Renu Gupta, Orient Blackswan Publications.

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General Education Course FFT 152 : Introduction to Biosciences

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Restrictions: The course is compulsory only for students with maths background

Objective:

Fundamentals of Bioscience is based on the structural organisation of the human body and the general functions of the body systems, emphasizing the relationship between structure and function.

Course Content:

UNIT I 10 lectures

Level of organization in life (water to protein).

UNIT II 10 lectures

Cytology - cell composition, structure and function.

UNIT III 10 lectures

Animal systems and plant physiology with introductory food biochemistry.

Plant and animal taxonomy - With reference to edible groups and their identification.

Domestication, improvement and disease control of animal and plants species.

UNIT IV 15 lectures

Economic biology - Cereals, pulses, fruits, Vegetables, Beverages, Meat, Dairy, Piggery, aquaculture, and other edible animal and plant product.

Introduction of Ecology and environment of edible species of plant and animals.

UNIT V 15 lectures

Brief introduction of genetics and evolution of Taxa with human interaction.

Plant and animal breeding, genetic engineering and GM Food (a brief introduction).

Reference Books:

- Biosciences by Taylor, Cambridge University Press.
- Biology by Storer, Viva publishing.

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General Education Course FFT 107 : Basic Concepts in Laboratory Techniques Practical

Credits: (0-0-2-2)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with handling and analyzing the high end euipments and to learn the concept and principles of food analysis euipments.

Course Content

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware

Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution, Handling techniques of solutions; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values.

Preparation of different agro-chemical doses in field and pot applications

Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability

Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

General Laboratory Safety: Preparing for laboratory work, during laboratory work andcleaningupbefore leaving, General Characteristics & procedure for handling & storage of hazardous materials and control of hazards.

Reference Books

- Furr A.K. 2000. CRC Hand Book of Laboratory Safety. CRC Press.
- Gabb M.H. &Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co

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SEMESTER-II

Skill Course FFT 123 :Introduction to Food Microbiology

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food.

Course Content

UNIT I 10 lectures

Introduction of microbiology, History and significance of food microbiology.

Classification of microbes, Structure of microbes, Metabolism of microbes.

UNIT II 5 lectures

Environmental microbiology: microbiology of air and water.

UNIT III 5 lectures

Food contamination and public health: food poisoning

UNIT IV 15 lectures

Food microbiology and spoilage of fruits and vegetables, milk and milk products, cereals and cereal products.

Industrial microbiology: Industrial application of microbes.

UNIT V 10 lectures

Thermal inactivation of microbes: pasteurization, sterilization etc. concept of TDT, F, Z and D values. Factors affecting heat resistance.

Antimicrobial agents: mechanism and action

Practical

- An introduction to microbiology, aseptic technique and safety.
- Preparation of culture media.
- To sterilize the media and equipment.
- To prepare serial dilutions.
- Plating techniques
- Culturing the bacteria on a solid media by using serial dilution method and determining the number of viable cells in the culture (standard plate count).
- Introduction to microscopy and to study cell morphology with simple staining.
- To study cell morphology and cell arrangement with negative stain.
- To stain bacteria with gram stain.
- To stain bacterial cells by wet-mount technique to check the mobility (flagellin) in bacterial cell.
- To stain bacterial cells with malachite green stain to check the presence of endospore.

Reference Books:

- Food microbiology by V. Ramesh, MJP publishing.
- Food microbiology by W.C. Frazier, Ist Edition by Mcgraw Hill Pub. Co. New York.
- Modern Food Microbiology, J.M. Jay. CBS publisher.

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Skill Course FFT 125 : Food Processing Equipments

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Spring

Pre-requisite: Course in Food processing (FFT 321)

Objective

Plan and carry out a course of action demonstrating the ability to manage time, money, energy/effort, energy/fuel, ingredients and equipment, according to a given situation

Course Content

UNIT I 5 lectures

Principle considerations of agricultural and food Processing Equipments.

UNIT II 15 lectures

Food Processingequipments:Types and Principle of dryers.

Types of heat exchanger, Principle of heat Exchangers and Evaporators, pasteurizer, Blancher, Retorts and boilers.

Low Temperature processing equipment: Refrigeration system and freezer.

UNIT III 5 lectures

Material handling equipments like belt conveyor, screw conveyor, bucket elevator and pneumatic conveyors.

UNIT IV 10 lectures

Mechanical separation: filtration, sieving, centrifugation sedimentation;

UNIT V 10 lectures

Equipments for size reduction, Mixing, and Extrusion etc.

Practical:

- Study of dryers, and its efficiency ;
- To study elevating and conveying equipment's,
- Sieve analysis and determination of its efficiency.
- To study extrusion technology and pasta making.
- Mixing index determination for solid mixing
- Visit to food processing plants.

Reference Books

- S. K. Sharma, S.J.Mulvaney, and S.S.H.Rizvi, Food Process Engineering: Theory and Laboratory Experiments, Wiley and Sons, 2000
- H. Pandey, H.K. Sharma, R.C.Chouhan, B.C. Sarkar and M.C. Bera, Experiments in Food Process Engineering, CBS Publishers and Distributors, 2004
- M.A. Rao, S.S. H.Rizvi and A.K.Dutta, Engineering properties of Foods, 3rd ed., Marcel Dekker, 2005.

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Skill Course FFT 126 :Technology of Processed and Preserved Foods

Credits: (2-0-2-4)

Level: Undergraduate food products, operating& maintenance the modern equipment's& machineries, Make different processed food products with quality assurance, and Process of Packaging, Storing & marketing.

Course Content

UNIT I 5 lectures

An overview of types of processed fruit and vegetable Products: juice, squashes, RTS, sauce, ketchup, jam, jelly, marmalade etc.

UNIT II 5 lectures

Pickles and chutneys: Preparation of various types of pickles- theory and practice; preparation of sauces and chutneys.

UNIT III 5 lectures

Pectin: Raw materials; processes and uses of pectin.

Vinegar: Types, General methods of preparation.

UNIT IV 5 lectures

Cereal products: Wheat, Rice, Legumes and Oil seeds: Composition, general processing and their products etc.

UNIT V 10 lectures

Definition of milk, colostrums, factors affecting composition of milk. Constituents of milk.Transportation, reception, grading and general processing of milk.An overview of types of market milk and milk products.

Meat - post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat.

Practical

- Dehydration of fruits & Vegetables
- Preparation of Jelly, Marmalades, Sauce and Squash
- Pectin estimation
- Milling of rice with emphasis on quality and recovery.
- Gluten content estimation
- To conduct the platform tests of milk sampling of dairy products.
- Determination of moisture and protein of milk.
- Study of processed food samples available in market pasteurized milk, ketchup, squash, jelly, biscuit, soybean oil.

Reference Books

- Food Science by N.N. Potter, CBS publishing.
- Food Science by Srilakshmi, New Age International Publishing Ltd.
- Food Science by Manay, New Age International Publishing Ltd.

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Skill Course: FFT 127 :Introduction to Food Quality Management

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: Course in Food hygiene and Food plant sanitation

Objective

To learn about quality management in food production chain and understand the significance of safe processing of foods.

Course Content

UNIT I 5 lectures

Quality Management System- ISO 9000

UNIT II 10 lectures

Management Principles, Process Model, ISO 9000 Family, principles and requirements of ISO 9001

UNIT III 10 lectures

Food Safety Management System- Key role, Principles of FSMS, ISO-22000.

UNIT IV 10 lectures

HACCP- Prerequisites; GMP/GHP, Cleaning and Sanitation, Pest Control, Recall Procedures.

UNIT V 10 lectures

Principles and steps of HACCP Plan, Hazard Identification, Risk assessment Risk communication with communication agencies and Hazard analysis, CCP Decision Tree, HACCP Plan.

Practical:

- To conduct Hazard Analysis & Risk Assessment of identified hazards
- Determination of CCP through CCP Decision Tree
- Formation of CCP Monitoring Checklist
- Identification of PRP's (GHP & GMP) of food plant
- Preparation of detail flow diagram of manufacturing process & identification of potential hazards of food at each step/process
- Preparation of sample pages of Quality Manual
- Preparation of sample pages of Management System Procedure (MSP)
- Preparation of sample pages of Standard Operating Procedure (SOP)
- Preparation of sample pages of Formats for Quality Management System
- Preparation of on-site audit plan
- Preparation of an Audit CheckList /Observation Sheet
- To conduct Document Review (Adequacy Audit) before Audit
- To conduct opening meeting of audit
- To conduct Closing Meeting

- Preparation of Audit Plan Schedule before an Internal Audit
- To conduct an Audit Meeting before conducting Internal/External Audit
- Preparation of Corrective /Preventive Action Recommendation for the organization after Audit (Report Writing)
- Preparation of report by auditee after correction of non-conformities
- To conduct audit Follow-up

Reference Books

- Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Krammer A &Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ.

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General Education Course FFT 102 :Environmental Studies I

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the natural resources and the ecosystem, and ecology.

Course Content

UNIT I 5 lectures

The Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance.

Natural Resources: Renewable and Non-Renewable Resources, Natural Resources and Associated Problems, Renewable Resources

UNIT II 15 lectures

Ecosystems: Concept of an Ecosystem, Structure and Functions of an Ecosystem, Energy Flow in the Ecosystem: The Water Cycle, The Carbon Cycle, The Oxygen Cycle, The Nitrogen Cycle, The Phosphorus Cycle, The Sulphur Cycle, The Energy Flow, Integration of Cycles in Nature, Food Chains, Food Webs and Ecological Pyramids, Introduction, Types, Characteristic Features, Structure and Functions.

UNIT III 3 lectures

Biodiversity: Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation, Conservation of Biodiversity: In Situ and Ex Situ.

UNIT IV 15 lectures

Pollution: Definition, Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards, Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Waste, Pollution Case Studies, Social Issues and the Environment From Unsustainable to Sustainable Development, Urban Problems Related to Energy, Water Conservation, Rainwater Harvesting, Watershed Management, Consumerism and Waster Products

Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents an Holocaust.

UNIT V 7 lectures

The Environmental (Protection) Act- The Air (Prevention and Control of Pollution) Act, TheWater(Preventionand Control of Pollution) Act

Value Education: Environmental Values, Valuing Nature, Valuing Cultures, Social Justice, Human Heritage, Equitable Use of Resources, Common Property Resources, Ecological Degradation.

Practical:

- Visit to a local area to document environmental assets, river/forest/grasslands
  - Visit to gangatic plain to document environmental diversification in river and grass land.
  - Documenting the environmental assets and comparing with local gazettes
- visit to a local polluted site
  - Enlisting the types of pollutants/wastes visible in allahabad, sangam area before kumbh.
  - Enlisting and comparing the types of pollutants/wastes visible in allahabad, sangam area after kumbh.
  - Observing the anthropogenic change at gangatic river coast near sangam area during kumbh.
- Study of common plants, insects, birds
  - Documenting the special resource features of individual ecosystems. (river/ forest)

- Study of simple ecosystems
  - observing the water cycle- observing how rain recharges ground water like wells and rivers.
  - Observing the energy cycle – by looking different types of insects and birds in the trees.
  - Observing food chains and interpret the food web.
  - Observing water from a pond under the microscopefor measuring flora, fauna and turbidity. There are a large number of algae and zooplankton that form the basic food chains of the aquatic ecosystem

Reference Books

- Kumarasamy, K., A.Alagappa Moses And M.Vasanthy, 2004. Environmental Studies, Bharathidsan University Pub, 1, Trichy
- Rajamannar, 2004, Environemntal Studies, Evr College Pub, Trichy
- Kalavathy,S. (Ed.) 2004, Environmental Studies, Bishop Heber College Pub., Trichy

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General Education Course FFT 104 :Introduction to Computer Application

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the knowledge and use of computers and to introduce the basic principles, organization and operational aspects of computers.

Course Content

UNIT I 10 lectures

Microsoft Word and its applications (in relation with Food Industry)

Font formatting, Paragraph formatting, Inserting images, auto shapes symbols, diagrams, header & footer, References, watermarks and Hyperlinks, Style & Formatting, Mail Merge through word, Excel, Access database, Page setup, Printing a document

UNIT II 10 lectures

MS Excel and its applications (in relation with Food Industry)

Making column chart & pie chart and chart formatting, Use of general functions & formula (autosum, using basic arithmetic operators: +,-,*,/), Use of filter & sorting, Cell references, header & footer, age setup, use of page break preview, printing worksheets.

UNIT III 15 lectures

MS PowerPoint and its applications (in relation with Food Industry)

Creating own design, formatting objects on a slide, Use of Slide Master to control the design & formatting of a presentation, Use of Image, audio, video in the presentation, Slide show setup, slide transition, use of animation, Use of narration in presentation, Print setup & Printing handouts of a presentation.

UNIT IV 5 lectures

Internet & Web Applications (in relation with Food Industry)

UNIT V 5 lectures

Websites, Internet applications, Google Applications (G mail, Google search, G Drive, Google Docs) and other Email Services, Industry customer approach.

Practical

- Applications of MS Excel to solve the problems of food technology
- Statistical quality control, Sensory evaluation of food, and Chemical kinetics in food processing;
- Use of word processing software for creating reports and presentation;
- Familiarization with the application of computer in food industries -Milk plant, Bakery Units, Fruit & Vegetable processing Unit;
- Familiarization with software related to food industry;
- Ergonomics application in the same; Visit to Industry and case study problems on computer.
- Visit to Industry and case study problems on computer.

Reference Books

- Fundamentals of Computers by E. Balagurusamy (Author) Publisher: McGraw Hill Education (India) Private Limited
- Ms Office 2007 in a Nutshell by S. Saxena (Author) Publisher: S.Chand (G/L) & Company Ltd
- Computer Fundamentals Paperback – by P. K. Sinha (Author) Publisher: BPP

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General Education Course FFT 110 : General Biochemistry

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A basic course in Food Chemistry (FFT 329)

Objective

To acquaint the students with scope and importance of biochemistry and the pathways of metabolism of nutrients in human body.

Course Content

UNIT I 3 lectures

Scope and importance of biochemistry in Food Technology.

Aqueous solutions - properties of water - hydrogen ion concentration - acids, bases and their concept - buffers and electrolytes and their functions - acidity, alkalinity and pH determination.

UNIT II 10 lectures

Classification, structure and function of carbohydrates, lipids, proteins, and nucleic acids.

Structure and biological functions of vitamins, Vitamins as co-enzymes.

Classification and biological functions of minerals, Minerals as co-factors.

UNIT III 13 lectures

Enzymes: Classification and nomenclature of enzymes, Physico- chemical nature of enzymes, Enzyme kinetics, Mechanism of enzyme action, Factors affecting enzyme activity.

UNIT IV 14 lectures

Pathways of metabolism of carbohydrates, proteins, lipids.

UNIT V 5 lectures

Hormones as regulators of biochemical pathways- Introductory concept.

A brief account on the biochemistry of the secondary plant products: Alkaloids, flavonoids, anthocyanins, terpenes

Practical

- Qualitative and quantitative estimation of carbohydrates and proteins.
- Measurement of blood Pressure.
- Estimation of haemoglobin in blood.
- Estimation of glucose in blood.
- Qualitative urine analysis for normal and abnormal constituents.

Reference books

- Biochemistry by A. Satyanarayan
- Biochemistry by KeshavTrehan
- A textbook of Biochemistry by A. K. Berry
- L. Stryer, Biochemistry, 1999, IV Edition. Freeman Company, New York.
- Lehninger, Biochemistry, 1982. Worth Publications Inc., CBS Publication, New Delhi.
- H.S. Srivastava, Elements of Biochemistry, Rostogi Publications.
- Outline of Biochemistry, Corn & Stump.

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Skill Course FFT 130 :Industrial Training-I for 15 days

Credits: (0-0-2-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course in Food processing

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SEMESTER-III

Skill Course FFT 221 : Unit Operations in Food Processing

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on food processing equipments

Objective

To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I 5 lectures

Introduction: Basic principles of food processing, Conservation of mass and energy, Units and dimensions of engineering parameters, dimensionless ratios, and calculations involving various physical parameters.

UNIT II 10 lectures

Distillation: Distillation, Steam distillation, applications and equipment – determination of height equivalent of theoretical plate (HETP) – McCabe-Thiele method – reflux ratio. Molecular distillation, theory and examples. Mass transfer phenomenon applied to food systems

UNIT III 10 lectures

Evaporation: Needs, basic principles, Calculations, Single and multiple effect evaporation, Heat economy – enthalpy balances for evaporators, Vapour recompression, Thermo and mechanical systems, boiling point elevation, Falling film, climbing film tubular evaporators, plate evaporators, thin film and scraped surface evaporators.

UNIT IV 10 lectures

Contact Equilibrium Separation Processes: Concentrations, Gas-liquid equilibria, Solid liquid equilibria, Equilibrium concentration relationships, operating conditions; Basics of Solid-liquid extraction processes, liquid-liquid extraction, with food application examples, Crystallization

UNIT V 10 lectures

Leaching and Extraction: Leaching – Leaching equipments – principles of continuous and countercurrent leaching. Liquid extraction – extraction equipment – principles of extraction.Special extraction techniques – supercritical fluid extraction.Applications; extraction of Fatty acids, oleoresins and essential oils; Relative advantages, limitations and economics.Mechanical extraction – Expellers, screw press, filter press.

Reference Books

- Albert Ibarz, Cannovas, G.V. Unit Operations in Food Engineering. CRC Press. 2003.
- J.M. Coulson, J.F. Richardson, J.H. Harker - Coulson & Richardson's Chemical Engineering - Vol 2 Particle Technology and Separation Processes, Fifth Edition, 2002. Butterworth & Heinemann - Elsevier science Ltd.

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Skill Course FFT 222 : Basic Food Chemistry

Credits: (2-0-2-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint with properties and role of various constituents in foods, interaction and changes during processing.

Course Content

UNIT I 2 lectures

Food Constituents: Proximate composition of foods, water in foods,

UNIT II 6 lectures

Carbohydrate: Introduction, Definition nomenclature, classification. General properties of sugar (physical and chemical) identification of common mono saccharides, disaccharides and polysaccharides, determination of the amount of reducing and non – reducing sugars.Chemistry of starch, glycogen, cellulose, gums and mucilage, crude fibre.

UNIT III 7 lectures

Protein: Physical and Chemical properties of amino acids. Classification of proteins, amino acid sequence in proteins, pleated sheet and helix structure of protein tertiary structure and conformation of proteins.Physical and chemical properties of proteins, molecular weight of proteins, protein denaturation.

UNIT IV 7 lectures

Lipids: Classification of lipids, fatty acid, soap and detergent, essential fatty acids, fats and oils saponification number, acid numbers, iodine value, acetyl value, Reichart – Meissl number, Oxidative and hydrolytic rancidity, reversion.

UNIT V 8 lectures

Vitamins & minerals: Occurrence, chemistry, food sources, deficiency, loss during storage and processing of foods

Natural Pigments and Flavouring Agents: Chlorophyll, carotonoids, anthocyannics, anthoxanthins, flavonoids, tannins. Natural flavour constituents.

Practicals

- Qualitative test for proteins and fats/oils and their identification in unknown mixtures - Free fatty acid, Peroxide value, Saponification value, RM Number, TBA test, Iodine value.
- Quantitative estimation of proteins by Lowry and Bradford methods
- Estimation of vitamins - ascorbic acid..
- Analysis of edible common salt for MC, iodine and total chlorides.
- Estimation of ammonia in water.
- Estimation of plant pigments - carotenoids, flavonoids
- To determine alcohol soluble and insoluble solids in peas.
- Effect of heat on proteins
- Determination of smoking points of fat and oils

Reference Books

- Belitz HD.1999. Food Chemistry. Springer Verlag.
- DeMan JM. 1976. Principles of Food Chemistry. AVI.
- Fennema OR.1996. Food Chemistry. Marcel Dekker.
- Meyer LH. 1987. Food Chemistry. CBS

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Skill Course FFT 223 : Food Quality and Analysis-II

Credits: (2-0-2-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A basic course in Food quality and analysis (FFT 327)

Objective

To develop an understanding and methodologies of instrumental techniques in food analysis used for objective methods of food quality parameters.

Course Content

UNIT I 2 lectures

Concept of quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation

UNIT II 6 lectures

Colour:Importanceandneedofcolourdetermination,methodsofcolourdeterminationwithHunter Colour lab, CIE systemand their applications.

Flavour: Importance offlavour, foodflavours, factorsaffectingfoodproductflavours, measurementof

foodflavours.

Texture:Food texture,Physical characteristicsoffood, workingoftexture measuringinstrumentssuchasTextureAnalyser, Texture Profile Analysis (TPA).

UNIT III 7 lectures

Chromatography:PrincipleandworkingofGas chromatography(GC),Highpressureliquid chromatography (HPLC), Thin layer chromatography (TLC), Column Chromatography, chromatographic methods applied as qualitycontrol.

UNIT IV 8 lectures

Spectroscopy: Beers and Lambert's Law. General principles of colorimeters and spectrophotometers, Atomic absorption spectroscopy, IR spectroscopy, Flouremetry.

Special Techniques: Electrophoresis, Immuno assay techniques.

UNIT V 7 lectures

Introduction to quality attributes: Appearance, flavour, textural factors and additional quality factors.

Sensory Analysis: Introduction to sensory analysis; general testing conditions, Requirements of sensory laboratory; organizing sensory evaluation programme. Factors influencing sensory measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and gloss; Detection, threshold and dilution tests, discrimination, descriptive, affective; Ranking tests; Methods of sensory evaluation of different food products.

Practical

- Demonstration of HPLC and GC for analysis of bioactive compounds,antioxidant, pesticides, fatty acids etc.
- Qualitative analysis of compounds by chromatography techniques- a) Thin layer Chromatography, b) Paper Chromatography: Descending, Ascending and Circular Paper chromatography.
- Estimation of metals - Fe, Ca, Cu, Cu, Pb, Zn, Sn and Cr- by atomic absorption spectrometer and flame photometer. Demonstration of AAS for estimation of metals.
- Colour measurement (L a b values) by X Rite.
- Use of electrophoresis in the determination of proteins.
- Determination of pesticide residue in water and cauliflower by HPLC.
- To conduct sensory evaluation of the given samples using descriptive method.
- To perform the difference testes (Paired comparison test, Duo trio test and Triangle test) in the given sample
- To study and conduct sensory evaluation of different pairs of sugar with lemon samples using 'paired test' and prepare score card for the same.
- Texture analysis of raw and processed foods.

Reference Books

- Clifton M &Pomeranz Y. 1988. Food Analysis - Laboratory Experiments. AVI Publ.
- Gruenwedel DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. I. Physical Characterization. Marcel Dekker.
- Nollet LML. 1986. Handbook of Food Analysis. Vol. I. Marcel Dekker.

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Skill Course: FFT 224 : Cereal Pulses and Oil Seed Technology

Credits: (3-0-2-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course in Food Science (FFT 322)

Objective

To acquaint with production and consumption trends, structure, composition, quality evaluation, and processing technologies for product development and value addition of various cereals, pulses and oilseeds.

Course Content

UNIT I 5 lectures

Status, production and major growing areas of cereals, in India and world.

Coarse Cereals Products: Maize- Dry and wet milling of corn, corn products, sorghum, pearl millet and small millets processing.

UNIT II 10 lectures

Wheat Processing: Wheat classification, Functionality of wheat flour components.

Rice Processing: Classification, paddy Processing, Parboiling and treatment for quality improvement, Milling, rice products.

UNIT III 10 lectures

Pulses: Pre-treatment of pulses for milling, milling of major pulses. Methods to improve recovery, Nutrition and anti- nutritional factors in pulses.

UNIT IV 10 lectures

Oil seeds Processing: Groundnut, Mustard, Soybean, Sunflower, Safflower, Sesame and other oil seeds processing.

UNIT V 10 lectures

Special Topics: Processing & Utilization of Soya bean for value added products, Innovative products from cereals, pulses and oilseeds. Extrusion technology for cereals

Practical:

- Physico-chemical examination of wheat and its products test weight, kernal hardness, gluten content.
- Millingof rice with emphasis on quality and recovery.
- Physicochemical tests of rice and flour quality of wheat- geletinization temperature, water absorption tests.
- Determination of Yeast activity used in fermented cereal products.
- Quality test for wheat flour used in the baked products. Maltose Number, Water Absorption, Sedimentation value, Alcohol Acidity
- Quality tests for oils.
- Texture profile analysis of baked cereal food products by texture analyzer.
- Products of Soybean- tofu, soya milk,
- Estimation of antinutritional factors in pulses- Trypsin inhibitors and tannins.
- Visit to dhal mills

Reference Books

- Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.
- Dendy DAV &Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
- Hamilton RJ &Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.
- Hoseney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed. AACC.

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Elective Course FFT 229 : Bakery and Confectionery Products

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course on processing of cereals (FFT 331)

Objective

To familiarize the students with different form of bakery confectionary and the analysis equipment involved, and to acquire the knowledge of manufacturing process of bakery and confectionary products in range.

Course Content

UNIT I (3 lectures)

Bakery and Confectionery industry; raw materials and quality parameters; dough development; dough chemistry;

UNIT II (10 lectures)

Rheological testing of dough-principles of Farinograph, Mixograph, Extensograph, Amylograph / Rapid ViscoAnalyzer, Falling number, Hosney's dough stickiness tester.

UNIT III (10 lectures)

Technology for the manufacture of bakery products- detailed description of unit operations for the manufacturing of bread, biscuits, cakes and the effect of variations in formulation.

UNIT IV (10 lectures)

Manufacturing of confectionary products: Characteristics and processing of raw material; Technology of manufacturing of toffee, chocolate, hard boiled candies, bars, chewing gums, bubble gums and Characteristics of finished products.

UNITV (10 lectures)

Equipment used in bakery and confectionary industry: Construction and working of various equipments like Mixers, proofing chambers, dough dividers, moulder and sheeter, baking ovens, cooling chamber, sealing and packaging machines, Rolling and cutting machines.

Practical

- Quality test for wheat flour used in the baked products. Maltose Number, Water Absorption, Sedimentation value, Alcohol Acidity
- Preparation and quality evaluation of cakes
- Preparation and quality evaluation of biscuits
- Preparation and quality evaluation of nan khatai
- Preparation and quality evaluation of cookies
- Effect of syrup consistency and temperature on the quality characteristics of hardboiled sweets
- Preparation and quality evaluation of chocolate
- Visit to bakery and confectionery industries.

Reference Books

- Dubey SC. 2002. Basic Baking. The Society of Indian Bakers, New Delhi.
- Francis FJ. 2000. Wiley Encyclopedia of Food Science & Technology. John Wiley & Sons.
- Manley D. 2000. Technology of Biscuits, Crackers & Cookies. 2nd Ed. CRC Press.

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General Education Course FFT 203 :Communication Skills and Technical Writing

Credits: (3-2-0-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A basic course on Communication and Documentation skills (FFT 301)

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. and equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Course Content

UNIT I 15 lectures

Grammar: Expressions, Modals & Moods, Word Stress, Fluency, Voice, Enhancing VocabularyPunctuations

UNIT II 20 lectures

Technical Writing:

Introduction to Technical writing – Definition, types, characteristics, Report Writing, CV & Resume making, Research paper

UNIT III 10 lectures

Effective Communication Skills: Power Point Presentations (Subject-Oriented), Soft Skills - Proper Body Postures, Right/Positive Body Language, Eye Contact, Public speaking, Interactive Communication Skills -Group Discussions, Debates, Conversations, Telephonic Etiquettes, Facing an interview

UNIT IV Tutorial 15 lectures

Communication Skills: How to make Delivery of Content Effective, Proper Articulation, Modulation, Voice Throw, Proper Stress on Words, Presenting PPT's, Confidence Building, Motivation, Writing Covering Letters , Filling Application Forms

UNIT V Tutorial 15 lectures

Technical Writing : Documentation of Academic credentials, Writing of Introduction, Acknowledgement, Abstract & Conclusion, Commonly used Abbreviations in the Thesis & Research Communication, Structuring the Presentation, Learning how to make PPT's, number of Slides, font, font size, Table Insertions, Picture, Clip Art, Chart, Grammatical Accuracy

Reference Books

- Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek, Chandigarh.
- Shelton James H. 1994. Handbook for Technical Writing. NTC Business Books, Chicago.
- Wren PC & Martin H.2006. High School English Grammar and Composition. S. Chand, New Delhi.

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General Education Course FFT205 : Environmental Studies – II

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: An introductory course on environmental studies (FFT 305)

Objective

To acquaint the students with environmental aspect like natural resources and biodiversity, and different techniques involved in preserving the environment

Course Content

UNIT I (10Lectures)

Natural Resources: forest resources, water resources, mineral resources, food resources, energy resources, land resources. Role of an individual in conservation of natural resources.Equitable use of resources for sustainable life style.

UNIT II (15 Lectures)

Biodiversity and its conservation: Introduction, definition, genetic, species and ecosystem diversity. Bio geographical classification of India, Value of diversity, consumptive use, productive use, social, ethical aesthete and option values.

UNIT III (15 Lectures)

Biodiversity at global, national and local levels.India as mega-diversity nation.Hot-spot of biodiversity. Threat to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts. Endangered and endemic species of India.Updated list of red data book ,Conservation of biodiversity, In-situ conservation of biodiversity.

UNIT IV (10 Lectures)

Environmental Pollution: definition, Causes effect and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards.

UNIT V (10 Lectures)

Solid waste management: causes effect and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.Pollution case studies. Disaster Management : flood, earthquake, cyclone and landslides.

Reference Books

- Kumarasamy, K., A.Alagappa Moses AndM.Vasanthy, 2004. Environmental Studies, Bharathidsan University Pub, 1, Trichy
- Rajamannar, 2004, Environemntal Studies, Evr College Pub, Trichy
- Kalavathy,S. (Ed.) 2004, Environmental Studies, Bishop Heber College Pub., Trichy

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SEM IV

Skill Course FFT 225: Human Nutrition

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students about importance of nutrition, balanced diets, therapeutic diets for health and role of food and nutraceuticals in health.

Course Content

UNIT I 8 lectures

Introduction to human nutrition.
Macronutrients and micronutrients- Classification and functions.
Digestion, absorption and assimilation of nutrients.

UNIT II 15 lectures

Energy metabolism- Components of energy expenditure, Basal Metabolic Requirements and Activity, Recommended Dietary Allowances, Food Groups, Concept of a balanced diet, Methods of evaluation of nutritive value of foods.
Nutritional assessment and nutritional policies- Salient features, concept of community nutrition

UNIT III 15 lectures

Carbohydrates- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Proteins- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT IV 10 lectures

Fat- Types, functions, sources, requirement, storage, Effect of deficiency and excess.

UNIT V 12 lectures

Vitamin- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Minerals- Types, functions, sources, requirement, storage, Effect of deficiency and excess.
Water and electrolytes- Concept and importance

Reference books

- Nutrition Science by B. Srilakshmi
- Fundamentals of Foods & Nutrition by Sumati R. Mudambi
- Textbook of Nutrition : A Life cycle approach by RavinderChadha

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Skill Course FFT 226 : Fruits and Vegetable Technology

Credits: (2-0-2-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course on processed and preserved foods (FFT 325)

Objective

To acquaint with the proper handling technologies of fruits and vegetables to reduce post harvest losses and acquaint with principles and methods of preservation of fruits and vegetables into various products.

Course Content

UNIT I 2 lectures

Pre-packaging of fresh fruits and vegetables.Storage techniques for fresh fruits and vegetables.

UNIT II 6 lectures

Primary processing: grading, sorting, cleaning, washing, peeling, slicing and blanching

UNIT III 6 lectures

Dehydration of fruits and vegetables using various drying technologies like sun drying, solar drying, osmotic, tunnel drying, fluidized fed drying, freeze drying.

UNIT IV 8 lectures

Processing of juices: Processing of vegetable juice, Processing of fruit juice

Manufacturing of fruit juices concentrates, puree and pastes, Preparation of jam, jellies and marmalades.

UNIT V 8 lectures

Preparation of preserve and candied fruits, Pickling of fruits and vegetables.,Waste management in fruits and vegetable processing units

Practical

- Determination of ascorbic acid, acidity, total soluble soild.
- Evaluation of pectin content.
- Preparation and quality evaluation of fruit jam, fruit jelly, fruit marmalade; squash
- Processing of tomato products; Ketchup
- Preparation of dehydrated vegetables.
- Determination of chemical preservatives- benzoic acid, KMS
- Visit to commercial storage, and canning unit.

Reference Books

- Lal G, Siddapa GS &Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.
- Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.
- Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.
- Verma LR. & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

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Skill Course FFT 227 : Introduction to Food Packaging

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: A basic course on food processing

Objective

To acquaint the students with packaging methods, packaging materials, packaging machineries, modern packaging techniques etc.

Course Content

UNIT I 7 lectures

Packaging–Concepts, definition, Significance, classification. Deteriorative changes in food and packaging methods for prevention.

UNIT II 7 lectures

Primary packaging media – Properties and application of Paper, paper boards, metals, plastics, glass. Food containers-rigid containers and flexible packaging materials.Application of different packaging materials in food industry.eg. bags, pouches, wrappers, cartons etc.

UNIT III 8 lectures

Factors determining the packaging requirements of various foods, Packaging of perishable and processed foods.

UNIT IV 4 lectures

Advancements in packaging: Biodegradable packaging, Edible packaging,

UNITV 4

lecturesActive packaging, Modified atmosphere packaging, Vacuum packaging, Aseptic packaging

Practical

- Familiarization of different types of packaging materials.
- To perform vacuum packaging of food sample and carry out its storage study.
- To perform modified atmospheric packaging of food sample and carry out its storage study.
- Cut out analysis of canned food
- Determination of wax absorptiveness of paper

Reference Books

- Robertson, G.L. "Food Packaging: Principles and Practice". 2nd Edition. Taylor & Francis, 2006.
- Ahvenainen, Raija. "Novel Food Packaging Techniques". Wood Head Publishing, 2003.
- Mathlouthi, M. "Food packaging and Preservation". Aspen Publications, 1999.
- Paine, F.A. and Paine, H.Y. 1983. A Handbook of Food Packaging. Leonard Hill, Glasgow, UK.

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Skill Course FFT 228 : Dairy Technology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course in food science (FFT 322)

Objective

To acquaint with techniques and technologies of testing and processing of milk into various products and by products.

Course Content

UNIT I 4 lectures

Physical properties of milk: Color, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing,boiling point, specific heat, OR, electrical conductivity.

UNIT II 9 lectures

Lactose: Lactose (alpha and beta forms). Significances of lactose in dairy industry.

Milk fat: Composition and structure, and physical properties, crystallization, structure of fat granules, lipolysis, autoxidation, fat constants (saponification value, iodine value, RM value, Polenske value, peroxide value).

Protein and Enzymes: General structure, amphoteric nature, difference between casein and serum protein, differenttypes of casein (acid and rennet), uses of casein, fractionation of protein. Enzymes- catalase, alkaline phosphatase, lipases and proteases.

UNIT III 7 lectures

Market milk industry and milk products: Systems of collection of milk, Reception, Platform testing, Various stages of processing: Filtration, Clarification, Standardization,Homogenization, Pasteurization, Sterilization, Packaging and Storage, Cleaning and Sanitation

UNIT IV 5 lectures

Description and working of clarifier, cream separator, homogenizer and plate heat exchanger.

UNIT V 5 lectures

Flow diagram for manufacture of following milk products: Flavoured milk, Butter, ice-cream, milk powder.

Practical

- To perform platform tests in milk. (Acidity and COB).
- To estimate moisture content in milk.
- To estimate skim milk protein by titration method.
- To estimate milk fat by Gerber method, SNF and specific gravity of milk.
- To check the efficiency of sterilization of milk by Turbidity test.
- To prepare casein and calculate its yield.
- Preparation of flavoured milk
- Preparation of butter
- Visit to a milk industry

Reference Books

- Aneja RP, Mathur BN, Chandhan RC & Banerjee AK. 2002. *Technology of Indian Milk Products*. Dairy India Publ., Delhi.
- De S. 1980. *Outlines of Dairy Technology*. Oxford Univ. Press Publ., New Delhi.
- Smit G. 2003. *Dairy Processing – Improving Quality*. CRC-Woodhead Publ.
- Walstra P, Geurts TJ, Noomen A, Jellema A & Van Boekel MAJS. 1999. *Dairy Technology – Principles of Milk Properties and Processes*. Marcel Dekker.

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General Education Course FFT 201 : Crop Production: Concepts and Practices

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the basics of agriculture and crop farming so as to learn the related field of food processing such as farm machinery, land & water resources, and horticulture.

Course Content

UNIT I 5 lectures

Agriculture and its role in national development, food security; General features of climate - India; Crop environment, weather and significance of various weather elements;

Crop production - definition and scope, crop classification based on season, life cycle, taxonomy and economic use; Growth and yield of crops, growth parameters, yield attributes and factors affecting them

UNIT II 10 lectures

Quality of good seed, ideal condition for germination, seed treatment, hybrid and composite seeds, categories of seeds (certified, foundation and breeder seed); Importance of sowing time, seed rate, sowing methods, plant population; Tillage and Inter-culture operations.

UNIT III 10 lectures

Irrigation - scheduling, methods and water use efficiency; Harvesting, threshing, winnowing, storage and processing.

UNIT IV 10 lectures

Crop rotations, mixed cropping, inter cropping, its objectives and importance; Definitions of mono-cropping, double cropping, multiple/intensive cropping, relay cropping.

Soil as a three phase disperse system, its physical chemical and biological properties; Soil fertility and soil productivity, manures and fertilizers,

UNIT V 10 lectures

Classification of vegetable crops; Types of vegetable farming; Principles of vegetable production; Raising of vegetable seedlings under different environmental conditions

Concepts in Horticulture - methods of propagation, systems of planting and layout, fruit growth and development, fruit maturity and ripening, Post harvest management of fruits.

Reference Books

- Batnakar S &Schware R. 2000. Information and Communication Technology in Development- Cases from India. Sage Publ.
- Meera SN. 2008. ICTs in Agricultural Extension: Tactical to Practical. Ganga- Kaveri Publ. House. JangamWadiMath, Varanasi.
- Willem Zip. 1994. Improving the Transfer and Use of Agricultural Information – A Guide to Information Technology. The World Bank, Washington.

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General Education Course FFT 202 : Food Business Management

Credits: (3-0-0-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To give basic fundamentals to students for managing the food processing operations starting for raw material procurement to the end consumer and familiarizing them with international trade.

Course Content

UNIT I 5 lectures

Business Management: introduction, theories and functions, food industry management, marketing management and human resource development, personal management. Sectors in food industry and scale of operations in India.

UNIT II 5 lectures

Human Resource Management: Study the basics about HR and related policies and capacity mapping approaches for better management.

UNIT III 10 lectures

Consumer behavior towards food consumption, Consumer Surveys by various Institutes and Agencies, various journals on consumer behavior and market research, internet based data search.

UNIT IV 15 lectures

International trade: basics, classical theory, theory of absolute advantage, theory of comparative modern theory, free trade- protection, methods of protection, quotas, bounties, exchange control, devaluation, commercial treaties, terms of trade, balance of payments, Exim policy, foreign exchange, mechanics of foreign exchange, GATT, WTO, role of WTO. International trade in agriculture. World trade agreements related with food business, export trends and prospects of food products in India.

UNIT V 10 lectures

World consumption of Food: patterns and types of food consumption across the globe. Ethnic food habits of different regions. Govet. Institutions related to international ad trade; APEDA, Tea board, spice board, wine board, MoFPI etc. management of export import organization, regristration, documentation, export import logistics, case studies. Export and import policies relevant to horticultural sector.

Reference Books

- Chhabra TN &Suria RK. 2001. Management Process and Perspectives. KitabMahal.
- Jhingan ML. 2005. International Economics. 5th Ed. Virnda Publ.
- Kotler P. 2000. Marketing Management. Prentice Hall.
- Reddy SS, Ram PR, Sastry TVN &Bhavani ID. 2004. Agricultural Economics. Oxford & IBH.

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General Education Course FFT 207 :Statistics and Data Analysis

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

The students will be exposed to various research methods and statistical tools required to analyze the experimental data in food research and industry. The focus will be on providing knowledge related to research process, data collection and data analysis etc.

Level: Undergraduate

Semester: Spring

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

The students will be exposed to various research methods and statistical tools required to analyze the experimental data in food research and industry. The focus will be on providing knowledge related to research process, data collection and data analysis etc.

Course Content

UNIT I 10 lectures

Scientific Approach to Research: Meaning, significance, variables

Research Process: Formulating the problem, objectives, hypothesis, Experimental design, sample design, collecting data, analysis of data, interpretation, preparation of report.

UNIT II 10 lectures

Sampling Techniques: Probability and non probability sampling.

Experimental designs: Randomized Block design

UNIT III 10 lectures

Measurements: measurement scale, Frequency distribution, graphical presentation of data.

Measures of Central Tendency: Mean, median and mode, their uses.

UNIT IV 15 lectures

Measures of variability: Mean deviations, Quartile deviation, standard deviation, their uses.

Correlation: Spearman and Pearson's techniques of correlation, Linear regression

UNIT V 15 lectures

Tests of significance of difference between means: t-test, F-test, One way ANOVA.

Applications to food quality assessments

Reference Books

- Aggarwal BL. 2003. Basic Statistics. New Age.
- Kothari CR. 1989. *Research Methodology*. Wiley Eastern.
- Gupta SP. 2004. *Statistical Methods*. S. Chand & Sons

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Elective Course: FFT 251: Technology of Meat, Fish and Poultry

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course on Food Science (FFT 322)

Objective

To provide an understanding of the technology for handling, processing, preservation and bi-product utilization of meat, poultry and fish products processing.

Course Content

UNIT I 5 lectures

Development of meat and poultry industries in India.Ante-mortem examination of animals and poultry birds.Slaughter and dressing, post-mortem examination. Post-mortem changes in meat and factors affecting them.

UNIT II 5 lectures

Nutritive value of meat. Whole sale and retail cuts. Meat tenderization methods.

UNIT III 15 lectures

Canning of meat and meat products, Restructured meat products, sausages, curing and smoking of meat. Disposal and utilization of meat industry by- products

Chilling and freezing of carcass and meat; canning, cooking, drying, pickling, curing and smoking; prepared meat products like salami, kebabs, sausages, sliced, minced, corned; intermediate moisture and dried meat products; meat plant hygiene – GMP and HACCP; Packaging of meat products.

UNIT IV 10 lectures

Structure, composition and nutritive value of poultry eggs.Poultry dressing, Functional properties of eggs, internal quality of eggs and its preservation.

Eggs spoilage, Spray dried and frozen egg products.

UNIT V 10 lectures

Fish structure and composition.Cold storage, freezing preservation and canning of fish. Picking of fish, fish protein concentrates, fish meal and by products of fish processing industry

Practical:

- Slaughtering and dressing of meat animals
- Study of post-mortem changes; meat cutting and handling
- Evaluation of meat quality
- Evaluation of quality of eggs
- Preparation of meat products
- Visit to meat processing plants.

Reference Books

- Forrest JC. 1975. Principles of Meat Science. Freeman.
- Govindan TK. 1985. Fish Processing Technology. Oxford & IBH.
- Hui YH. 2001. Meat Science and Applications. Marcel Dekker. 32
- Kerry J. et al. 2002. Meat Processing. Woodhead Publ. CRC Press.
- Pearson AM & Gillett TA. 1996. Processed Meat. 3rd Ed. Chapman & Hall.

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Elective Course FFT 252 :Flavour Technology

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: A basic course of Food Chemistry (FFT 329)

Objective

To equip the students with the knowledge of flavor science, extraction of pigment and safe storage and nutritional retention principles.

Course Content

UNIT I 65 lectures

Sources of flavours (natural, processed and added), Flavour composites (natural, semi-synthetic and synthetic).

UNIT II 12 lectures

Biogenesis of flavours in food – natural and processed foods (Maillard Reaction and Lipid Oxidation).

UNIT III 3 lectures

Analysis of flavours (Subjective and objective); Formulations of flavours, adulteration, Flavour emulsions, Flavours production in fermented foods, Off-flavours in foods.

UNIT IV 3 lectures

Spices and spice-based products as flavours, Plantation crops as flavours tea, coffee, cocoa and vanilla.

UNIT IV 6 lectures

Sensory evaluation of flavours, selection of flavourist, flavours and legal issues.

Ppractical

- Odour recognition and thresholds tests
- Analysis of different types of flavours such as whole and powdered spices, essential oils, oleoresins, synthetic flavours, plated and dispersed spices-general tests.
- Sensory analysis of flavours; monitoring flavours during food processing
- Preparation of flavour emulsions and their stability
- Study of off-flavours in different foods.

Reference Books

- Ashurst PR. 1994. Food Flavorings. 2nd Ed. Blackie.
- Burdock GA. 2004. Fenaroli's Handbook of Flavor Ingredients.5th Ed. CRC Press.
- Deibler D &Delwiche J. 2004. Handbook of Flavor, Characterization: Sensory Analysis, Chemistry and Physiology. Marcel Dekker.

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Elective Course FFT 253 : Fermentation Technology

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Spring

Pre-requisite: An introductory course of Food Microbiology (FFT 323)

Objective

To familiarize about the various microbial processes/systems/activities which have been used for the development of industrially important products/processes.

Course Content

UNIT I 6 lectures

History of fermentation. Introduction to fermentation processes, Media formulation and process optimization.

UNIT II 8 lectures

Microorganisms used in food fermentation, Types of cultures, starter cultures: maintenance, propagation and activation of cultures.

UNIT III 5 lectures

Types of fermentation sub-merged/solid state, Batch /continuous fermentation, Fermenter design and operation.

UNIT IV 5 lectures

Fermented Foods-types, methods of manufacture for vinegar, saurkraut, tempeh, miso, soya sauce, bakery foods and traditional Indian foods.

UNIT V 6 lectures

Food related fermentations: Microbial biomass, Single cell protein, baker's yeast and enzyme production

Practical

- Media formulation and sterilization
- Study of fermentation of pulses and millets
- Maintenance and activation of lyophilised starter cultures.
- Study of dough raising power of yeasts
- Production of fermented products viz. saurkraut, idli, curd etc.

Reference Books

- Stanburry P.P. and Whitaker, A. 1984. Principles of Fermentation Technology. Pergamon
- Press, Oxford UK.
- Steinkraus, K.H. 1983. Handbook of Indigenous Fermented Foods. Marcel Dekker, New York.
- Biely, J.E. and Ollis D.F. Bio Chemical Engineering Fundamentals (1986) McGraw Hills.
- Moo-young M. Comprehensive Biotechnology Vol. 1-4 Pergamon Press Oxford.

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Skill Course FFT 230 : Industrial Training-II for 15 days

Credits: (0-0-2-2)

Level: Undergraduate

Semester: Spring

Pre-requisite: Any course in Food Processing

SEMESTER V

Skill Course FFT 321 :Principles of Food Engineering

Credits: (1-2-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on unit operations in food processing (FFT 328)

Objective

To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.

Course Content

UNIT I 10 lectures

Process time calculations; Sterilizers and accessories used in canning industries; Engineering aspects of pasteurizer; homogenizer, evaporators (basic principle and single-effect evaporator) and concentrators used in food industries; Seaming machine.

UNIT II 8 lectures

Construction of cold storage; Different types of freezers including plate contact freezer, air blast freezer, cryogenic freezing and refrigerated vans.

UNIT III 9 lectures

Various types of driers (basic principle and drying time) – Tray drier, roller drier, spray drier, fluidized bed drier, freeze drier and solar drier.

UNIT IV 9 lectures

Heat exchangers (including paraflow HEs); Extruders – Basic principles and types, Difference between single- and twin-screw extruders; Kneader; Oil expeller

UNIT V 9 lectures

Advanced separation processes: Dialysis, ultrafiltration, reverse osmosis, electro dialysis and membrane separation.

Practical:

- Determination of viscosity of Newtonian fluid, Non Newtonian fluids;
- Determination of conductivity, calorific value and filtration properties of food& water.
- Calculation of freezing time for some typical foods
- Determination of Textural characteristics TPA of food product
- Evaluation of Bulk density and basics of true and bulk density

Reference books

- Fundamentals of Food Engineering by Stanley Charm.
- Introduction to Food Engineering - R.Paul Singh, Dennis R.
- Fundamentals of Food Process Engineering; Toledo RT; 2nd ed, 2000, CBS Publishers.
- Food process engineering, D.R.Heldman and R.P.Singh

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ElectiveCourse FFT 351 :Post Harvest Management of Fruits and Vegetables

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: An introductory course on fruits and vegetables (FFT 333)

Objective

To acquaint with the proper handling technologies of fruits and vegetables to reduce post harvest losses and acquaint with principles and methods of preservation of fruits and vegetables into various products.

Course Content

UNIT I 6 lectures

Morphology, structure and composition of fruits and vegetables; maturity indices and standards for selected fruits and vegetables; methods of maturity determinations

UNIT II 8 lectures

Harvesting and handling of important fruits and vegetables, Field heat of fruits and vegetables and primary processing for sorting and grading; factors affecting post harvest losses; Standards and specifications for fresh fruits and vegetable.

UNIT III 8 lectures

Post-harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits; Storage practices: CA and MA, hypobaric storage, pre-cooling and cold storage; Commodity pretreatments - chemicals, wax coating, prepackaging and irradiation.

UNIT IV 4 lectures

Physiological post harvest disorders - chilling injury, freeze injury and disease.

UNIT V 4 lectures

Prevention of post harvest diseases and infestation; Handling and packaging of fruits and vegetables.

Practical

- Quality evaluation of raw vegetables
- MAP of fruits, Preparation of Products- Lemon Squash, Mango Soup
- Waxing of fruits
- Preservation of vegetables- Low Temperature, Determination of Preservative(KMS)

Reference Books

- Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.
- Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.
- Verma LR. & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

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Elective Course FFT 352 : Food Beverage Technology

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A basic course in Food Science (FFT 322)

Objective

In this the students will be exposed to the knowledge of beverage types and manufacturing process involved in different beverage manufacturing industries.

Course Content

UNIT I 6 lectures

Types of beverages and their importance; status of beverage industry in India;

UNIT II 4 lectures

Manufacturing technology for juice-based beverages; synthetic beverages; technology of still, carbonated, low-calorie and dry beverages; isotonic and sports drinks;

UNIT III 4 lectures

Specialty beverages based on tea, coffee, cocoa, spices, plant extracts etc.

UNIT IV 8 lectures

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, , wine and related beverages, distilled spirits.

UNIT V 8 lectures

Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, carbonated water.

FFT 422 Food Beverage Technology Practical

- Chemical and microbiological analysis of raw water quality;
- Preparation of regional fruit juices;
- Preparation of whey-based beverages;
- preparation of crush, nectar, blended juice
- Preparation of soy milk, fruit milkshakes, herbal beverages;
- Visit to relevant processing units.

Reference Books

- Srivastava RP & Kumar S. 2003. Fruit and Vegetable Preservation - Principles and Practices. International Book Distributors.
- Hardwick WA. 1995. Handbook of Brewing. Marcel Dekker.
- Hui YH. et al 2004. Handbook of Food and Beverage Fermentation Technology. Marcel Dekker.
- Priest FG & Stewart GG. 2006. Handbook of Brewing. 2nd Ed. CRC.
- Richard P Vine. 1981. Commercial Wine Making - Processing and Controls. AVI Publ.

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Elective Course: FFT 353 :Technology of Indigenous Milk Products

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on Dairy Technology/Food Science

Objective

To acquaint the students with the milk and milk based product preparations and the nutritional composition and health effect (good/bad).

Course Content

UNIT I 2 lectures

Status and significance of traditional milk products in India.

UNIT II 6 lectures

Khoa: Classification of types, standards methods of manufacture and preservation factors affecting yield of khoa. Physico-chemical changes during manufacture and storage of khoa. Confectioneries made from Khoa-Burfi, peda, Milkcake, Kalakhand, Gulabjaman and their compositional profile and manufacture practices.
Rabri and Basundhi: Product identification, process description, factors affecting yield physico-chemical changes during manufacture.

UNIT III 6 lectures

Channa: Product description, Standards method of manufacture, packaging and preservation.
Chhana-based sweets, Mechanization of manufacturing process.
Paneer: Product description standards method of manufacture packaging and preservation. Physico-chemical changes during manufacture and storage.

UNIT IV 7 lectures

Srikhand: Chakka product description, standards method of manufacture, small scale and industrial, packaging and preservation aspects. Physico-chemical changes and quality assurance during manufacture and storage.
Sandesh, Mistidahi: Product description method of manufacture and packaging process.
Kheer and Payasam: Product description methods of manufacture, innovations in manufacturing and packaging processes.

UNIT V 9 lectures

Microbiology of indigenous milk products: predominance of spoilage & pathogenic organisms in Curd, Khoa, Channa, Paneer, Shrikhand, control measures & legal specifications.
Biopreservative principles in enhancing the shelf-life ofindigenous milk products including active packaging.

FFT 366 Technology of Indigenous Milk Products Practical:

- Preparation of khoa from cow and buffalo milk.
- Preparation of chhana from buffalo milk.
- Preparation of paneer from buffalo milk.
- Analysis of khoa, chhanna and paneer for total solids, moisture, fat and acidity.

- Preparation of mistidahi, chhaka and srikhand.
- Microbiological examinations of traditional dairy products: Khoa, paneer, coliform counts, yeast and molds counts etc.

Reference Books

- Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. *Technology of Indian Milk Products*. Dairy India Publ.
- De S.1980*. Outlines of Dairy Technology*. Oxford Univ. Press.
- Rathore NS *et al.* 2008. *Fundamentals of Dairy Technology - Theory & Practices*. Himanshu Publ.

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Elective Course FFT 354: New Product Development and Sensory Science

Credits: (2-0-1-3)

Level: Undergraduate

Semester: Autumn

Pre-requisite: An introductory course on Food quality and analysis (FFT 327)

Objective

To acquaint the students with the Sensory evaluation techniques and steps for the development of new food products.

Course Content

UNIT I (5 lectures)

Introduction to sensory analysis.Background and importance of Sensory Analysis, Definition of Sensory Analysis, Fields of Application of Sensory Analysis, Legislation on Sensory Analysis, Sensory perception and the organs of senses

UNIT II (6 lectures)

Methodology of sensory analysis, Preparation of trial, Location of test and tasting Rooms, Sensory evaluation techniques, Types of tests Differentiation sensory tests, Variables and scales, Descriptive sensory tests Affective sensory tests

UNIT III (7 lectures)

Assessors: Selection, training and monitoring, Assessors, Types of assessors, Factors influencing sensory evaluations, Features of assessors, Selection, training and monitoring of assessors: Recruitment, Selection, Training,Monitoring

UNIT IV (6 lectures)

Concept of product development - product success and failure, factors for success, process of product development, managing for product's success. Innovation strategy - possibilities for innovation, building up strategy, product development programme.

UNIT V (5 lectures)

The product development process - product strategy, product design and process development, product commercialization, product launch and evaluation.

Practical

- Selection and training of sensory panel
- Detection and threshold tests
- Ranking tests for taste, aroma colour and texture
- Sensory evaluation of various food products using different scales, score cards and tests
- Estimation of color and texture,Relationship between objective and subjective methods
- Idea and Concept generation for development of new product

Reference Books

- Meilgaard Morten; Sensory evaluation techniques Stone Herbert; Sensory evaluation practices. ISBN: 0-12-672690-6
- Schaffner, D. J., W. R. Schroeder e M. D. Earle; Food Marketing: An International Perspective - 2nd ed, McGraw Hill, 2003. ISBN: 978-0072952889
- Varela, P. e G. Ares; Novel Techniques in Sensory Characterization and Consumer Profiling, CRC Press , 2014. ISBN: ISBN 9781466566293

Skill Course FFT 322 :Waste Management and Effluent Treatment

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on hygiene and plant sanitation (FFT 320)

Objective

To acquaint the students with the major source of living ie water, its treatment, analysis and how to make it potable.

Course Content

UNIT I 10 lectures

Selection of sanitizing agents for cleaning, packaging sanitation, food storage sanitation, transport sanitation and water sanitation.

UNIT II 10 lectures

By-products obtained from cereals, pulses, legumes, oil seeds, fruit and vegetables, dairy plant, sugar and bakery, plantation crops and spices egg and poultry processing industry and meat, Fermentation industry.

UNIT III 10 lectures

Characterization of food industry wastes e.g., BOD, COD and total organic content, floatable and suspended solids in water.

UNIT IV 15 lectures

Pretreatment, secondary treatments of solid waste, sludge volume index, advanced techniques activated bio-filtration, biological fluidized bed reactor, dried bacteria culture process

UNIT V 15 lectures

tertiary treatments or advanced waste water treatment system (AWT); polishing ponds, DAF Techniques, micro trainers treatment and disposal of sludge, sand filters, removal of nitrogen, phosphorus, sulphur, physical chemical treatment process.

Reference Books

- Energy Conservation through Waste Utilization, American Society of Mechanical Engineers, New York.
- Kreit F &Goswami DY. 2008. Energy Management and Conservation Handbook. CRC Press.
- Murphy WR &Mckay G. 1982. Energy Management. BS Publ. Patrick DR. 1982.. Energy Management and Conservation. Elsevier Publ.
- Patrick DR., Fardo SW, Richardson RE & Steven 2006. Energy Conservation Guidebook. The Fairmont Press.
- Wulfinghoff DR. Energy Efficiency Manual. Energy Institute Press

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Skill Course FFT 323 :Food Laws and Regulations

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on Food science/processing

Objective

To acquaint with food quality parameters and control systems, food standards, regulations, specifications.

Course Content

UNIT I 5 lectures

Introduction and Need of enforcing to Food Laws.

UNIT II 20 lectures

Mandatory food laws; The food safety and standards Act 2006, Establishment of the authority, composition of authoring functions of chief executive officer, scientific part, General principles to be followed in administration of act, General provisions as to articles of food, special responsibility as to safety of food, analysis of food offences of penalties.

UNIT III 15 lectures

Edible Oils Packaging (Regulation) Order, 1998, Environment (Protection) Act, 1986, Fruit Products Order, 1955 (FPO), Meat Food Products Order, 1973 (MFPO), Milk and Milk Product Order, 1992 (MMPO), Solvent Extracted Oil, De-oiled Meal and Edible Flour (Control) Order, 1967.

UNIT IV 10 lectures

Standards of Weights and Measures Act, 1976, The Essential Commodities Act, 1955, The Export (Quality Control and Inspection) Act, 1963, The Insecticides Act, 1968, Vegetables Oil Products(Control) Order, 1998, Prevention of Food Adulteration Act & Rules (PFA Act), 1954 , Agmark Standards (AGMARK), Codex Alimentarius Standards, BIS Standards and Specifications, Consumer Protection Act, 1986.

UNIT V 10 lectures

Recommended international code of hygiene for various products.

Reference Books

- Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Krammer A &Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ

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Skill Course FFT 324 :Food Plant Design and Layout

Credits: (3-1-0-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course of food processing unit operations (FFT 328)

Objective

To acquaint the students with the plant layout operation which is required by all industries to check their comparative factors as equipment position raw material handling and end product delivery

Course Content

UNIT I 10 lectures

Introduction : Plant design concepts - situations giving rise to plant design problems - differences in design of food processing and non-food processing plants

UNIT II 20 lectures

General design considerations, Food Processing Unit Operations, Prevention of Contamination, Sanitation, Deterioration, Seasonal Production, Flow Chart for Plant Design, Identification Stage, Looking for a need, Finding a product, Preliminary Screening of ideas, Comparative rating of product ideas: Present Market, Market Growth potential, Costs, Risks,

UNIT III 15 lectures

Plant location: Introduction, Location Decision Process, Factors involved in the plant location decision, Subjective, Qualitative and Semi-Quantitative Techniques

UNIT IV 5 lectures

Food Plant Utilities: Process Water, Steam, Electricity, Plant Effluents.

UNIT V 10 lectures

Plant layout : Importance, Flow Patterns, Basic Types of plant layouts, Product or line layout, Process or functional layout, Cellular or group layout, and Fixed position layout, Plant Layout factors, Layout design Procedure., Maintenance of Food Plant Building

Reference Books

- Peters, M.s and Timmerhaus, K.D, Plant Designs and Economics for Chemical Engineers, 4th Edition McGraw Hill,1991
- Biegler L.,grossmannI.E.andWesteberg A.W., Systematic Methods of Chemical Engineering and Process Designs, prentice Hall ,1997.
- Z. B. Maroulis and G. D. Saravacos, Food Process Design, Marcel Dekker 2003.

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General Education Course FFT 301 : Disaster Management

Credits: (3-2-0-5)

Level: Undergraduate

Semester: Autumn

Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To familiarize the students with the concept of disaster, how to response to disaster and field work to access the cause.

Course Content

UNIT I 15 lectures

Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and Local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

UNIT II 15 lectures

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT III 10 lectures

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction.

UNIT IV 15 lectures

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion.

UNIT V 15 lectures

Field work / Case studies Hazard mapping of vulnerable areas, Vulnerability assessment (physical, social, organizational, economical, technological) Risk mitigation planning for vulnerable areas.

Reference Books

- Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan.
- Hodgkinson PE & Stewart M. 1991. Coping with Catastrophe: A Handbook of Disaster Management. Routledge.
- Sharma VK. 2001. Disaster Management. National Centre for Disaster Management, India.

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General Education Course FFT 303 :Introductory Biotechnology

Credits: (3-0-1-4)

Level: Undergraduate

Semester: Autumn

Pre-requisite: A course on basic microbiology (FFT 323)

Objective

To acquaint the students with the fundamental of bio-technology, industrial microbiology and fermentation processes.

Course Content

UNIT I 5 lectures

Prospectus of biotechnology- definition, scope and importance, DNA structure, function and metabolism.

UNIT II 10 lectures

GMO, genetic recombination mechanisms and technique used for improvement in microbial strains; Methods of recombinant DNA technology; Nucleic acid hybridization; Plant and animal cell and tissue culture techniques and their applications.

UNIT III 10 lectures

Molecular markers and their applications; DNA sequencing; Genetic engineering and transgenics; Genomics, transcriptomics and proteomics.

UNIT IV 10 lectures

General application of biotechnology in food industry, pharmaceuticals and agriculture Public perception of biotechnology; Bio-safety and bioethics issues.

UNIT V 10 lectures

Introduction to nanotechnology, history and recent developments, sources of nanoparticles, microbial production of nanoparticles, advantages of microbial nanoparticles and their applications.

FFT 303 Introductory Biotechnology Practical

- Isolation of genomic DNA from different sources
- Gel electrophoresis techniques
- Restriction enzyme digestion, ligation, transformation and screening of transformants
- Demonstration of PCR

Reference Books

- Becker JM, Coldwell GA &Zachgo EA. 2007. Biotechnology – a Laboratory Course. Academic Press.
- Brown CM, Campbell I & Priest FG. 2005. Introduction to Biotechnology. Panima Pub.
- Gupta PK. 2004. Biotechnology and Genomics. Rastogi Publications.
- Sambrook J, Fritsch T &Maniatis T. 2001. Molecular Cloning – a Laboratory Manual. 2nd Ed. Cold Spring Harbour Laboratory Press.
- Singh BD. 2007. Biotechnology Expanding Horiozon. Kalyani Publishers
- Fundamentals of Biotechnology, Prave. P. Faust, V. Sitih. W., Sukatsh, DA, 1987. ASM press.

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FFT 330: Seminar(0-0-4-2)

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SEMESTER-VI

Skill Course FFT 325 :Quality Assurance and Certification

Credits: (3-0-0-3)

Level: Undergraduate
Semester: Spring
Pre-requisite: A course of food Quality and Analysis (FFT 327)

Objective

To acquaint the students with the certifications involved in raw material food and industries and different organizational system such as HACCP, GMP/GHP and auditing and surveillance.

Course Content

UNIT I 5 lectures

Quality inspection, quality control, quality management and Quality Assurance.

UNIT II 10 lectures

Total quality management; Good Manufacturing Practices, Good Agricultural Practices, Good Laboratory Practices, Quality Management systems QSS. Quality Circles, SQC.,

UNIT III 10 lectures

ISO System. HACCP, Principles, Implementation.

UNIT IV 5 lectures

Plan of Documentation, types of records.

UNIT V 15 lectures

Auditing, Surveillance; Audit, Mock audit, third party quality certifying audit, Auditors and Lead auditors. Certification, Certification procedures, Certifying bodies, Accrediting bodies, International bodies.

Reference Books

- Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Krammer A &Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ

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General Education Course FFT 306 :Human Values and Ethics

Credits: (4-0-0-4)

Level: Undergraduate
Semester: Spring
Pre-requisite: 10+2 science examination with PCB/PCBM/PCM/10+2 Agriculture

Objective

To acquaint the students with the ethics involve in environmental protection, IPR and safe guarding heatlh of consumer.

Course Content

UNIT I 10 lectures

The importance and the needs of ethics; Ethical business practices; Laws and ethics; Environmental protection;

UNIT II 10 lectures

Creating awareness and safeguarding health of consumers; Fair trade practices.

UNIT III 10 lectures

Concept of property, rights, duties and their correlation; History and evaluation of IPR; Copyrights and related rights.Distinction among various forms of IPR.

UNIT IV 15 lectures

Patent rights/protection and procedure; Infringement or violation; Remedies against infringement; Indian Patent Act 1970 and TRIPS; Geographical indication and Industrial design.

UNIT V 15 lectures

International Registration systems; WIPO treaties; Unfair competition; Protection of new plant varieties; Legal implications and public concerns in genetic modification of foods; National policies on food security.

Reference Books

- Daniel and Selvamony - Value Education Today, (Madras Christian College, Tambaram and ALACHE, New Delhi, 1990)
- S. Ignacimuthu - Values for Life - Better Yourself Books, Mumbai, 1991.
- M.M.M.Mascaronhas Centre for Research Education Science and Training for Family Life Promotion - Family Life Education, Bangalore, 1993.
- Agochiya D. 2002. Every Trainer's Handbook. Sage Publ.
- David Gross. 1997. Human Resource Management - The Basics. TR Publ.
- Davis Keth&Newston W John 1989. Human Behaviour at Work. 8th Ed. McGraw-Hill.
- Lynton RP &Pareek U. 1993. Training for Development. DB. Taraporewale Sons & Co.

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General Education Course FFT 307 :Project Management and Entrepreneurship

Credits: (3-2-0-5)

Level: Undergraduate

Semester: Spring

Pre-requisite: A course on business management (FFT 309/FFT 317)

Objective

To acquaint the students with the performance evaluation and review techniques and critical path method to solve the industrial problems.

Course Content

UNIT I 15 lectures

Definition of Entrepreneurship given by various economists, the conceptual model of Entrepreneurship.Entrepreneur and Manager, Enterprise and Entrepreneur. Managing Creativity Issues to be addressed in working the definition of creativity, Attributes of a creative person, Creative Thinking and Motivation.

UNIT II 15 lectures

Composition of Small Business, Economic Contribution of Small Business. Strategic Planning for Small Business, Steps in Strategic Planning -Conduct a thorough Market Segment Analysis, Formulate Strategic Options and Select appropriate Strategies (Focus, Cost leadership & Differentiation), Why Strategic Planning fails in Small Business.

UNIT III 8 lectures

Forms of Ownership: Sole Proprietorship, Partnership &Corporation form of Organisation -Advantages and Disadvantages, Franchising- What is Franchising -Advantages and Disadvantages to Franchising - Franchise Evaluation Checklist –Franchise contracts -Types of Franchise arrangements.

UNIT IV 20 lectures

Project creation, significance of infrastructure in economic development, Project Identification, Idea generation, Project screening, Feasibility study. The advantages and disadvantages of starting your business, Financial Record Keeping – Profit Planning & Cost Control, Project costing : Breakdown structure of the project, cost estimation of the project, factor affecting the cost of the project, Costing with alternative configurations/specifications.

UNIT V 17 lectures

Traditional sources of financing, Equity shares, preference, shares, Debentures/bonds, loan from financial institutions- Loan syndication and consortium finance; Alternative sources of financing, Franchising etc; Role played by various Financial Institutions like IDBl, ICICI and IFCI etc. Project insurance, Human resource management, network analysis.

Reference Books

- Chandra P. 2005. Project Management. Tata McGraw Hill.
- GopalKrishan P &Nagarajan K. 2005. Project Management. New Age.

- Hisrich RD & Peters MP. 2002. Entrepreneurship. Tata McGraw Hill.
- Kaplan JM. 2003. Patterns of Entrepreneurship. John Wiley & Sons.
- Nandan H. 2007. Fundamentals of Entrepreneurship Management. Prentice Hall

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FFT 340 : Project Work for 3 months (0-0-18-18)