Revised B. Sc. (GEOLOGY) Syllabus -2014

Course Curricula

B. Sc. (Part I)

a.	**Theory Papers:**		**Marks**	**Hrs/week**
	Paper-I	General Geology	30	2
	Paper-II	Structural Geology	35	2
	Paper-III	Crystallography and Mineralogy	35	2
b.	**Practical:**		50	4
		Total	**150**	**10**

B. Sc. (Part II)

a.	**Theory Papers:**		**Marks**	**Hrs/week**
	Paper-I	Paleontology	35	2
	Paper-II	Stratigraphy	30	2
	Paper-III	Petrology	35	2
b.	**Practical:**		50	4
		Total	**150**	**10**

B. Sc. (Part III)

a.	**Theory Papers:**		**Marks**	**Hrs/week**
	Paper-I	Economic Geology	35	2
	Paper-II	Geochemistry and Geoexploration	35	2
	Paper-III	Environmental Geology and Remote Sensing	35	2
	Paper IV	Geohydrology and Engineering Geology	35	2
b.	**Practical**			
	I	**Field Geology**	35	8hrs/day
	II	**General viva-voce**	50	--
		Total	**225**	**8+Field Geol.**

Syllabus for Geology as one subject in B.Sc.
(Revised 2014)

B. Sc. Part-I

Paper-I: General Geology

Geology and its branches, history of the earth and solar system, Basic principles of stratigraphy, geological timescale and rock record, rock and minerals. Weathering and erosion, natural water cycle and ground, geological action of river, wind, glacier and sea, Rock cycle, sedimentation and sedimentary rock, earth and life. Interior of earth, the internal heat of earth, age of earth, geodating techniques, formation of igneous rock, volcanism, plutonism and metamorphism, nature of seismic wave inside the earth, earth's magnetism and gravity, plate tectonics, deformation of the earth's crust, the plate in the solar system, a summary of the current knowledge, matter and energy of the earth.

Books recommended:

Holmes, Arthur (1992): Principles of Physical Geology, Vol. 1, Chapman and Hall, London.
(Van Nostrand Reinhold Co. Ltd., U.K., 1978; ISBN: 0 442 30780 2; p. 30)
Leet, L.D. and Judson, S. (1969): Physical Geology, Prentice Hall.
(Prentice-Hall, 1987; ISBN: 0136696988, 9780136696988; p. 484)
Ritter, Dale F. (1986): Processes of Geomorphology. Wm C. Brown Publ.
(Waveland Press, 2006; ISBN: 1577664612, 9781577664611; p. 560)
Singh, S (2001): Geomorphology, Prayag Pustak Bhandar, Allahabad
(Prayag Pustak Bhawan, Allahabad ,1998; p. 613)

Paper-II: Structural Geology

Outline of Structural Geology, Primary and Secondary structures, Importance of primary structures in structural geology (bedding, graded bedding, top and bottom criteria, cross stratification, ripple marks, sole marks pinch and swell structures, peneccontemporaneous folds, and primary volcanic and plutonic structures), sedimentary structure of deformed origin, differential compaction, Fundamental deformed structures, Nature of contacts (unconformities, Intrusive and faulted contacts), Recognition and classification of faults, dynamics analysis of faulting, Ductile Shear Zones, General characteristic of fractures and joints, Classification of joints and Joint related structures, Classification and Geometric and kinematic analyses of folds, Classification and significance of foliations and lineations, Deformation pattern in Meteoritic Impact Structures and Regional Tectonic Structures of India.

Books recommended:

George H. Davis and Stephen J. Reynolds, 1996, Structural Geology of Rocks and Regions, John Wiley & Sons, Inc., 492p. ISBN- 047152621-5
Robert D. Hatcher, 1995, Structural geology, principles, concepts, and problems, Prentice Hall, 525p. ISBN-0023557133.
S. K. Ghosh, 1993, Structural Geology, Fundamentals and modern developments, Peramon Press, 598p. ISBN-0080418791.

Subir Kumar Ghosh and SudiptaSengupta and S. Sengupta, 1997, Evolution of geological structures in micro- to macro-scales, Springer, Berlin.446p. ISBN-0412750309.
John G. Ramsay and Martin I. Huber, 2003, The Techniques of Modern Structural Geology, Volume 1: Strain Analyses, Academic Press, 305p. ISBN-0-12-576921-0.
John G. Ramsay and Martin I. Huber, 2003, The Techniques of Modern Structural Geology, Volume 2: Folds and Fracture, Academic Press, 697p. ISBN-0-12-576902-4
Stephen Marshak and GautumMitra,Basic, 1988, Methods of Structural Geology, Prentice Hall, 446p. ISBN- 0130651788
Richard J. Lisle, 2003, Geological Structures and Maps: A Practical Guide, Butterworth-heinemann, 124p. ISBN-0750657804
R. G. Park, 2004, Foundation of Structural Geology, Routledge, 202p. ISBN-074875802X
Haakon Fossen, 2010, Structural Geology, Cambridge University Press, 463p. ISBN-9780521516648.
David D. Pollard and Raymond C. Fletcher, 2005, Fundamentals of Structural Geology, Cambridge University Press, NewYork, 500p. ISBN-10 0-521-83927-3.
Donal M. Ragan, 2009, Structural Geology: An Introduction to Geometrical Techniques, Cambridge University Press, 602p. ISBN-0521897580.

Paper-III: Crystallography and Mineralogy

Introduction to fundamentals of Crystals : bonding, chemistry, solid solution, polymorphism, isomorphism, pseudomorphism; their faces, forms and laws of crystallography, Miller notation, symmetry elements, study of crystal forms of all seven crystal systems, twinning and its important laws, common types of twins and their examples in minerals. Hermann – Mauguin symbols, crystal projections: spherical and stereographic projection and their uses, liquid crystals and their applications, principles of optics, use of petrological microscope, concept of indicatrix and optic axis figure. Structure, chemistry and phase equilibria study of common rock-forming minerals.

Books recommended:

Berry, L.G., Mason, B. and Dietrich, R.V. (1982): Mineralogy,
(Freeman (San Francisco), 1983; ISBN: 0716714248, p. 561)
Dana, E.S. and Ford, W.E.(2002): A textbook of Mineralogy (Reprints).
(J. Wiley & Sons, 1958; p. 851)
Nesse, D.W. (1986): Optical Mineralogy, McGraw Hill.
(Oxford Univ Pr, 2009; ISBN: 0195391152, 9780195391152;p. 364)
Phillips, F.C (1971): Introduction to Crystallography, Longman Group Publ..
(Read Books Design, 2011ISBN: 1447417003, 9781447417002; p. 312)
Read, H.H. (1968): Rutley's Element of Mineralogy (Rev. Ed.), Thomas Murby and Co.
(T. Murby & Co., 1970; ISBN: 0045490058, 9780045490059; p. 560)
Deer, W.A., Howie, R.A. and Zussman, J. (1996) An Introduction to the Rock-Forming Minerals, Prentice Hall, London.
(Longman Scientific & Technical, 1992; ISBN: 0582300940, 9780582300941; p. 696)

Bloss, F.D. (1971): Crystallography and Crystal Chemistry. Holt, Rinehart and Winston, New York.
(Holt, Rinehart and Winston, 1971; ISBN: 0030851556 (0-03-085155-6); p. 545)
Klein, C. and Hurlbut, C.S. (1993): Manual of Mineralogy. John Wiley & Sons, New York.
(Wiley, 1999; ISBN: 0471312665, 9780471312666; p. 681)

Crystallography & Mineralogy
Study of physical properties of minerals mentioned in theory course; Study of elements of symmetry of representative crystals from each system; Use of polarizing microscope; Study of optical properties of important rock forming minerals and an introduction to gem stones and gems.

Structural Geology
Problems of dip strike and thickness of bed , Study of some primary (bedding, cross-bedding, ripple marks, salt pseudomorphs etc.) and deformed structures (folds, faults, joints, foliation and lineations) in meso-scopic scale, contour maps and completion of outcrops, study and interpretation of topographical maps, geological maps and section including geological history, stereographic projection.
Field studies

B. Sc. Part-II

Paper-I: Paleontology
Paleontology: Definition, subdivision and scopes. Fossils: Definition, character and kinds (body and trace) and applications. Conditions and modes of fossilization. Classification and nomenclature. Living and derived fossils. Collection and preparation of fossils.
Study of morphological characters and geological distribution of the following invertebrate groups; Brachiopoda, Bivalvia, Gastropoda, Cephalopoda, Echinoidea and Trilobita.
Elementary idea about different types of microfossils (calcareous, siliceous, phosphatic and organic –walled) and their applicability. A brief outline of vertebrate fossils with special reference to the Siwalik fauna. Study of Gondwana plant fossils.

Books recommended:
Moore, R.C., Lalicker, C. G., and Fischer, A.G., (1997) Invertebrate Fossils, CBS Publ., N. Delhi.
(CBS Publishers & Distributors Pvt. Ltd., 2004; ISBN 8123911394, p. 766)
Shrock, R.R. and Twenhofel, W. H., (1999) Principles of Invertebrate Paleontology, CBS Publ., N. Delhi.
(Textbook Publishers, 2003; ISBN: 075818395X, 9780758183958; p. 816)
Jain P.C., & Anathraman, M. S., (2010) Palaeontology: Evolution and Animal Distribution, Vishal Publ. Co., Delhi
(
Wood, H., (1997) Paleontology Invertebrate (9th Edition), CBS Publ., N. Delhi.
Kathal, P. K., (2012) Applied Geological Micropaleontology, Scientific Publishers, Jodhpur, India.
(Scientific Publishers, 2012; ISBN817233754X, 9788172337544.

Paper-II: Stratigraphy

Introduction; Stratigraphic Principles, Classification and Nomenclature; Litho-, Chrono- and Biostratigraphy; Stratigraphic Correlation.

Precambrian Stratigraphy- Dharwar Province, Singhbhum Region, Central India; Cuddapah and Vindhyan Supergroups.
Phanerozoic Stratigraphy- Stratigrphic succession, Lithology and Fossil characteristics of important Paleozoic, Mesozoic and Cenozoic formations in India. Gondwana and Siwalik Groups. Deccan Trap.

Books recommended:
Kumar, R. (2007) Fundamental of Historical Geology & Stratigraphy of India. New Age Intntl. Pvt. Ltd. Publishers, New Delhi
(Wiley Eastern, 1985; ISBN: 0852267452, 9780852267455; p. 254)
Krishnan, M.S. (1998) Geology of India & Burma, CBS Publ., Delhi.
(CBS Publishers & Distributors, 2006; ISBN: 8123900120, 978-8123900124 ; p. 536)

Paper-III: Petrology

Introduction to petrology,classification of rocks and their surface abundance. Igneous rocks: forms, textures, structures and microtextures , crystallization of magma ,one component (SiO_2), Two component(Di-An, MgO-SiO_2 and Ab- An systems) and multi component systems (Di – Ab- An and Ne-Ks-SiO_2). Classification of igneous rocks,Peacocks index, causes of diversity in igneous rocks, Petrographic province and Harkar Variation diagram, study of following rock type: Basaltoids, Granitoids, Alkaline rocks, ultramafic rocks and lamprophyres and lamproites.
Nature and origin of sedimentary rocks, classification of sedimentary rocks, sandstone, conglomerate, shale and limestone; textures of sedimentary rocks, provenance, sedimentary structures, diagenesis; Introduction to sedimentary basins and depositional environments.
Metamorphic rocks: definition and types of metamorphism, texture, fabric and structures in metamorphic rocks, basic concepts of metamorphic zones, facies and grades , anatexis , metamorphism of different rock types.

Books recommended:
Best, Myron G. 2002, Igneous and Metamorphic Petrology. Blackwell Science
(Blackwell Science Ltd., 2003; ISBN: 1-40510-588-7; p. 752)
Winter, J.D. 2001, An introduction to Igneous and Metamorphic Petrology, Prentice-Hall India, NewDelhi.
(Prentice Hall, 2010; ISBN: 0321592573, 9780321592576; p. 702)
Sengupta, S.M. 2007, Introduction to sedimentology. CBS Publ, New Delhi , ISBN 81-239-1491-1, 339 pages.
Prothero D.R. and Schwab, F. 2004, Sedimentary Geology. Freeman.
(W.H. Freeman, 2004; ISBN: 0716739054, 9780716739050; p. 557)

Paleontology

Study of modes of preservation of given fossil specimens. Study of morphological characters of various invertebrate fossil genera. Morphological study of some Gondwana plant fossils. Microscopic study of various types of microfossils.

Petrology

Study of rocks in hand specimens and in thin sections: igneous, metamorphic and sedimentary; preparation of thin sections; study of sedimentary structures; grain-size analysis.
Field studies

B. Sc. Part-III

Paper-I: Economic Geology

Mode of occurrence, origin, classification of ore deposits (magmatic, metamorphic ,hydrothermal and sedimentary), Forms of ore deposits, Introduction to ore microscopy, Stratiform and stratabound ores, Origin and distribution of copper iron , manganese, aluminium, lead and zinc, asbestos, barytes, gypsum, graphite, apatite and beryl deposit of India, Geothermometry, Metallogenic epochs and provinces of India, Strategic , essential and critical minerals with examples. Coal and petroleum deposits of India. Raw material for ceramic, cement, refractory and glass industries and building stones.

Books recommended:

Prasad, U. 2003, Economic geology, CBS Publ.
(CBS Publishers & Distributors, 2005; ISBN: 8123904606, 9788123904603; p. 300)
Gokhale, K.V.G.K. and Rao, T.C. (1983): Ore Deposits of India, East West Press Pvt. Ltd.
(Thomson Press (India), 1978; p. 226)
Jense, M.L., Bateman, and A.M. (1981): Economic Mineral Deposits, John Wiley and Sons.
(Wiley, 1981; ISBN: 0471090433, 9780471090434; p. 593)
Krishnaswamy, S. (1979): India's Minerals Resources, Oxford and IBH Publ.
(Oxford & IBH, 1979; p. 658)
Sharma, N.L. and Ram, K.V.S. (1972): Introduction to India's Economic Minerals, Dhanbad Publ..
(Dhanbad Publications, 1964; p. 258)

Paper-II: Geochemistry and Geoexploration

Introduction, cosmic abundance of elements, composition of planets and meteorites, structure and composition of earth and distribution of elements, elementary crystal chemistry and thermodynamics, introduction to isotope geo-chemistry, geochemical cycle. Principles of geochemical exploration, sampling, path finders, primary and secondary dispersion, geobotanical survey, geophysical methods of prospecting(gravity, magnetic, electrical, seismic and radioactive). Stage of mineral exploration , classification of reserves.

Books recommended:

Rajendran S. et al (2007) : Mineral Exploration : Recent Strategies.
(New India Publishing Agency, 2007 ; ISBN : 81-89422-71-5 ; p. 528)
Dobrin, M. B., and Savit, C. H., (1988): Introduction to Geophysical Prospecting, McGraw-Hill Book Co.
(McGraw-Hill Book Co., 1988; ISBN: 0070171963, 9780070171961; p. 867)
Mason, B. and Moore, C.B. (1991) Introduction to Geochemistry, Wiley Eastern
(Wiley, 1982; ISBN: 0471575224, 9780471575221; p. 344)

Paper-III: Environmental Geology and Remote sensing

Concepts and principles of environmental geology, natural hazards- prevention and precautions (earthquakes, floods, landslides, river and coastal erosion), impact assessment of urbanization, open cast mining and quarrying, river valley projects, disposal of industrial and radioactive waste, excess withdrawal of ground-water, use of fertilizers, dumping of ore, mine waste and fly ash, organic and inorganic contamination of groundwater and their remedial measures, soil degradation and remedial measures. Concept and principles of aerial photography and photogrammetry, satellite remote sensing- data products and their interpretation, digital image processing, remote sensing in landform and land use mapping, structural mapping, hydrogeological studies and mineral exploration, Geographic Information System (GIS) – principles and applications.

Books recommended:

Bryant, E. (1985): Natural Hazards, Cambridge Univ. Press.
(Cambridge Univ. Press., 2005; ISBN: 0-521-53743-6; p. 312)
Keller, E.A. (1978): Environmental Geology, Bell and Howell, USA.
(Prentice Hall, 2010; ISBN: 0321643755, 9780321643759; p. 596)
Valdiya, K.S. (1987): Environmental Geology – Indian Context, Tata McGraw Hill.
(Tata McGraw-Hill Pub. Co., 1987; p. 583)
Lillesand, T.M. and Kiefer, R.W. (1987) Remote Sensing and Image Interpretation. John Wiley.
(John Wiley, 2004; ISBN: 81-265-1335-7; p. 820)
Siegal, B.S. and Gillespie, A.R. (1980) Remote Sensing in Geology. John Wiley
(Wiley, 1980; ISBN: 0471790524, 9780471790525; p. 702)
Gupta, R.P. (1991) Remote Sensing Geology, Springer, Berlin.
(Springer,2003; ISBN: 3-540-43185-3; p. 655)

Paper-IV: Geohydrology and Engineering Geology

Origin of water, meteoric, juvenile, magmatic and sea waters, hydrological cycle, precipitation, runoff, infiltration, evapotranspiration, hydrographs, classification of aquifers, hydrological properties of rocks (specific yield, specific retention, porosity, permeability, hydraulic conductivity, transmissivity, storage coefficient), Darcy's law, water table fluctuations –causes, Groundwater provinces of India.

Mechanical properties of rocks and soils, geological investigations for river valley projects,- dams, and reservoirs, tunnels- types, methods and problems. Bridges-types and foundation problems. Landslides- classification, causes and prevention and rehabilitation, concrete

aggregates-sources, alkali-aggregate reaction. Geotechnical case studies of major projects in India-in brief.

Books recommended:

Todd, D. K. (1995): Groundwater hydrology, John Wiley and Sons.
(John Wiley and Sons, 1959; ISBN: 81-265-0836-1; p. 556)
Karanth, K. R. (1989): Hydrogeology, Tata McGraw Hill Publ.
(McGraw-Hill Education, 1989; ISBN: 0074601806, 9780074601808; p. 458)
Raghunath, H. M. (1990): Groundwater, Wiley Eastern Ltd.
(Wiley Eastern Ltd., p. 520)
Krynine, D.H. & Judd, W.R. (1998) Principles of Engineering Geology, CBS Edition.
(
Schultz, J.R. & Cleaves, A.B. (1951) Geology in Engineering, John Willey & Sons, New York.
(Wiley, 1966; p.592)
McKinstry, H.E. Mining Geology, Prentice Hall, Englewood Clifts, N.J.
(Prentice-Hall, 1948; p.680)

Practical-I: Field geology

Students will be required to carry out fieldwork for 1-2 weeks in suitable geological areas to study various aspects of field geology and submit a report thereon.

Viva-voce

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