कोल्हान विश्वविद्यालय, चाईबासा

KOLHAN UNIVERSITY, CHAIBASA

भूगर्भशास्त्र

University Department of Geology

CBCS Syllabus Of M.Sc. Programme

(Semester System)

W.E.F Session 2017-19

GEOLOGY
M.Sc. Semester – I
FC – Compulsory GEOL (FC-1)

Full Marks: 70+30
Time : 03 Hours

Total Lecture : 70 Hours
Credit : 5
Ten questions are to be set out of which five are to be answered.
 # Geotectonics and Structural Geology

Unit I

Study of seismic waves – structure and composition of the earth – Radioactivity - : Basic concept of palaeomagnetism Major tectonic features of the earth-eatrth-shield areas, mobile belts, rift valleys, mid oceanic ridges, continental shelves and slopes, submarine canyons.

Unit 2

Plate Tectonics: concept, geological and tectonic environment of Plate boundaries, Sea Floor Spreading, Island arcs, Hydrothermal vents; Orogeny and orgenic cycles – Epeirogeny and evolution of plateaus. Strutural and tectonic features of India. Tectonic framework of India; Structure and Origin of the Himalaya Quaternary tectonics

Unit 3

Mechanical principles of rock deformation ; Concept of stress, strain and the resulting ellipsoids; Factors controlling behavior of rock material. Folds, Recognition, Mechanics and causes of folding – Recognition of top and bottom of beds; Faults, recognition criteria and mechanics of faulting; Joints Quantitative and qualitative classification of joints; Unconformities – types, recognition, significant, distinction from faults and their use in dating structural events.

Unit 4

Cleavage, Schistosity and Lineation – their description orign and relation to major structures.Petrofabric analysis – Field and laboratory techniques – petrofabric diagrams land their interpretation. Classification and characteristics of Tectonies, diapirs and related structural features.

Unit 5

Toposheets: Definition, Scale – definition, scale, reading various components of a toposheet. Geological map-definition, various components of a geological map including scale, legend, structures etc. Geological Field work instruments, Use of clinometer compass, Brunton compass, strike and dip measurement; Sampling and oriented sample and its significance; Geological mapping of igneous, sedimentary and metamorphic terrains. GPS and its applications in Geology.

SUGGESTED BOOKS:

Condie, Kent. C (1982): Plate Tectonics and Crustal Evolution, Pergamon Press Inc.
Gass I.G. (1982): Understanding the Earth. Artemis Press (Pvt) Ltd. U.K.
Ghosh, S.K. (1993): Structural Geology: Fundamental and Modern Development.
Pergamon Press.
Hobbs, B.E., Means, W.D. and Williams, P .F. (1976): An outline of Structural Geology, John Wiley and Sons, New York
Naqvi, S.M. (2005) Geology and Evolution of the Indian Plate (From Halocene-4Ga to 4 Ka) GSI, Bangalore

Ramsay, J.G. (1967): Folding and fracturing of rocks, McGraw Hill.
Windley B. (1973): The Evolving continents, John Wiley and Sons, Ney York.
N.J.Price and J.W. Cosgrave (1990) Analysis of Geological Strutures, Cambridge University Press
Ragan, Donal M.: Structural Geology, Cambrifge University Press
Whitten, E.H. Timonthy (1966) Structural geology of folkded rocks. Chicago: Rand McNally,

George H. Davis (2011) Structural Geology of Rocks and Regions, John Wiley and Sons Fossen H (2010) Strutural Geology, Cambridge University Press

Geology
M.Sc. Semester – I
Core Course- 1 GEOL (CC-1)

Full Marks : 70+30
Time : 03 Hours

Total Lecture: 70 Hours
Credit :5
Ten questions are to be set out of which five are to be answered.
Stratigraphy and Palaeobiology

Unit 1
Principles of Statigraphy ; Concept of Lithofacies and Biofacies; Stratigraphic Correlation; Concepts of Magnetostratigraphy and Sequence stratigraphy; precambrain Stratigraphy of Dharwar and Singhbhum-Chotanagpur craton; Proterzoc stratigraphy – tectonic framework, geological history and evolution of Vindhyan Super Group, Cuddapahs and their equivalents.

Unit 2
Palaeozoic stratigraphy: Palaeozoic formation of India with special reference to type localities , history of sedimentation, fossil content; concept, classification, lithology, life and age of Gondawana supergroup; Mesozoic formation of India with special reference to type localities, history of sedimentation, fossil content; Tertiary formations of Northeastern India, Siwalik Group; Stratigraphy boundary problems, Pre Cambrian-
Cambrian (PC/C), Permain-/Triassic(P/Tr) and Cretraceous- Tertiary (K/T) boundaries.

Unit 3
Study of Ichno fossils; Taphonomy and
preservation; Morphology, classification, biostratigraphy and evolutionary trends of Trilobiotes, Brachiopods, Bivalves, Cephalopoda, Gastropods and Echinoids.

Unit 4
Vertebrate and its classification. Evolutionary trends in Equidae, proboscidae and Man ; Swalik mammals and their causes of extinction;

Unit 5
Micropalaeontology; Forminifera, 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:

A.Sahni, (1996), Cretaceous Straigraphy and Palaeoenvironments. GSI, Banglore
Boggs, S. (2001): Principles of Sedimentology and Stratigraphy, Prentice Hall.
Danbar, C.O. and Rodgers, J. (1957): Principles of Stratigraphy, John Viley and Sons.
Doyle, P. and Bennett. M.R. (1996): Unlocking the Stratigraphy Record, John Viley 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 (Form 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.
Pomerol, C. (1982): The Cenozoic Era? Tertiary and Quaternary, Ellis harwood Ltd., Halsted Press.
Schch, Robert, M. (1989): Stratigraphy ; Principles and Methods, Van Nostrand Reinhold, New York.
Boardman, R.S. Cheetahn, A.M. and Rowell, A.J. (1988): Fossil Invertebrates, Blackwell.
Clarksons, 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 Paleontoogy, CBS Publ
Romer A.S. (1959) The Vertebrate Story, Univ. of Chicago Press.
Smith, A.B. (1994): Systematics and Fossil Record – Documenting Evolutionary Patterns, Blackwell.
Strean, 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 Trottman (1985): Elements of Micropaleontology, London.

Geology
M.Sc. Semester – 1
Core course – 2 GEOL (CC-2)

Full Marks : 70+30
Time : 03 Hours

Total lecture : 70 Hours
Credit :5
Ten question are to be set out of which five are to be answered.
Crystallography and Descriptive Mineralogy

UNIT 1 :

External symmetry of crystals : Symmetry Elements, methods of prejection, Hermaun Muguin notation. Internal symmetry of crystals. Derivation of 230 space groups, diffraction of crystals by X-rays, Braggs' law.

UNIT 2:

Principles of optical mineralogy : polarized light, behavious of isotropic and anisotropic minerals in polarized light, refractive index, pleochroism double refraction, birefringence, sign of elongation, interference figures, 2V, dispension in minerals; Optic sign-detemination
Description Mineralogy

UNIT 3 :
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 VI :
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 V :
Description of chemistry, optical and physical properties and paragenesis of the following mineral groups : Mica group, Chlorite group and clay minerals, Quartz group, Feldspar group, Feldspathoids and Zeolites.

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

Wiiliam 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

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

heinrich, E.W. – 1965 – Microscopic identification of Minerals MsGraw 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 – 1

Core course (P) GEOL :CC(P)-3

Full Marks : 100

Time : 06 Hrs

Completion of outcrops in given maps;Structural problems by Stereographic Net;Plotting of Geological Section; Mineral formulae, calculation of important rock forming mineral groups;Microsopic identification of important rock forming minerals;Determination of Optic Sign of Uniaxial and Biaxial Mierals; Determination of pleochroic scheme;Determination of An content in Plagioclase feldspars; Study of rocks in hand specimens from known Indian stratigraphic horizons and type localities;megascopic study of Invertebrate fossils; Study of Moear tooth of important vertebrate fossils; study of morphological characters of selected microfossils; Megascopic study of plant Fossils;study of morphological characters of selected palynomorphs

SEMESTER – II

Geology

M.Sc. Semester – II

Elective Course (SE) (EC-1)

Full Marks : 70+30

Time : 03 Hours

Total Lecture: 70 Hours

Credit :5

Ten questions are to be set out of which five are to be answered.

Select one Elective from the following Elective Groups:

Group A: Fossil Fuel Geology

Group B: Sedimentology

Group C: Hydrogeology

Group D: Ore Geology

Group E: Environmental Geology

Elective Course (SE) GEOL (EC-1) **Group A: Fossil Fuel Geology**

Full Marks : 70+30

Time : 03 Hours

Total Lecture: 70 Hours

Credit: 5

Ten questions are to be set out of which five are to be answered.

UNIT 1 :

Definition and origin of coal, sedimentology of coal bearing steata;Mode of occurrence and structures of coal; Coal forming epochs in the geological past;

UNIT 2:

Physical and chemical charactization of coal; Proximate and Ultimate analysis of coal;Rank, grade and types of coal; Types of coking and non coking coals;Classification of Coal

UNIT 3 :

Macroscopic and microscopic examination of coal, Concepts of Macerals and Microlithotypes, Origin and classification of macerals, Concept of coal rank; Application of coal Petrology

UNIT 4 :

Basics of Coal Bed Methane, Coal as its sreservoir- its exploration and production; Application of microscopic methods for C.B.M. prospecting;Gas Hydrates,Shale gas.

UNIT 5 :

Microscopic techniques for evaluation of rank, Palaeoenvironmental study and characterization of coal for carbonization, gasification and hydrogenation processes.

SUGGESTED BOOKS

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

Scott, A.C. (1998): Coal and Coal-bearing: Recent Advances, Blackwell Scientific Publications.

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

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

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

Van Krevelen Stach;,E., Mackowsky, M-Th. Taylor, GH., Chandra. D., Teichumullelr, M. and Teichmuller R. (1982): Stach Textbook of Coal Petrology, Gebruder Borntraeger, Stuttgart.

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

or

Elective Course (SE) GEOL(EC-1) Group B: Sedimentology

Full Marks : 70+30

Time : 03 Hrs

Total Lecture : 70 Hours
Credit : 5
Ten questions are to be set out of which five are to be answered.

Unit – 1
Sedimentary texture – shape, size, fabric and surface textures, methods of textural analysis, textural parameters and theisignificance. Framework, Matrix and cement of terrigenous sediments.

Unit – 2
Sedimentary structures: classification, genesis and significance of Primary structures, palaeocurrent analysis. Biogenic and chemical sedimentary structures; Use of structures and textures in basin studies.
Unit – 3
Origin of sediments and sedimentary rocks, Lithification and and diagenses.
Unit – 4
Petrogesis of sandstones, Graywacke and grawacke problem plate – tectonics and sandstones composition;
Argillaceous rocks, their classification and genesis.
Unit – 5
Carbonates: Mineralogy, chemistry, texture and. classification of Limestones; Diagenesis of Limestone in various diagenetic realms, change in mineralogy, fabric, chemistry and petrophysical characteristics; Study of evaporates such as gypsum, anhydrite and halite

SUGGESTED BOOK

Blatt, H., Middleton, G.V. and Murray, R.C. (1980): Origin of Sedimentary Rocks, Pretince – Hill Inc.
Collins, J.D. and Thompson, D.B. (1982): Sedimentary Stuctures, George Allen and Unwin London.
Lindholm, R.C. (1987) Sedimentary Rocks (3rd Ed.), Harper and Row Publ., New Delhi.
Reading, H.G. (1997): Sedimenatry Environments and facies, Balkwell Scientific. Publication
Reineck H.E. and Singh, I.B. (1973): Depositional Sedimentary Environments, Springer – Verlage.
Selley, R.C. (2000) Applied Sedimentology, Academic Press.
Tucker, M.E. (1981): Sedimentary Petrology: An Introduction, Wiley and Sons. New York.
Tucker, M.E. (1990): Carbonate Sedimentolgy, Blackwell Scientific Publication.

Elective Course (SE) GEOL (EC-1) Group C : Hydrogeology

Unit – 1

Hydrologic Cycle, Distribution of Water in Earth crust, Groundwater in hydrologic cycle; Ground water, origin, types important,; Aquifer, their types and characteristics; hydrologic properties of aquifer materials : porosity, permeability, specific yield, specific retention, hydraulic conductivity, transmissivity, storage coefficient;

Unit – 2

Forces and laws of groundwater movement; Darcy law and its application in hudrogeology; Confined, unconfined, steady, unstrady and radial flows of groundwater; Methods of pumping test and evalution of aquifer parameters. Springs: types, origin and movement of water; Water Table amp and its significance.

Unit – 3

Hydrographic analysis, Water budget studies; Water resource inventory of the basin; Consumptive and conjunctive use of surface and groundwater; Causative factors for Water Table fluctuation. Wells : types drilling methods, construction, design and development of wells.

Unit -4

Physical and Chemical characteristics of gorudwater. Inerpretation of chemical analysis. Relationship of quality to use. Ground water pollution; Sources of surface and subsurface pollution; Control of ground water pollution.

Unit – 5

Chemical characteristics of groundwater in relation to various uses – domestic, industrial and irrigation; Water contaminants and pollutant, natural (geogenic) and anthropogenic. contaminants; Saline water intrusion in coastal and other aquifers and its prevention; Groundwater contamination and problems of arsenic and fluoride in Indian subcontinent with special reference to Jharkhand.

SUGGESTED BOOKS

C.F. Tolman (1937): Groundwater, McGram Hill, New York and London.
D.K. Todd (1995): Groundwater Hydrology, John Wiley and Sons.
F.G. Driscoll (1988): Groundwater Wells, UPO, Johnson Div. St. Paul. Min USA.
H.M. Raghunath (1990): Groundwater, Wiley Eastern Ltd.
H.S. Nagabhusahaniah (2001): Groundwater In Hydrosphere (Groundwater hydrology) , CBS Publ.
K.R. Karanth (1989): Hydrogeology, Tata McGram Hill Publ.
S.N. Davies and R.J.N. De Wiest (1966): Hydrogeology, John Wiley and Sons, New York.
Ptra H.P. Adhikari, Shyamal Kumar, Kumar, Subrata (2016) Groundwater.
Prospecting and Managements, Springer
Jakeman, A.J. Barreteau, O., Hunt, R.J. Rinaudo, J. –D Ross A. (2016) Integrated
Groundwter Managemet; Concepts, approaches and Challenge, Springer
Ramanathan, A., Johnston, S., Mukherjee, A., Nath, B. (Eds.) 2015, Safe and Sustainable Use of Arsenic-Contaminated Aquifers in the Gangetic Plain
Amultidisciplinary Approch; Springer
C.W. Fetter Jr. (2016) Applied Hydrogeology (4th Edition) 4th Edition Pearson Education Lts.
Kevin M. Hiscock (2009) Hydrogeology; Principles and Practic, Wiley-Blackwell
Singhal, B.B.S. Gupta R.P. (2010) Applied Hydrogeology of Fractured Rocks, Springer

or

Elective Course (SE) **GEOL(EC-1)** **Group D: Ore Geology**

Full Marks : 70+30

Time : 03 Hrs

Total Lecture : 70 Hours

Credit : 5

Ten questions are to be set out of which five are to be answered.

Unit – 1

Ore deposits and ore minerals. classification of ore deposits Magmatic processes of mineralization. Porphyry, skarn and hydrothermal mineralization.

Unit – 2

Structure and texture of ores. Paragenesis, Control of ore localization, Spatial and temporal distribution of ore deposits.

Unit – 3

Plate tectonics and ore genesis. Ore bearing fluids, movement of ore bearing fluids, Fluid inclusion studies of ores, Geothermometry.

Unit -4

Mineralization associated with ultramafic, mafic and acidic rocks, Wall rock alteration, Magma related mineralization through geological time.

Unit – 5

Mineralization associated with sedimentary rocks, submarine volcanism, Weathering and metamorphic processes. Stratiform and stratabound ores.

SUGGESTED BOOKS

Edwards, R. and Atkinson, K. (1986) Ore Deposit Geology. cha[man and Hall, London.
Craig J.M. and Vaughan, D.J. (1981) Ore Petrography and Mineralogy. John Wiley.
Evans, A.M. (2012) Ore Geology and Industrial Minerals. Third Edition (Reprint) , Blackwell
Sawkins, F.J. (1984) Metal Deposits in realtion to Plate Tectonics, Springer Verlag.
Stanton, R.L. (1972) ore Petrology. McGraw Hill.
Torlineg, D.H. (1981) Economic Geology and Geotectonics. Blackwell Sci. Publ.
Barnes , H.L. (1979) Geochemistry of Hydrothermal Ore Deposit John Wiley.
Klemm, D.D. and Schneider, H.J. (1977) Time and Strata Bound Ore Deposits ; Springer Verlag.
Guilbert, J.M. and Park Jr. C.F. (1986) The Geology of Ore Deposits. Freeeman.
Mookherjee, A. (2000) Ore genesis – a Holistic Approach Allied Publishers.
Wolf K.H. (1981) Hand book of Strata Bound and Stratiform Ore Deposits. Elsevier Jensen, M.L. and Bateman, A.M. (1981) Economic Mineral Deposit John Wiley and Sons, New York.
McKinstry, H.E. (1972) Mining Geology. Prentice-Hall Inc.
Arogyaswamy, R.N.P. (1995) course in Minig Geology. Oxford and IBH Publishing Co., New Delhi. Thomas, L.J. (1978) An Introduction to Mining Methuen, Brisbace.
Clark, G.B. (1967) Elements of Minig. Asia Publishing House.
Sinha, R.K. & Sharma, N.L. (1993) An Introduction to Mineral Economics, Wiley Eastern
Chaterjee, K.K. (1993) An Introduction to Mineral Economics, Wiley Eastern

or

Elective Course (SE) **GEOL(EC-1)** **Group D: Ore Geology**

Full Marks : 70+30

Time : 03 Hrs

Total Lecture : 70 Hours

Credit : 5

Ten questions are to be set out of which five are to be answered.

Unit – 1

Basics of Environment; Types of Environment; Man and Environment; Components of Environmental geology, Concepts and principles of Environmental Geology; Time scales of global changes in the ecosystem and climate.

Unit – 2

Atmosphere, structure and composition of atmosphere; Global warming house affect.;
CO2 increase and global warming in the present and past atmostpheres;

Unit – 3

Environmental Pollution: Sources of Air Pollution, emission of major industrial air pollutants, effects of air pollution on atmostpheric processes, oxides of carbon as pollutants, green house effect, global warming, chloro fluro carbons (CFC's) depletion of ozone layer, effects of ozone depletion, smog, acid rain;

Unit- 4

Components of Hydrosphere, solubility of gases in water; impact of oceanic and atmostpheric circulation on climate and rain fall.

Unit – 5

Water Pollution: Types of water pollution, groundwater pollution and its effect sources of water pollution. ; organic and inorganic contamination of groundwater and its remedial measures;

SUGGESTED BOOKS:

Abhijit Dutta; Environmental Issues and Challenge
B.K. Sharma Environmental Pollution.
Bell, F.G. (1990): Geological Hazards, Routledge, London.
Bryant, E. (1985): Natural hazards, Combridge Univ. press.
Keller, E.A. (1978) Environment Geology.
Rekha Ghosh and D.S. Chatterjee : Environmental Geology
Valdeiya K.S. (1987) Environmental Geology – Indian Context
Parwarrdahn, A.M. (1999) The Dynamix Earth System
Smith. K. (1992) Environment Hazzeds.
Subramaniam, V. (2001) Texrbook of Enviornmental Hazards
Strahler and Stahler : Environmental Geology.

Geology
M.Sc. Semester – II
Core Course- 4 GEOL (CC-4)

Full Marks : 70+30
Time : 03 Hours

Total Lecture: 70 Hours
Credit :5
Ten questions are to be set out of which five are to be answered.

 # Geochemistry and Igneous Petrology

Unit 1
origin and abundance of elements in the Solar System and in the Earth, cosmis abundance of elements; Geochemicalclassification 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 – 2
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.

Unit – 3
Nature and evolution of magma; Plate tectonics and generation of magmas; Plume magmatism and hot spots; Large igneuous provinces and mafic dyke swams, Partial melting batch and franctional melting; Crystal Fractionation and contamination; IUGS classification of the igneous rocks and CIPW norm.

Unit – 4
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 – 5
Petrogenetic significance of igneous texture; Petrology and petrogenesis of major igneous rock types with Indian examples of ultramafic, komatiite, basalt, anorthosite, granite, alkaline rocks, ophiolote, carbonatite, lamprophyre.

SUGGESTED BOOKS:

Krauskopf, K.B. (1967) : Introduction to Geochemistry, MsGraw Hill
Mason, B. and Moore, C.B. (1991) : Introduction to Geochemistry, Wiley Eastern.
Rollonson, H.R. (1993): Using geochemical data : Evaluation, Presentation Interpretation , Interpretation Longman U.K.
Bose, M.K. (1997): Igneous Petrology, World Press, Kolkata
Best, Myron G. (2002): Igneous and Metamorphic Peterology, Blackwell Science.
Cox, K.G. Bell, J.D. and Pankhust, R.J. (1993): The Interpretation of Igneous Rocks, Champaman and Hallm London.
Faure, G. (2001): Origin of Igneous Rocks, Springer.
Hall A. (1997): Igneous Petrology, Longman.
LeMaitre R.W. (2002) : Igneous Rocks: A Callsification and Glossary of Terms, Cambridge University Press.
MsBirney (1994): Igneous Petrology, CBS Publ. Delhi.
Phillpotts, A.R. (1994): Principles of Igneous and Metamorphic Petrology, Prentice Hall of India.
Sood, M.K. (1982): Moden igneous Petrology, Wiley-Interscience Publ., New York.
Srivastava Rajesh K. and Chandra, R., (1995): magmatism in Relation to Diverse Tectonic Settings, A.A. Balkema, Rotteram.
Wilson, M. (1993): Igneous Petrogenesis, Chapman and Hall, London.
Winter J.D. (2001): Am Introduction to igneous and Metamorphic Petrology, Prentice hall, New Jersey .
Hoefs, J. (1980): Stable Isotope Geochemistry, Springer – Verlag
Kruaskopf, 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. Longman U.K.

Geology
M.Sc. Semester – II
Core Course- 4 GEOL (CC-5)

Full Marks : 70+30
Time : 03 Hours

Total Lecture: 70 Hours
Credit :5
Ten questions are to be set out of which five are to be answered.
 # Sedimentary and Metamorphic Petrology

Unit 1
Surface processes and rock weathering ; Processes of transport and generation of sedimentary rocks; Sedimentary Texture elements of clastic and non clastic rocks, Sructures:
Important erosional, depositional and post depositional sedimentary structures and their signigicance; Provenance; Source of sediments, compositional maturity; Significance of light and heavy minerals in provenance study.

Unit – 2
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.

Unit – 3
Concept of Zones and Grades: Metamophic facies and facies series ; Fabric in meramorphism; Classification of Metamorphic Roks. 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 politic rocls. Regional and thermal meramorphism of basic and ultrabasic rocks. Regional and Thermal metamorphism of impure,m silicious carbonate rocks; Metamorphism of Granitoides, Charnockites and Migmatites.

Unit – 5
Metamophism is space and time: Plate tectonics and metamorphic processes; Paired metamorphic belts, Archaean and Proterozoic terrains; polymetamorphism,

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 Sdimentology, 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.
Bucher, K. and Martin, F. (2002): Petrogenesis of Metamorphic Rocks (7th Rev. Ed.), Springer-Verlag.
Philpotts, 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.
Yardlley, 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

GEOLOGY
M.Sc. SEMESTER - II
CORE COURSE (P) - 6 GEOL : [CC(P)-6]

Full Marks: 100
Time: 06 Hrs

(A)

(i) Megascopic and Microscopic studies of Igneous, Sedimentary and Metamorphic rocks.

(ii) Megascopic studies of Sedimentary structures.

(iii) Graphic representation of Modal analysis in QAP and APF diagrams

(iv) Graphic representation of chemical analyses in ACF, AKF and AFM diagrams.

(v) Calculation of C.I.P.W. Norm and Niggli Values

(B)

(vi) Geological Mapping of two weeks duration in a geologically complex area and Field Work Report based on it

GEOLOGY
M.Sc. SEMESTER - III
CORE COURSE – 7 GEOL : (CC-7]

Full Marks: 100
Time: 06 Hrs

Total Lecture : 70 Hours
Credit: 5
Ten question are to be set out of which five are to be answered.

#Geomorphology and Remote Sensing in Geology

Geomorphology

Unit 1:
Fundamental concepts – significance of structure, process and time ; A brief account of concepts of evolution of landform ; Characteristic features of landforms, Characteristics and types of fluvial landform , Fluvial cycle, concept of peneplains, stream rejuvenation, causes and effects; Aeolian landform, Arid Cycle of erosion; Glacial landforms, periodicity of glaciation and its causes; Karst topography, Relationship of geologic structures to topography; Volcanic landforms

Unit II:
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.

Remote Sensing in Geology

Unit III
Electromagnetic spectrum and its properties, Atmospheric Windows; Interaction of electromagnetic radiation with matter, Spectral signatures; Basic ideas of Thermal Infra red and Microwave Remote Sensing; Photogrammetry – recent advancement and applications; Remote Sensing Satellite programmes and their characteristics;

Unit 4:
Basic principles of Image interpretation and Digital techniques; Principles and applications of GIS;

Image characters and their relation with ground object based on tone, texture and pattern; Interpretation of topographic and tectonic features; Identification of Igneous, Sedimentary and Metamorphic rock types in images;

Unit 5

Principles of terrain analysis; Morphometric analysis; Geomorphological mapping based on genesis of landforms; Terrain evaluation for strategic purposes.

SUGGESTED BOOKS:

Richard J. Huggett – 2007 – Fundamentals of Geomorphology, Routledge

Keith A. Sverdrup, Alison Duxbury, Alyn C. Duxbury, 2006 – Fundamentals of Oceanography, McGraw-Hill Higher Education

Thornbury, W.D., 1969 – Principles of Geomorphology, Wiley.

Worcester, P.G., 1948 – A text book of Geomorphology, Wiley.

B.W. Sparles, 1981 – Geomorphology, Longman Group Ltd.

George Allen & Coates, 1980 – Coastel Geomorphology

Pitty, A.F., 1972 – Introduction to Geomophology, Methuen.

Bloom, A.L. 1979 – Geomorphology, Prentice Hall.

Arthur, L. Bloom, 2004 – Geomorphology: a systematic analysis of late Cenozoic landforms, Waveland PrInc,

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

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

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

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

Gupta R.P.1990:Remote Sensing Geology;SpringerVerlag

Compton R.R. (1962)Manual of Fiels Geology-

Angela L. Coe (2010) Geological Field Techniques, Blackwell

Oya, M2001:AppliedGeomophology for Mitigation of Natural Hazards, Springer

GEOLOGY
M.Sc. SEMESTER - III
CORE COURSE – 8 GEOL : (CC-8]

Full Marks: 70+30
Time: 06 Hours

Total Lecture: 70 Hours
Credit: 5
Ten questions are to be set out of which five 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; Imporant 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.

Unit 5

Geological criteria for prospecting; Basic principles of Geochemical Exploration; Principles and application of surface geophysical exploration techniques; Brief outline of various well logging techniques; Strategic, critical and essential minerals. India's status in mineral production vis a vis world scenario; National Mineral Policy.

SUGGESTED BOOKS:

Arogyaswami, R.P.N. (1996): Courses in Mining Geology, Oxford and IBH Publ.
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.
Clark, G.B. (1967): Elements of Mining, (3rd Ed.), John Wiley.
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

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.
Bagchi, T.C., Sengupta, D.K. Rao, S.V.L.N. (1979): Elements of Prospecting and Exploration, Kalyani Publ.
Banerjee, P.K. and Ghosh, S. (1997): Elements of Prospecting for Non-fuel Mineral deposits, Allied Publ.
Chaussier, Jean – Bernars and Morer, J. (1987): Mineral Prospecting Manual., North Oxford Academic.

GEOLOGY
M.Sc. SEMESTER - III
Elective (GE/DC) GEOL (EC-2)

Full Marks: 70+30
Time: 03 Hours

Total Lecture: 70 Hours
Credit: 5
Ten questions are to be set out of which five are to be answered.

Select one Elective from the following Elective Groups:

Elective (GE/DC) GEOL (EC-2) Group A: Fossil Geology

Full Marks: 70+30
Time: 03 Hours

Total Lecture: 70 Hours
Credit: 5
Ten questions are to be set out of which five are to be answered.

Unit 1

Elementary idea about coal preparation, Washing and beneficiation of coal, Blending of coal; coal carbonization, coal gasification, coal liquefaction and coal combustion,; Briquetting of coal

Unit 2
Assesment of coal reserves; Geological, Geobotanical and Geophysical survey for coal; Gondwana palynology and its application for coal exploration;

Unit 3
Mining of coal- underground mining and open cast mining; Coal Mining hazards and its mitigation; Trace elements in coal; Coal as environment pollutant; Conservation of coal

Unit 4
Unit Geological and geographical distribution of coal deposits of Jharkhand

Unit 5
Geological and geographical distribution of coal and Lignite deposits in India except Jharkhand;

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. (19980: 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, Stuttgear.
Taylor, D.W. (1993): Coal: Typology-Physics-Chemistry-Constitution), Elsevier Science, Netherlands

or

Elective (GE/DC) GEOL (EC-2) Group B: Sedimentology

Full Marks: 70+30
Time: 03 Hours

Total Lecture: 70 Hours
Credit: 5
Ten questions are to be set out of which five are to be answered.

Unit 1

Concept of basin analysis; Tectonic classification and evolution of sedimentary basins; Plate tectonics in relation to type and evolution of basins.

Unit 2

Sedimentary facies and facies models with Indian analogues; Paleocurrent analysis and its applications.

Unit 3

Processes and characteristics of depositional environments such as fluvial, estuarine, deltaic, lagoonal, barrier beach, tidal flats, deep-sea environments, lacustrine, Aeolian, glacial etc.

Unit 4

Sedimentary basins of India.Plate tectonics in relation to type and evolution of basins.

Unit 5

Concept of sequence stratigraphy, regional unconformities, systems tracts and parasequences.

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, George Allen and Unwin, London.
Lindholm, R.C. (1987) A Practical Approach to Sedimentology, Allen and Unwin, London.
Pettijohn;, F.J. (1975): Sedimentary Rocks (3rd Ed.), Harper and Row Publ. New Delhi.
Reding, H.G. (1997): Sedimentary Environments and facies, Blackwell Scientific Publication.
Reineck, H.E. and Singh, 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, New York.
Tucker, M.E. (1990): Carbonate Sedimentary, Blackwell Scientific Publication.

or

Elective (GE/DC) **GEOL (EC-2) Group C: Hydrogeology**

Full Marks: 70+30
Time: 03 Hours

Total Lecture: 70 Hours
Credit: 5
Ten questions are to be set out of which five are to be answered.

Unit 1

Occurrence of groundwater in different rock types; Geologic structures favouring groundwater occurrence; Occurrence of groundwater in various hydrostratigraphic units of India; Groundwater provinces of India.

Unit 2

Components of Groundwater basin characterization: slope characteristics, lithology and associated geological structures, soil type and thickness, etc; Geomorphic controls for groundwater accumulation; Drainage pattern, their relationship with lithology and geologic structure; tools.

Unit 3

Groundwater basin characterization and prioritization by Remote Sensing and GIS

Unit 4

Surface and subsurface geological and geophysical methods of groundwater exploration; Identification of groundwater potential zones by various Remote sensing techniques, Application of GPR in groundwater exploration, Use of radio isotopes in hydrogeological studies.

Unit 5

Groundwater problems and management related to foundation work, mining, reservairs, tunnels and effects of water in landslides; Environmental effects of over-exploitation of groundwater, Water logging problems;

SUGGESTED BOOKS:

C.F. Tolman (1973): Groundwater, MCGraw Hill, New York and London.
D.K. Todd (1995): Groundwater Hysrology, 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

or

Elective (GE/DC) **GEOL (EC-2) Group D: Ore Geology**

Full Marks: 70+30
Time: 03 Hours

Total Lecture: 70 Hours
Credit: 5
Ten questions are to be set out of which five are to be answered.

Unit 1

Non-magmatic processes of mineralization, Occurrence and distribution in India of iron and base metal deposits.

Unit 2

Occurrence and distribution in India of manganese, aluminium, chromium, nicklel and gold deposits, Energy and fuel minerals, PGE and associated ores..

Unit 3

Indian deposits of non-metals-: mica, asbestos, gypsum, graphite and apatite. Gemstones, refractory minerals, abrasives and minerals used in glass, fertilizer, paint, ceramic and cement industries.

Unit 4

Strategic, critical and essential mineral. India's status in mineral production. National Mineral Policy. Marine mineral resoueces and Laws of Sea. Mineral concession rules.

Unit 5

Various methods of sampling. Surface and sub-surface exporations. Definition and outline of UNFC classification of mineral reserves and resources. Grade and recovery of ores. Methods of ore reserves estimation.

SUGGESTED BOOKS:

Edwards, R. and Atkinson, K. (1986) Ore Deposit Geology. Chapman and Hall, London.
Craig, J.M. and Vaughan, D.J. (1981) Ore Prtrography and Mineralogy, John Wiley.
Evans, A.M. (2012) Ore Geology and Industrial Minerals. Third Edition (Reprint),
Blackwell Publishingand Wiley India Pvt. Ltd.
Sawkins, F.J. (1984) Metal DEposits in relation to Tectonic. Springer Verlag.
Stanton, F.J. (1972) Ore Petrology. McGraw Hill.
Torling, D.H. (1981) Economic Geology and Geotectonics. Blackwell Sci. Publ.
Barnes, H.L. (1979) Geochemistry of Hydrothermal Ore Deposits. John Wiley.
Klemm, D.D. and Schneder, H.J. (1977) Time and Strata Bound Ore Deposits. Springer Verlag.
Guilbert, J.M. and Park, Jr. C.F. (1986) The Geology of Deposits. Freeman.
Mookherjee, A. (2000) Ore genesis-a Holistic Approach. Allied Publishers.
Wolf, K.H. (1981) Hand book of Strata Bound and Stratiform Ore Deposits. Elsevier.
Jensen, M.L. and Bateman, A.M. (1981) Economic Mineral Deposits. John Wiley and Sons, Ney York.
McKinstry, H.E. (1972) Mining Geology. Prentice-Hall Inc.
Arogyaswamy, R.N.P. (1995) Courses in Mining Geology. Oxford and IBH Publishing Co., New Delhi.
Thomas, L.J. (1978) An Introduction to Mining. Methuen., Brisbane.
Clark, G.B. (1967) Elements of Mining Asia Publishing House.
Sinha, R.K. & Sharma, N.L. (1993) An Introduction to Mineral Economics, Wiley Eastern
Chterjee, K.K. (1993) An Introduction to Mineral Economics, Wiley Eastern.

or

Elective (GE/DC) **GEOL (EC-2)** **Group E: Environmental Geology**

Full Marks: 70+30
Time : 03 Hours

Total Lecturer :70 Hours
Credit :5

Ten questions are to be set out of which five are to be answered.

Unit l
Basics of Environment; Type of Environment; Man and Environment; Components of environmental geology ,Concepts and principles of Environmental Geology/;Time scales of global changes in the ecosystem and climate;

Unit 2
Atmosphere, structure and composition of atmosphere; Global warming. Green housc effect. ; CO2 increase and global warming in the present and past atmospheres:

Unit3
Environmental Pollution: Sources of Air Pollution, emission of major industrial air pollutants, effects of air pollution on atmospheric processes, oxides of carbon as pollutants, green house effect, global warming, chloro fluro carbons (CFC's), depletion of ozone layer. ' effects of ozone depletion, smog, acid rain;

Unit 4
Components of Hydrosphere, solubility of gases in water; Impact of oceanic and atmospheric circulation on climate and rain fall.

Unit 5 '
Water Pollution: Types of water pollution, groundwater pollution and its effects, sources of water pollution. 1 organic and inorganic contamination of groundwater and its remedial measures;

SUGGESTED BOOKS

Abhijit Dutta.Environmental Issues and Challenges
B. K. Sharma Environmental Pollution
Bell. F G. (1999): Geological Hazards, Routledge. London.
Bryant. E. (1985): Natural Hazards, Cambridge Univ. Press.
Keller, EA. (1978) Environmental Geology ‘
Rekha Ghosh and D. S. Chatterjee : Environmental Geology
Vaidiya, KS. (1987) Environmental Geology Indian Context
Patwarrdhan, A.M. (1999) The Dynamic Earth System
Smith. K.(l992) Environmental Hazards _
Subramaniam,V.(2001) Textbook of Environmental Hazards
Strahler and Strahler :Environmental Geology

Geology
M.Sc. Semester-III
GEOL EC(P)-3

Full Marks : 100
Time : 06 Hrs,

Credit :5

Elective practicals

GEOL EC(P)-3 Group A:Fossil Fuel Geology

Full Marks : 100
Time : 06 Hrs,

Credit :5

Megascopic study of varieties of coal

Megascopic study of coal bearing rocks,

Drawing and labeling of parts of Gondwana fossils from different coalfields

Borehole problems and calculation of coal reserves from borehole data

Study of different coal and oilfields of India

Study of crude oil samples from oilfields ofl ndia

Estimation of oil reserves

or

GEOL EC(P)-3 Group B:Sedinientology

Full Marks : 100
Time : 06 Hrs,

Credit :5

l.Graphic plot of size data and calculation of statistical parameters.

2.Microscopic study of Clastic rocks

3.Megascopic study of Clastic rocks

4.Mechanical sedimentary structures and their environmental significance

or

GEOL EC(P)-3 Group C :Hydrogeology

Full Marks : 100
Time : 06 Hrs,

Credit :5

(i)Determination of porosity of aquifer materials.
(ii)Study of hydrological properties of soil and rocks.

(iii)Construction of water table and piezometric maps and their interpretations.

(iv)Interpretation of geological cross section for locating water bearing horizons.

(v) Flow net analysis .

(vi)Pumping test for evaluation of aquifer parameters.

(vii)Construction of lithologs.

or

GEOL EC(P)-3 Group D :Ore Geology

Full Marks : 100
Time : 06 Hrs,

Credit :5

Study of morphological features of ore bodies

Megascopic study of important ores-their texture and structure.

Megascopic study of important industrial, non metallic minerals, precious and semi precious stones.

Estimation of grade of ores.

Study of metallogenic provinces of India

or

GEOL EC(P)-3 Group E:Environmental Geology

Full Marks : 100
Time : 06 Hrs,

Credit :5
1.Analyses of pH and electrical conductivity in Water i
2. Preparation of oceanic and atmospheric circulation maps.
3. Preparation of seismic zonation maps of India and World
4. Demarcation of flood prone areas in the outline map of India;
5.Preparation of volcanic hazard zonation map
6. Preparation of oceanic and atmospheric circulation maps

SEMESTER IV

Geology
M.Sc. Semester-IV
GEOL CC-9

Full Marks: 70+30
Time : 03 Hours

Total Lecturer :70 Hours '
Credit :5 A
Ten questions are to be set out of which five are to be answered

#Hydrogeology, Engineering Geology, Environmental l Geology, Mining Geology

Unit-1

Role of groundwater in the hydrological cycle; Controls of geology on groundwater occurrence and distribution; Classification of aquifers and aquifer systems; Darcy's law; Hydraulic conductivity, transmissivity, storage coefficient and specific capacity; Water table contour maps and flow net analysis. Causative factors of groundwater level fluctuations and environmental influences

Unit-2

Chemical characteristics of groundwater in relation to various uses — domestic, industrial and irrigation; Groundwater contamination and problems of arsenic, fluoride and nitrates; Management of groundwater res0urces:"Artif1cial recharge to groundwater and rainwater harvesting;; Groundwater exploration; Hydrogeomorphic mapping using various Remote Sensing techniques ;Groundwater provinces of India.

Unit-3

Engineering Properties of rocks. and Soils;Propelties and selection of Construction Materials; Landslides and stability of Hill slopes;Geological investigation for Engineering Projects; Geological investigations and criteria for sites selection of Dam sites, Reservoirs ./Tunnels and Bridges;Engineering Projects- Case Histories from India.

Unit 4

Components of environment. Carbon dioxide in atmosphere, global warming caused by CO2 increase in the atmosphere. Impact assessment of degradation and contamination of surface water and ground water quality due to industrialization and mining. Soil Quality degradation due to irrigation, use of fertilizers and pesticides. Introduction to climatic changes, causes of climatic changes, world climate during geological periods. Impact of climate on society.
Impact of man on climate.

Unit 5

Mining of surface and underground mineral deposits involving diamond drilling, shaft sinking, drifting, cross-cutting, winging, stoping, 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:

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

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

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

Keary, P., Brooks, M. and Hill, I. (2002)1 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

TS. Ramakrishna (2006), Geophysical Practice in Mineral Exploration and Mapping GSI,Bangalore '

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

H.M. Raghunath (1990): Groundwater, Wiley Eastern Ltd,

K. R. Karanth (1989). Hydrogeology, Tata McGraw Hill Pub1..

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

Kiynine, 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.

Geology
M.Sc. Semester-IV

Elective (GE/DC) GEOL [EC-4]

Full Marks: 70+30
Time : 03 Hours

Total Lecturer :70 Hours
Credit :5
Ten questions are to be set out of which five are to be answered.

Select one Elective from th e following Elective Groups:

Group A: Fossil Fuel Geology '

Group B: Sedimentology

Group C :Hydrogeology

Group D :Ore Geology

Group E: Environmental Geology

Elective (GE/DC) GEOL [EC-4] Group A:Fossil Fuel Geology

Full Marks: 70+30
Time : 03 Hours

Total Lecturer :70 Hours '
Credit :5
Ten questions are to be set out of which five are to be answered.

Unit l
Origin and nature of oil and gas ; Amount, type and maturation of organic matter; Migration of Petroleum;

Unit2
Reservoir rocks - petrology of reservoir rocks, porosity and permeability; Reservoir traps ~ structural, stratigraphic and combination traps.

Unit3
Identification and characterization of petroleum source rocks, Oil and source rock correlation; Palaeodepositional and palaeoenvironmental models with the help of microfossils and Palynology; .

Unit 4
Quantitative evaluation of oil and gas, Geological, Geochemical and Geophysical exploration of Petroleum.

Unit 5
Petroleum basins of India, important oil fields of India; Brief idea about global occurrence of Petroleum; Position of oil and natural gas in India, Future prospects and economic scenario.

SUGGESTED BOOKS:

Barker, C. (I996): Thermal Modeling of Petroleum Generation, Elsevier Science, Netherlands. ,

Holson, G.D. and Tiratso, E.N. (I985): Introduction of -Petroleum Geology, Gulf Publishing, Houston, Texas. '

Hunt, J.M. (I996): Petroleum Geochemistry and Geology (2nd Ed.), Freeman, San Francisco.

Jahn, F ., Cook, M. and Graham, M. (I998): 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. (I984): Petroleum Formation and Occurrence, Springer-VerlagR.C.Chapman(l973)Petroleum Geolog,Elsevier Scientific Pub.Co.

Or

Elective (GE/DC) **GEOL [EC-4] Group B:Sedimentology**

Full Marks: 70+30
Time : 03 Hours

Total Lecturer :70 Hours
Credit :5 '
Ten questions are to be set out of which five are to be answered.

Unit-l
Concept of soil, components of soil, soil profile; Process of soil formation, pedogenic processes, Factors of soil formation;
Unit 2 ' ,
Classification of soil, mineral and chemical composition of soils, mineral stability during weathering; Soil organic matter form and function;.
Unit-2
Fabric analysis - size and shape, concepts of size and shape, grade scale, methods of analysis presentation of data, analysis and field grading; Concepts of structure fabric: Soil fabric, soil structure, soil texture and field grading units;
Unit-3
Paleosols - field recognition; description, origin and causes; Paleosol in stratigraphic records; Significance of paleosol study; Paleosols and human evolution.
Unit-4
Calcrete - definition, classification, calcrete formation, pedogenic calcrete soil profile, macro features in calcretes, micromorphology (petrography), calcretes from Quaternary and ancient sedimentary sequences; significance of calcretes; -Laterite - characteristics, genesis, Indian occurrences.
Unit 5
Causes of Soil erosion and degradation,A brief introduction to methods of soil conservation.

SUGGESTED BOOKS

Boul, S.W., Hole, F.D., McCraken, R.J. and South, R.J. (1997): Soil Genesis and

classification. 4th Edition,

State University Press.

Braddy, NC. (2002): Nature and Properties of Soils.

Govinda Rajan, S.V. and Gopala Rao, K. H.G. (1979): Studies of Soils of India.

Sposito, Garrison. (1989): The Chemistry of Soils, Oxford Univ. Press.

Terzaghi, K. and Pock, R.G. 1996): Soil Mechanics in Engineering (3rd Ed), John Wiley.

Wright; V. Paul (1992): Paleosols: their recognition and interpretation, Blackwell Scientific

Publ.

Wright, V. Paul and Tucker, M.E. (1991): Calcretes. Blackwell Scientific Publ..

or

Elective (GE/DC) **GEOL [EC-4] Group C :Hydrogeology**

Full Marks: 70+30
Time : 03 Hours

Total Lecturer :70 Hours
Credit :5 '
Ten questions are to be set.out of which five are to be answered.

Unit l
Watershed- concept, classification; Components of watershed; rainfall, temperature, topography, nature of soil and depth, lithology and geological structures, drainage pattern, land use pattern Valley to basin concept in water management

Unit 2
Natural and artificial recharge of groundwater, Rain water harvesting techniques for rural and urban areas;Physical structures for water resource management in Rural areas;Use of Remote sensing and GIS in Watershed Management ;

Unit 3
Water management physical structures and their characteristics such as Ridge area treatment,gully plug, contour bunding, check dams, gabion structure,percolation tanks etc.Traditional methods for water resource management in India;

Unit 4
Basic components of Watershed Guidelines of India,Participato1y approach for programme implementation of watershed. Water management and Panchayati Raj Acts;

Unit 5
Legislations related to water resources: Basic Constitutional provisions,Water Pollution Acts, National Water Policy

SUGGESTED BOOKS

Isobel W. Heathcote(2009) Integrated Watershed Management: Principles and Practice Wiley
J V S Murty(2008)Watershed Management New Age Int.
K. R. Karanth (1989): Hydrogeology, Tata McGraw Hill Publ.
Watershed Guidelines:Govt.. of India

Rao, K. L., India's water wealth
C.G.W.B . Publications
Constitution of India
Jharkhand Panchayati Raj Act.

or

Elective (GE/DC) [EC-4] Group D :Ore Geology

Full Marks: 70+30
Time : 03 Hours

Total Lecturer :70 Hours
Credit :5
Ten questions are to be set out of which five are to be answered.

Elective (GE/DC) [EC-3] Group D :Ore Geology

Unit 1
Geological prospecting of minerals.Different types of geophysical methods for exploration-gravity,magnetic,electrical,seismic . Geochemical exploration-nature of sample anomaly,strength of anomaly and controlling factors.

Unit 2
Ore dressing and its importance, low grade ores and their beneficiation; Mineral properties and their consideration in ore dressing techniques.
Basic ore dressing operations viz. crushing, grinding, sizing, screening and classification; Concentration processes; Magnetic and electrostatic separation, gravity concentration; Froth Floatation, amalgamation and agglomeration.

Unit-3
Introduction to ore microscopy, techniques, methods, textures and microstructures of ores, interpretation of ore texture and optical properties of common sulphide, oxide ore minerals; Industrial application of ore microscopy;Ore microscopy and its contribution to ore dressing techniques;

Unit-4
Surface and underground mining methods factors in selection of open cast and underground mining methods, room and pillar method , longwall method. Environmental aspect of mining activities.

Unit 5
Mineralogy and geochemistry of radioactive minerals. Radioactive methods for prospecting of mineral deposits. Occurrence and distribution of radioactive minerals in India. Radioactive methods in petroleum exploration-well logging techniques.

SUGGESTED BOOKS

Edwards, R. and Atkinson, K. (1986) Ore Deposit Geology. Chapman and Hall, London. Craig, J.M. and Vaughan, D.J. (1981) Ore Petrography and Mineralogy. John Wiley.

Evans, A.M. (2012) Ore Geology and Industrial Minerals. Third Edition (Reprint), Blackwell

Publishing.

and Wiley India Pvt. Ltd.

Sawkins, F .J . (1984) Metal Deposits in relation to Plate Tectonics. Springer Verlag.

Stanton, R.L. (1972) Ore Petrology. McGraw Hill.

Torling, D.H. (1981) Economic Geology and Geotectonics. Blackwell Sci. Publ.

Barnes, H.L (1979) Geochemistry of Hydrothermal Ore Deposits. John Wiley.

Klemm, D.D. and Schneider, H.J. (1977) Time and Strata Bound Ore Deposits. Springer

Verlag.

Guilbert, J. M. and Park, Jr. C.F. (1986) The Geology of Ore Deposits. Freeman.

Mookherjee, A. (2000) Ore genesis -a Holistic Approach. Allied Publishers.

Wolf, K.H. (1981) Hand book of Strata -Bound and Stratiform Ore Deposits. Elsevier.

Jensen, M .L. and Bateman, (1981) Economic Mineral Deposits. John Wiley and Sons,

New York. ‘

MCKihsiw, H.E. (1972) Mining Geology. Prentice-Hall lnc.

Arogyaswamy, R.N.P. (1995) Courses in Mining Geology. Oxford and IBH Publishing Co.

New Delhi. Thomas, L.J. (1978)An Introduction to Mining. Methuen, Brisbane.

Clark, G.B. (1967) Elements of Mining. Asia Publishing House.

Sinha, R.K. & Sharma, N.L. (1993) An Introduction to Mineral Economics, Wiley Eastern

Chaterjee, K.K. (1993) An Introduction to Mineral Economics, Wiley Eastern.

or

Elective (GEI DC) **GEOL[EC-4] Group E:Environmental Geology**

Full Marks: 70+30
Time : 03 Hours

Total Lecturer :70 Hours
Credit :5
Ten questions are to be set out of which five are to be answered.

Unit l
Natural Hazards: Its causes, prediction and forecasting,‘ control measures and its proper management. Problems of urbanization, human population and their impact on environment

Unit 2
Distribution, magnitude and intensity of earthquakes; Seismic hazard zones; Neotectonics in seismic hazard assessment; volcanic hazards ,their causes and control.
Unit 3

Landslide, soil creeping, mass movements; Coastal erosion, coastal inundations, cyclones, Tsunamis its causes and control.

Unit 4
Floods, causes of floods, flood hazarad, management of floods;Water logging, problems of water logging due to indiscrete construction of canals,reservoirs, dams; water logging problem in India

Unit 5
Hazards related with mining activities in India; Pollution in the mining areas and mitigation measures Land degradation in mining areas;Stabilisation of overburden in open cast mining areas;Management of underground mining areas.

SUGGESTED BOOKS

Bell. F.G. (I999): Geological Hazards, Routledge, London.
Bryant, E. (I985): Natural Hazards, Cambridge Univ. Press.
Keller, EA. (1978) Environmental Geology

Valdiya, K.S. (I987) Environmental Ge'ology- Indian Context

Patwarrdhan, A.M. (1999) The Dynamic Earth System
Smith, K.(I992) Environmental Hazards
Subramaniam,V.(2001) Textbook inEnvironmental Hazards
Tank, R.W. Focus on Environmental Hazards
Strahler and Strahler :Environmental Geology
Tnik and Truk: Environmental Geology

Geology
M.Sc. Semester-IV
GEOL :EC(P)-5

Full Marks: 100
Time : 06 Hrs

Credit :5

Elective Practicals

GEOL :EC(P)-5 Group A:Fossil Fuel Geology

Proximate analysis of coal

Preparation of palynomorphs slide

Identification of different palynomorphs

Preparation of polished particulate mounts of coal (coal pellets)

Microscopic examination of coal pellets

Microscopic study of Heavy minerals

Megascopic study of cores and their logging

Structural problems related to the coal seams.

Study of Geological Maps and Sections of important oil fields of India

or

GEOL:EC(P)-5 Group B:Sedimentology

l. Paleocurrent analysis ‘
2. Study of vertical profile sections of selected sedimentary environments;
3. Study of Heavy Minerals .
4. Graphic representation of Trace Element data and Heavy Minerals
5. Study of Chemical and Biogenic Sedimentary structures and their sedimentological significance
6. Recgnition of marine fossil groups in assorted assemblage and identification of their classes
7 Petrographic study of Limestones

or

GEOL: EC(P)-5 Group :Hydrogeology

l.Determination of temperature, pH,,T.D.S., conductivity ,TSS, alkalinity, dissolved oxygen, hardness etc.
2. Determination of Na and K
3.Construction of isochemical maps. .
4.Graphical representation of hydrochemical data on Piper Trilinear diagram.
5. Plotting and interpretation of resistivity data.
6.Delineation of watershed on topographical and satellite imageries.

or

GEOL: EC(P)-5 Group D :Ore Geology

Preparation of polished sections.

Mineralogical studies of common Ore Mineralsunder microscope and establishment of paragenetic sequence

Flowchart analysis of ore beneficiation techniques.

Ore petrographic study of ore minerals and establishment of paragenetic sequence.

Exercises on ore reserve calculation.

or

GEOI:EC(P)-5 Group E:Environmental Geology

1. Analyses of alkalinity, acidity etc in water samples. I
2. Presentation of natural hazards map '
3. Plotting of temperature variations.
4. Measurement of Noise level
5. Demarcation of landslide prone areas .

Geology
M.Sc. Semester-IV
Project

Full Marks: 100
Time : 06 Hrs

Credit :5

The paper will consist of
(a) Field work/Lab work related to the project.
(b) Preparation of dissertation based on the work undertaken.
(c) Presentation of project work in the seminar on the assigned topic in the University Department of Geology, Ranchi University, Ranchi & open viva there on.
NB:- The students will select topics for the project work in consultation with a teacher of the department.

Topics
Project work will be related to the Elective Paper.
Each student has to submit two copies of the dissertation work duly forwarded by the Supervisor and Head of Department concemed. The forwarded copies will be submitted in the University Department of Geology, Ranchi University for evaluation.