

KOLHAN UNIVERSITY, CHAIBASA



University Department of Geology

Syllabus of P.G. Programme

GEOLOGY

M.Sc. Semester – I

Geomorphology of the coasts, classification of shorelines and their evolution. Evidences of eustatic changes and their causes. Influence of lithology on relief. Development of landforms of flat lying, tilted, folded, dome and faulted structures; Development of drainage systems, Drainage Patterns, Drainage analysis in Geological interpretation. Geomorphic features of India; Application of Geomorphology in groundwater, mineral and oil exploration and Engineering projects.

SUGGESTED BOOKS:

Ghosh, S.K. (1993): Structural Geology: Fundamental and Modern Development.
M.P.Billings(1987) Structural Geology.Prentice Hall
G.R.Davis(1984).Structural Geology of Rocks.John Wiley.
D.D.Polard (2005)Fundamentals of Structural Geology. Cambridge Univ. Press.

GEOLOGY
M.Sc. Semester – I

Core Course- GEOL (CC-2)

Theory **Full Marks – 70**

Total Lecture: 60 Hours

Credit :4

The paper contains 8 questions in which question 1 will be objective type consisting of 10 questions of one mark each is compulsory. Out of remaining seven questions of 15 marks each, 4 are to be answered.

Crystallography and optical mineralogy

Unit-1

Crystalline and amorphous substances. Laws of crystallography. Interfacial angle. Methods of projection of crystals. Forms in crystals. Symmetry in crystals. Different systems of notation. Hermann Mauguin notation.

Unit-2

Symmetry elements and common forms of various crystal system. Derivation of 32 crystal classes. Space lattice and Space groups. Twinning- laws and methods of twinning. Crystal structure by X-rays. Bragg's law.

Unit-3

Principles of optics. Ordinary and polarized light. Behavior of isotropic and anisotropic minerals in polarized light. Optic indicatrix, Double refraction. Colour and pleochroism, Refractive index and surface relief, interference colours, birefringence, extinction and extinction angle.

Unit-4

Behaviour of Uniaxial and biaxial minerals under convergent polarized light. Accessory plates. Optic sign determination of uniaxial and biaxial minerals. Dispersion in minerals. Special optical characters of Orthorhombic and Monoclinic crystals.

SUGGESTED BOOKS

Dexter Pekins, 2003 – Mineralogy, peason Education Private ltd.

Carmelo Giacovazzo, 2002 – Fundamentals of crystallography, oxford University Press

Boris Konstantinovich Vainshten, 1994 – Modern Crystallography ; Fundamental of crystals, symmetry and methods of structural crystallography, Springer

William D. Nesse, 2009 – Introduction to Mineralogy, Oxford University Press

Dana, E.S. – 1955 – Text Book of mineralogy, Wiley

Wade, F.A. and Mattox, R.E. – 1860 – Elements of crystallography and Mineralogy Harmer and Brods.

Philips, P.C. – 1971 – An introduction to Crystallography, John Wiley

Winchell, A.N. – 1968 – Elements of optical Mineralogy, part, I & II Wiley Eastern

Berry, L.G. and Mason B, Dietrich. 1983 – Mineralogy – Concept, Descriptions Determinations, Freeman

Burrougher, M.J. – 1956 – Elementary Crystallography Wiley

heinrich, E.W. – 1965 – Microscopic identification of Minerals McGraw Hill

Naidau, P.R.J.C.S. – 1971 – Johansen's optical Mineralogy , Allied

Haribury, C.S. – 1091 - Dana's Manual of Mineralogy, Wiley

Deer, W.A. Howie, R.A. Zussman, J – 1992 – Rock forming Mineralogy Vols. 1 to 5, Longmans.

Hammond, C. 1990. Introduction to Crystallography. Oxford university Press.

Klein, C. 2002 manual of Mineral Science 22nd edition. New York. John Wiley and Sons.

GEOLOGY

M.Sc. Semester – I

Core Course- GEOL (CC-3)

Theory **Full Marks – 70**

Total Lecture: 60 Hours

Credit :4

The paper contains 8 questions in which question 1 will be objective type consisting of 10 questions of one mark each is compulsory. Out of remaining seven questions of 15 marks each, 4 are to be answered.

Mineralogy and Geochemistry

UNIT 1 :

Principles of crystal chemistry; Chemical bonds, ionic, Coordination principles, Radius ratio,; principles of ionic substitution in minerals; Isomorphism, Exsolution, Polymorphism, Pseudomorphism; Introduction to XRF, XRD and Electron Probe.

UNIT 2 :

Structural classification of silicate minerals ; Description of chemistry, optical and physical properties, and paragenesis of the following mineral group, Garnet Group, Epidote group, Pyroxene group, Amphibole group.

Unit 3

origin and abundance of elements in the Solar System and in the Earth, cosmic abundance of elements; Geochemical classification of Elements; Radiogenic Isotopes; Radioactive decay scheme of U-pb, Sm-Nd, Rb-Sr, K-Ar and growth of daughter isotopes; Radiometric dating Stable Isotopes: nature, abundance and fractions;

Unit – 4

Laws of Thermodynamics and its application in Petrology; Geochemistry and principles of evolution of hydrosphere, biosphere and atmosphere Geochemistry cycle and principles of geochemical prospecting.

SUGGESTED BOOKS

Dexter Pekins, 2003 – Mineralogy, Pearson Education Private Ltd.

Carmelo Giacovazzo, 2002 – Fundamentals of crystallography, Oxford University Press

Boris Konstantinovich Vainshten, 1994 – Modern Crystallography ; Fundamental of crystals, symmetry and methods of structural crystallography, Springer

William D. Nesse, 2009 – Introduction to Mineralogy, Oxford University Press

Dana, E.S. – 1955 – Text Book of mineralogy, Wiley

Wade, F.A. and Mattox, R.E. – 1860 – Elements of crystallography and Mineralogy Harmer and Brods.

Philips, P.C. – 1971 – An introduction to Crystallography, John Wiley

Winchell, A.N. – 1968 – Elements of optical Mineralogy, part, I & II Wiley Eastern

Berry, L.G. and Mason B, Dietrich. 1983 – Mineralogy – Concept, Descriptions Determinations, Freeman

Buerger, M.J. – 1956 – Elementary Crystallography Wiley

Heinrich, E.W. – 1965 – Microscopic identification of Minerals McGraw Hill

Naidau, P.R.J.C.S. – 1971 – Johansen's optical Mineralogy , Allied

Haribury, C.S. – 1911 - Dana's Manual of Mineralogy, Wiley

Deer, W.A. Howie, R.A. Zussman, J – 1992 – Rock forming Mineralogy Vols. 1 to 5, Longmans.

Hammond, C. 1990. Introduction to Crystallography. Oxford university Press.

Klein, C. 2002 manual of Mineral Science 22nd edition. New York. John Wiley and Sons.

Krauskopf, K.B. (1967) : Introduction to Geochemistry, McGraw Hill

Mason, B. and Moore, C.B. (1991) : Introduction to Geochemistry, Wiley Eastern.

Rollinson, H.R. (1993): Using geochemical data : Evaluation, Presentation Interpretation , Interpretation Longman U.K.

GEOLOGY

M.Sc. Semester – I

Core Course- GEOL (CC-4)

Theory **Full Marks – 70**

Total Lecture: 60 Hours

Credit :4

The paper contains 8 questions in which question 1 will be objective type consisting of 10 questions of one mark each is compulsory. Out of remaining seven questions of 15 marks each, 4 are to be answered. ‘

Igneous and Metamorphic petrology

Unit – 1

Nature and evolution of magma; Plate tectonics and generation of magmas; Plume magmatism and hot spots; Large igneous provinces and mafic dyke swarms, Partial melting batch and fractional melting; Crystal Fractionation and contamination; IUGS classification of the igneous rocks and CIPW norm.

Unit – 2

Phase and evolution – binary systems (Ab-An-Ab-Or-Di-An, Fo-Si) and their relations to magma genesis and crystallization in the light of modern experience works; Ternary systems (Di-Ab-An, Di-Fo-Si, Di-Fo-An, Fo-An-Si) and their relations to magma genesis and crystallization.

Unit – 3

Concept of Zones and Grades: Metamorphic facies and facies series ; Fabric in meramorphism; Classification of Metamorphic Rocks. Minerlogical Phase Rule; A detailed description of each of low pressure, medium to high pressure and very high pressure with special reference to mineralogical assemblages Meatmorphic Differentiation; ACF,AKF and AFM diagrams in metamorphic petrology.

Unit – 4

Regional metamorphism and Ocean Floor Metamorphism; Regional and thermal metamorphism of plutonic rocks. Regional and thermal metamorphism of basic and ultrabasic rocks. Regional and Thermal metamorphism of impure, siliceous carbonate rocks; Metamorphism of Granitoids, Charnockites and Migmatites.

SUGGESTED BOOKS

- Bose, M.K. (1997): Igneous Petrology, World Press, Kolkata
- Best, Myron G. (2002): Igneous and Metamorphic Petrology, Blackwell Science.
- Cox, K.G. Bell, J.D. and Pankhurst, R.J. (1993): The Interpretation of Igneous Rocks, Chapman and Hall London.
- Faure, G. (2001): Origin of Igneous Rocks, Springer.
- Hall A. (1997): Igneous Petrology, Longman.
- LeMaitre R.W. (2002) : Igneous Rocks: A Classification and Glossary of Terms, Cambridge University Press.
- MsBirney (1994): Igneous Petrology, CBS Publ. Delhi.
- Phillipotts, A.R. (1994): Principles of Igneous and Metamorphic Petrology, Prentice Hall of India.
- Sood, M.K. (1982): Modern igneous Petrology, Wiley-Interscience Publ., New York.
- Srivastava Rajesh K. and Chandra, R., (1995): magmatism in Relation to Diverse Tectonic Settings, A.A. Balkema, Rotterdam.
- Wilson, M. (1993): Igneous Petrogenesis, Chapman and Hall, London.
- Winter J.D. (2001): An Introduction to igneous and Metamorphic Petrology, Prentice hall, New Jersey .
- Phillipotts, A.R. (1994) Principles of Igneous and Metamorphic Petrology, Prentice Hall.
- Spry, A. (1976): Metamorphic Textures, Pergamon Press.
- Winter, J.D. (2005): An introduction to Igneous and Metamorphic Petrology, Prentice Hall.
- Yardley, B.W.D., Mackenzie, W.S. and Guilford, C. (1995): Atlas of Metamorphic Rocks and their textures, Longman Scientific and Technical, England.
- Yardley, BW (1989) An introduction to Metamorphic Petrology, Longman, NY
- Best, MG. (2004) Igneous and Metamorphic Petrology, cbs Publ.

Winkler H.G.F. (1979) Petrogenesis of Metamorphic Rocks, Springer Verlag

Turner E.J. (1980) Metamorphic Petrology, McGraw Hill, NY

Paper-5 - CC(P)-5 practical

6 credits 100 marks

- (i) Structural problems related to true and apparent dips.
- (ii) Determination of plunge and rake of fold axis/inclined line.
- (iii) Determination of fold axis using π and β diagrams
- (iv) Three-point problem.
- (v) Stereographic projection of crystals.
- (vi) Axial ratio calculation of crystals
- (vii) Megascopic identification of important rock forming minerals.
- (viii) Megascopic identification of important igneous and metamorphic rocks
- (ix) Calculation of CIPW norm and classification.
- (x) Plotting of ACF and AKF diagrams.
- (xi) Microscopic identification of important rock forming minerals.
- (xii) Microscopic identification of important igneous and metamorphic rocks.
- (xiii) Determination of pleochroic scheme of coloured minerals
- (xiv) Optic sign determination of uniaxial and biaxial minerals.
- (xv) Geological field work of about one week duration.

GEOLOGY
M.Sc. Semester – II
GEOL (CC-6)

Theory **Full Marks –70**
Total Lecture : 60 Hours
Credit : 4

The paper contains 8 questions in which question 1 will be objective type consisting of 10 questions of one mark each is compulsory. Out of remaining seven questions of 15 marks each, 4 are to be answered.

Sedimentology

Unit- 1

Surface processes and rock weathering, Processes of transport and generation of sedimentary rocks. Environments of deposition. Lithification and diagenesis. Composition of sedimentary rocks.

Unit-2

Primary, Secondary and organic structure of sedimentary rocks and their significance. Clastic and non- clastic textures. Provenance- source of sediments, compositional maturity, stability of minerals, significance of light and heavy minerals in provenance study.

Unit-3

General classification and nomenclature of sedimentary rocks. Classification of sandstones, limestones and shales.

Unit – 4

Sedimentary environment and facies. Facies modeling for marine, non-marine and mixed sediments. Tectonics and sedimentation. Classification and definition of sedimentary basins. Sedimentary basins of India. Cyclic

sediments. Seismic and sequence stratigraphy. Purpose and scope of basin analysis. Stratum contours and isopach maps.

SUGGESTED BOOKS

Blatt, H Middleton, G.V. and Murray, R.C. (1980): Origin of Sedimentary Rocks, Prentice- Hall Inc.

Collins, J.D., and Thompson, D.B. (1982): Sedimentary Structures, Geology Allen and Unwin, London.

Lindholm, R.C. (1987) A Practical Approach to Sedimentology, Allen and Unwin, London. Miall, A.D. (2000): Principles of Basin Analysis, Springer-Verlag.

Pettijohn, F.J. (1975): Sedimentary Rocks (3rd Ed.), Harper and Row Publ., New Delhi. Reading, H.G. (1997): Sedimentary Environments and facies, Blackwell Scientific Publication.

Reineck, H.E. and Single, I.B. (1973): Depositional Sedimentary Environments, Springer- Verlag.

Selley, R.C. (2000) Applied Sedimentology, Academic. Press.

Tucker, M.E. (1981): Sedimentary Petrology: An Introduction, Wiley and Sons, Ney York.

Unit-4

Tertiary formations of Northeastern India. Siwalik Group- lithology, faunal assemblages and classification. Deccan trap of central India. Stratigraphic boundary problems: Precambrian-Cambrian boundary, Permian- Triassic boundary and Cretaceous- Tertiary boundary.

SUGGESTED BOOKS

- A.Sahni, (1996), Cretaceous Stratigraphy and Palaeo environments. GSI, Bangalore
- Boggs, S. (2001): Principles of Sedimentology and Stratigraphy, Prentice Hall.
- Danbar, C.O. and Rodgers, J. (1957): Principles of Stratigraphy, John Wiley and Sons.
- Doyle, P. and Bennett. M.R. (1996): Unlocking the Stratigraphy Record, John Wiley and Sons.
- Krishna, M.S. (1982): Geology of Indian and Burma, C.B.S. Publ. and Distributors, Delhi.
- M. Ramakrishnan & R. Viadyanadhan (2008) Geology of India – (Vol. 1&2) GSI, Bangalore
- T.M. Mahadevan (2002), Geology of Bihar and Jharkhand. GSI, Bangalore
- Naqvi, S.M. and Rogers, J.J.W. (1987): Precambrian Geology of India, Oxford University Press.
- Naqvi, S.M. (2005) Geology and Evolution of the Indian Plate (From Hadean to Holocene – 4Ga to 4 Ka) GSI, Bangalore
- Pascoe, E.H. (1968): A Manual of the Geology of India and Burma (Vols I-IV), Govt. of Indian Press, Delhi.
- Pomeroy, C. (1982): The Cenozoic Era? Tertiary and Quaternary, Ellis Harwood Ltd., Halsted Press.
- Schuch, Robert, M. (1989): Stratigraphy ; Principles and Methods, Van Nostrand Reinhold, New York.

Micropaleontology, foraminifera, diamorphism, morphology and biostratigraphy, gondwana flora and their significance, palynology, types of gondwana palynomorphs and its importance, microfossils and their significance in oil exploration.

SUGGESTED BOOKS

Boardman, R.S. Cheetahn, A.M. and Rowell, A.J. (1988): Fossil Invertebrates, Blackwell.

Clarkson, E.N.K. (1998): Invertebrate Paleontology and Evolution, Allen and Unwin, London.

Horowitz, A.S. and Potter, E.D. (1971): Introductory Petrography of Fossils, Springer Verlag.

Mayr, E. (1971): Population, Species and Evolution, Harvard.

Prothero, D.R. (2004): Bringing Fossil to Life – An Introduction to Paleontology (2nd Ed), cGraw Hill.

Raup, D.M. and Stanley, S.M. (1985): Principles of Paleontology, CBS Publication

Romer A.S. (1959) The Vertebrate Story, Univ. of Chicago Press.

Smith, A.B. (1994): Systematics and Fossil Record – Documenting Evolutionary Patterns, Blackwell.

Stearn, C.W. and Carroll, R.L. (1989): paleontology – the record of life, John Wiley

Shrock R.R. (1953) Principles of Invertebrate paleontology, McGraw Hill Book Co.

Alfred Traverse (18988): Paleopalynology, Unwin Hyman, USA.

Arnold (2002): Quaternary Environmental Micropaleontology (Ed. Simon K. Haslett), Oxford University Press, New York.

Bignot, G., Grahm and Trotman (1985): Elements of Micropaleontology, London.

Unit 4

Mining of surface and underground mineral deposits involving diamond drilling, shaft sinking, drifting, cross-cutting, winging, stopping, room and pillaring, top-slicing, sub-level caving and block caving. Types of drilling methods. Mining Hazards: mine inundation, mine fire and rock burst.

SUGGESTED BOOKS

Kiyinine, D.H. and Judd, W.R. (1998): Principles of Engineering Geology, CBS Publ.

Schultz, J.R. and Cleaves, A.B. (1951): Geology in Engineering, John Willey and Sons, New

York. -

Singh, P. (1994): Engineering and General Geology, SK. Kataria and Sons, Delhi.

Keller, EA. (1978) Environmental Geology

Strahler and Strahler :Environmental Geology

Tnik and Truk: Environmental Geology

Arogyaswami, RPN. (1996): Courses in Mining Geology. Oxford and IBH Publ.

Clark, G.B. (1967): Elements of Mining, (3rd Ed.), John Wiley.

Paper-10- (CC (P)-10) Practical: 6 credits. 100 marks.

- (i) Megascopic study of sedimentary rock samples.
- (ii) Study of important sedimentary structures.
- (iii) Measurement of roundness of clastic grains.
- (iv) Graphical representation of size grades.
- (v) Study of important rocks of stratigraphic importance.
- (vi) Plotting of important stratigraphic units on the outline map of India.
- (vii) Identification of important invertebrate, vertebrate and plant fossils.
- (viii) Study of dentition pattern of lamellibranchs
- (ix) Analyses of pH and electrical conductivity in water.
- (x) Preparation of volcanic hazard zonation map

GEOLOGY
M.Sc. Semester – III
GEOL (CC-11)

Theory **Full Marks –70**
Total Lecture : 60 Hours
Credit : 4

The paper contains 8 questions in which question 1 will be objective type consisting of 10 questions of one mark each is compulsory. Out of remaining seven questions of 15 marks each, 4 are to be answered.

Field and Exploration Geology

Unit-1

Basic idea of field geology. Topographic maps and its interpretation. Numbering system of topographic maps. Clinometer and Brunton compass and their uses. Geological maps- preparation and interpretation. Methods and techniques of geological mapping. Sampling methods.

Unit-2

Concept of exploration. Principles of Geophysical exploration. Gravity method of exploration- correction gravity data, gravity anomaly and gravity anomaly map. Qualitative and quantitative Interpretation of gravity data. Magnetic method of exploration- magnetic susceptibility of rocks and minerals, qualitative and quantitative interpretation of magnetic data. Seismic method of exploration- reflection and refraction method, interpretation of reflection and refraction data.

Unit – 3

Electrical methods – Self potential method, resistivity method and electromagnetic method. Interpretation of electrical data.

Unit – 4

Geological and geobotanical methods of exploration. Geochemical method of exploration – dispersion, pathfinder elements, geochemical field techniques, geochemical analytical methods. Interpretation of geochemical data. Geochemical methods for petroleum and natural gas exploration.

SUGGESTED BOOKS

Bagchi, T.C., Sengupta, D.K., Rao, S.V.L.N. (1979): Elements of Prosectiing and Exploration, Kalyani Publ.

Banerjee, P.K. and Ghosh, S. (1997): Elements of Prospecting for Non-fuel Mineral deposits, Allied Publ.

Chaussier, Jean – Bernard and Morer,J. (1987): Mineral Prospecting Manual., North Oxford Academic.

Dobrin, M.B.; Savit, C.H. (1988): Introduction to Geophysical Prospecting, McGraw-Hill.

Keder, P.,Brooks, M. and Hill, I. (2002): An introduction to geophysical exploration, (3rd Ed.), Blackwell

Rider, M.H. (1986): Whittles Publishing, Caithness. The Geological interpretation of Well Logs, (Rev. Ed.).

Robert, D. (1985): Encyclopedia of Well Logging

T.S. Ramakrishna (2006), Geophysical Practice in Mineral Exploration and Mapping GSI, Bangalore

GEOLOGY
M.Sc. Semester – III
GEOL (CC-12)

Theory **Full Marks –70**
Total Lecture : 60 Hours
Credit : 4

The paper contains 8 questions in which question 1 will be objective type consisting of 10 questions of one mark each is compulsory. Out of remaining seven questions of 15 marks each, 4 are to be answered.

Economic geology

Unit 1

Concepts of Ore Genesis; Distribution of Ore deposits-Global Perspective; Mode of occurrences and morphology of ore bodies, Controls of Ore localization; Classification of Ore deposits; Processes of Pre formation – Magmatic, Sedimentary, Metamorphic associations and Weathering processes; Ore deposits and Plate Tectonics.

Unit 2

Occurrence and distribution in India of metalliferous deposits – base metals, iron, manganese, aluminum, chromium, gold; Indian deposits of non-metals deposits viz. – mica, asbestos, barytes, gypsum, graphite, apatite etc. Gemstones, refractory minerals, abrasives and minerals used in glass, fertilizer, paint, ceramic and cement industries. Building stones. Phosphorite deposits, Atomic Minerals: Atomic fuel resources of India – distribution and prospects.

Unit 3

Coal:Origin, structure, mode of occurrence and types of coal, Physical and chemical properties of coal, Macroscopic and microscopic constituents of coal, macerals and microlithotypes; Classification, rank, and grade of coal; Important coalfields of India with special reference to Jharkhand.

Unit 4

Petroleum: Origin and migration of Petroleum, Properties of source and reservoir rocks, Petroleum Traps, Petroliferous basins of India; Fundamentals of Coal Bed Methane (CBM), Prospects of CBM in India.

SUGGESTED BOOKS

Mookherjee, A. (2000): Ore Genesis-A Holistic Approach, Allied Publisher

Dhanraju, R. (2005): Radioactive Minerals, Geol. Soc. India, Bangalore.

Craig J M and Vaughan D J (1981) Ore Petrography and Mineralogy, John Willey

Evans (1973) Ore Geology and Industrial Minerals

Cogen B and A K (1975) Mineral and Nuclear Fuels of India, Oxford Pub.

SUGGESTED BOOKS

Chandra, D., Singh, R.M. Singh, M.P. (2000): Textbook of Coal (Indian context), Tara Book Agency, Varanasi.

Scott, A.C. (1987): Coal and Coal-bearing strata: Recent Advances, Blackwell Scientific Publications.

Singh, M.P. (1998): Coal and organic Petrology, Hindustan Publishing Corporation, New Delhi.

G.H., Teichmuller, M., Davis, A. Diessel, C.F.K., Littke, r. and Robert P. (1998): Organic Petrology, GebruderBorntraeger, Stuttgart.

Thomas, Larry (2002): Coal Geoligy, John Wiley and Sons Ltd., England.

Van LrevelenStach;, E., Mackowsky, M-Th., Taylor, G.H., Chandra, D., Teichumullelr, M. and Teichmuller R. (1982): Stach Textbook of Coal Petrology, GebruderBorntraeger, Stuttgart.

Taylor, D.W. (1993): Coal: Typology-Physics-Chemistry-Constitution), Elsevier Science, Netherlands.

Paper – DSE (P) – 2 Practical: 6 credits 100 marks

- i) Interpretation of topographic maps
- ii) Megascopic Identification of ore minerals
- iii) Study of Polished section of important ores
- iv) Identification of coal and lignite samples
- v) Identification of petrographic constituents of coal samples
- vi) Completion of outcrops of coal seam on the map
- vii) Calculation of coal reserves
- viii) Three points problems related to coal seam

Paper – Project (PR-1) 6 credits 100 marks

The project work will be carried out under the supervision of the teacher. The final outcome will be presented in the form of a thesis.

SUGGESTED BOOKS:

C.F. Tolman (1973): Groundwater, MCGraw Hill, New York and London.

D.K. Todd (1995): Groundwater Hydrology, John Wiley and Sons.

F.G. Drescoll (1988): Groundwater and Wells, UOP, Johnson Div. St.Paul. Min. USA.

H.S. Nagabhushaniah (2001): Groundwater, in Hydrosphere (Groundwater hydrology), CBS Publ..

K.R. Karanth (1989): Hydrogeology, Tata McGraw Hill Publ..

S.N. Davies and R.J.N. De Wiest (1966): Hydrogeology, John Wiley and Sons, Ney York.

Patra, H.P., Adhikari, Shyamal Kumar, Kunar, Subrata (2016) Groundwater Prospecting and Mangement, Springer

Jakeman, A.J., Barreteau, O., Hunt, R.J., Rinaudo, J.. -D., Ross, A. (2016) Integrated Groundwater Management: Concepts, Approaches and Challenges, Springer

Ramanathan, A., Johnston, S., Mukherjee, A., Nath, B. (Eds.) 2015, Safe and Sustainable Use of Arsenic-Contaminated Aquifers in the Gangetic Plain A Multidisciplinary Approach; Springer

C.W. Fetter Jr. (2016) Applied Hydrogeology (4th Edition) 4th Edition Pearson Education Ltd.

Kevin M. Hiscock (2009) Hydrogeology: Principles and Practice, Wiley-Blackwell

Singhal, B.B.S. Gupta R.P. (2010) Applied Hydrogeology of Fractured Rocks, Springer

GEOLOGY
M.Sc. Semester – IV
GEOL (CC-14)

Theory **Full Marks –70**
Total Lecture : 60 Hours
Credit : 4

The paper contains 8 questions in which question 1 will be objective type consisting of 10 questions of one mark each is compulsory. Out of remaining seven questions of 15 marks each, 4 are to be answered.

Photogeology, Remote Sensing and GIS

Unit-1

Photogeology- aerial photography and aerial cameras. Geometric characteristics of aerial photographs. Scale of the photographs. Stereoscopes- their types and function. Relief displacement - measurement of height of vertical features from relief displacement. Stereoscopic parallax and height measurements.

Unit-2

Remote sensing- principles, spectral signature of common earth's features. Electromagnetic spectrum. EMR interactions with the atmosphere and with the earth's surface. Platform and sensors. Resolution of sensor- types and mode of scanning, multispectral scanner and false colour composite. Microwave remote sensing.

Unit-3

Interpretation of aerial photo and satellite images. Digital image processing.

Remote sensing applications in geological mapping, mineral exploration, groundwater exploration, hydrocarbon exploration, geomorphology and in environmental and natural hazards management.

Unit-4

Geographic Information systems (GIS)- elements, GIS modules, Data models- their types, advantages and disadvantages. Spatial and attribute data. Digital elevation model (DEM). Data analysis in GIS. Global Positioning System (GPS). Applications of GIS.

SUGGESTED BOOKS:

Miller, V.C. 1961: Photogeology; McGraw Hill

Sabbins, F.F., 1985: Remote Sensing-Principles and Applications; Freeman

Lilleaand, T.M. and Keifer, R.W. 1987; Remote Sensing and Image Interpretation; John Wiley

S.N.Pandey, 1987; Principles and Applications of Photogeology; Wiley Eastern, New Delhi

Gupta R.P. 1990: Remote Sensing Geology; Springer Verlag

Fundamentals of Remote Sensing and GIS --- S.K.Sinha (Ayushman Publication House, New Delhi.

Text book of Remote Sensing and Geographical Information Systems- Kali Charan Sahu (Atlantic Publishers & distributors (P) Ltd, New Delhi.

wind energy, hydropower, tidal energy, geothermal energy. Energy conservation measures.

SUGGESTED BOOKS:

Barker, C. (1996): Thermal Modeling of Petroleum Generation, Elsevier Science, Netherlands. ,

Holson, G.D. and Tiratso, E.N. (1985): Introduction of -Petroleum Geology, Gulf Publishing,

Houston, Texas. '

Hunt, J.M. (1996): Petroleum Geochemistry and Geology (2nd Ed.), Freeman, San Francisco.

Jahn, F ., Cook, M. and Graham, M. (1998): Hydrocarbon exploration and production,

Eslevier Science. '

Makhous, M. (2000): The Formation of Hydrocarbon Deposits in North African Basins,

Geological and Geochemical Conditions, Springer~Verlag.

North, F.K. (1985): Petroleum Geology, Allen Unwin.

Selley. R.C. (1998): Elements of Petroleum Geology, Academic Press.

Tissot, B.P. and Welte, D.H. (1984): Petroleum Formation and Occurrence, Springer-

VerlagR.C.Chapman(1973)Petroleum Geology, Elsevier Scientific Pub. Co.

Paper – DSE(P)-4 Practical: 6 credits 100 marks

- (i) Plotting of groundwater potential area on the outline map of India/state.
- (ii) Study of watershed and drainage on the top sheet.
- (iii) Drinking water quality assessment using Piper's trilinear diagram.
- (iv) Irrigation water quality assessment using U.S. Salinity diagram.
- (v) Feature identification on the aerial photo and satellite images.
- (vi) Determination of scale aerial photo/image.
- (vii) Determination of height using parallax bar.
- (viii) Examination and study of crude oil.
- (ix) Plotting of petroliferous basins of India.
- (x) Identification of radioactive minerals

Paper- Project-2 : 6 credits 100 marks

The project work will be carried out under the supervision of a teacher. The final outcome will be presented in the form of thesis for evaluation.