UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025

REGULATIONS - 2009

CURRICULUM I TO IV SEMESTERS (FULL TIME)

M.Sc. APPLIED GEOLOGY

FIRST SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
MA 9114	Applied Mathematics for Geologists	3	0	0	3
AG 9112	Physical Geology and Geomorphology	3	0	0	3
AG 9113	Mineralogy and Analytical Techniques	3	0	0	3
AG 9114	Structural Geology and Geotectonics	3	0	0	3
AG 9115	Sedimentology and Sedimentary Petrology	3	0	0	3
PRACTICAL					
AG 9116	Mineralogy and Structural Geology Lab and Geological Mapping	0	0	4	2
RS 9117	Survey Practical	0	0	6	3
AG 9118	Seminar	0	0	2	1
	Total				**21**

SECOND SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
AG 9121	Exploration Stratigraphy and Micro Paleontology	3	0	0	3
AG 9122	Igneous and Metamorphic Petrology	3	0	0	3
AG 9123	Exploration Geophysics	3	0	0	3
AG 9124	Geochemistry	3	0	0	3
E1	Elective I	3	0	0	3
PRACTICAL					
AG 9125	Geophysics Lab	0	0	3	2
AC 9127	Geochemistry Lab	0	0	3	2
AG 9127	Petrology Lab	0	0	4	2
	Total				**21**

THIRD SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
AG 9131	Hydrogeology	3	0	0	3
AG 9132	Geological Remote Sensing and GIS	3	0	0	3
AG 9133	Petroleum Geology	3	0	0	3
AG 9134	Engineering Geology	3	0	0	3
AG 9135	Economic Geology	3	0	0	3
E2	Elective II	3	0	0	3

PRACTICAL					
AG 9136	Hydrogeology and Remote Sensing Lab	0	0	4	2
AG9137	Geological Fieldwork and Industrial Training (3-4) weeks)	0	0	0	2
	Total				**22**

FOURTH SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	C
	Elective III	0	0	3	3
	Elective IV	0	0	3	3
AG 9141	Project	0	0	20	10
	Total				**16**

TOTAL CREDITS : 80

ELECTIVES

COURSE CODE	COURSE TITLE	L	T	P	C
AG 9151	Coal Geology	3	0	0	3
AG 9152	Ore Geology and Mineral Technology	3	0	0	3
AG 9153	Mining Geology	3	0	0	3
AG 9154	Quaternary Geology	3	0	0	3
AG 9155	Geoprospecting	3	0	0	3
AG 9156	Nuclear Geology	3	0	0	3
AG 9157	Natural Hazards and Mitigations	3	0	0	3
AG 9158	Industrial Geology	3	0	0	3
AG 9159	Micropaleontology and Palynology	3	0	0	3
AG 9160	Advanced Remote sensing and GIS for Geological applications	3	0	0	3
AG 9161	Marine Geology	3	0	0	3
AG 9162	Applied Hydro geochemistry	3	0	0	3
AG 9163	Environmental Hydrogeology	3	0	0	3
AG 9164	Sequence Stratigraphy	3	0	0	3
AG 9165	Soil Science	3	0	0	3
AG 9166	Environmental Geochemistry	3	0	0	3
AG 9167	Earthquake disaster and mitigations	3	0	0	3
AG 9168	Oil Exploration and Production	3	0	0	3
AG 9169	Mineral evaluation and Management	3	0	0	3
AG 9170	Environmental Geology	3	0	0	3

AG 9112 PHYSICAL GEOLOGY AND GEOMORPHOLOGY

L	T	P	C
3	0	0	3

1. INTRODUCTION TO GEOMORPHOLOGY 9

Basic concepts, endogenous and exogenous processes, tropics, marine, fluvial types and tools, processes of weathering and soil formation. Mass movement, planation surfaces and geomorphic cycle.

2. FLUVIAL PROCESSES AND LAND FORMS 9

Drainage basin and network characteristics, genetic classification of streams, river valleys, work of river, sediment load, yield, channel geometry. Bedrock channels, classification of rivers and river metamorphosis. Karst landforms.

3. AEOLIAN PROCESSES AND LANDFORMS 9

Aeolian landforms: sand deposits and types. Age of desert, weathering in deserts, major causes of aridity. Glacial forms - glacial erosion, deposition and processes. Glaciations during the Quaternary period in the Himalaya.

4. COASTAL PROCESSES AND FORMS 9

Introduction tides, wave forms currents, types of coasts, coastal landforms, coral reefs, time based coastal changes, coasts of the world. Seal level changes, causes and neotectonism. Law of the sea.

5. SEDIMENT IN SECTION, NATURAL HAZARDS, ENVIRONMENTAL MANAGEMENT 9

Methods, models of sediment deposition, studies in three and four dimensions, natural hazards and methods of environmental management

BOOKS FOR REFERENCE

1. Pelletier J D. Quantitative Modelling of Earth Surface Processes, Cambridge University Press, Cambridge, 2008.
2. Schumm S A. River Variability and Complexity, Cambridge University Press, Cambridge, 2007.
3. Kale V.S. and Gupta A. Introduction to Geomorphology, Orient Longman, Hyderabad, 2001.
4. Holmes A. Principles of physical geology, Thomas Nelson and Sons, USA, 1964.
5. Goudie A.S. Geomorphology, Springer, UK, 1998.

AG 9113 MINERALOGY AND ANALYTICAL TECHNIQUES

L T P C
3 0 0 3

1. CRYSTALLOGRAPHY 9

Introduction – Crystal system of notation. mathematical relations of crystals: Axial ratio, law of rational indices, spherical projection, Stereographic projection and Gnomonic projections. Crystal symmetry and classification: the lattice, the unit cell and motif. Point groups and space groups. Derivation of symmetry in crystals.

2. DESCRIPTIVE MINERALOGY 9

Structural classification of silicates Physical, chemical and crystallographic characteristics of common rock forming silicate mineral groups. Common minerals of igneous and metamorphic rocks. Minerals of the carbonate, phosphate, sulphide and halide groups.

3. OPTICAL MINERALOGY 9

Properties of Light: Reflection, Refraction, dispersion, and Refractive Indices, and the Examination of Isotropic Minerals. Optical properties of common rock forming silicate minerals, uniaxial and biaxial minerals. Extinction angles, pleochroism, birefringenece of minerals and their relation with mineral composition. Twinned crystals. Dispersion. The U-stage.

4. ANALYTICAL TECHNIQUES – I 9

X-ray analysis: X-rays wave length and production – atoms and substances – crystals – X- ray diffraction diffractometer – structure and principle – X-ray generator, Goniometer and detector. X-ray fluorescence spectrometer: construction, application.

5. ANALYTICAL TECHNIQUES – II 9

Introduction to Spectroscopic studies: Scanning Electron Microscopy (SEM), Electron spin resonance (ESR), infra-red (IR) and Raman spectroscopy and Mossbauer spectroscopy, Atomic absorption Spectrometry (AAS) and Mass Spectrometry. Differential thermal analysis (DTA) and Differential Thermal Gravimetry (DTG)

L: 45

BOOKS FOR REFERENCE

1. Ford, W.E., Dana's Text book of mineralogy (Fourth Edition), Wiley Eastern Limited., New Delhi, 1989.
2. Putnis, A Introduction to mineral sciences, Cambridge University Press, New Delhi, 1992.
3. Deer, Howie and Zusmann, Introduction to Rock forming minerals, IBH Publishers, New Delhi, 1998.
4. Rogers and Kerr Optical Mineralogy, McGraw Hill Book Company, New Delhi, 1986.
5. Winchel and Winchel, Elements of Optical Mineralogy, John Wiley & Sons, INC. USA.,1989.
6. Dexter Perkins, Mineralogy, Prentice Hall, USA, 2002
7, Hans Rudolf Wenk and Andrei Bulakh, Minerals their constitution and origin, Cambridge University Press, UK, 2004

AG 9114 STRUCTURAL GEOLOGY AND GEOTECTONICS

L T P C
3 0 0 3

1. INTRODUCTION **9**

Concept, approach and scope of structural geology, primary and secondary structures. Principles of geological mapping and map reading, projection diagrams.

2. DEFORMATION MECHANISMS & MICROSTRUCTURES **9**

Behaviour of minerals, sediments and rocks under deformation conditions. Joints and shear fractures. Cleavage, foliation, lineation: Unconformities. Structural behaviour of igneous intrusions. Introduction to petro fabrics, Kinematic analysis: Dynamic analysis and structural analysis - Liquefaction

3. FAULTS **9**

Fault rocks, recognition, classification of faults and fault surfaces, slip sense and surface effects. Dynamic analysis of faults, thrust fault terminology, role of fluid pressure. Normal faults, strike-slip faults.

3. FOLDS **9**

Folds: Elements of fold geometry, fold classification. Folding mechanisms, Regional fold styles. Study of superposed folds.

5. GEOTECTONICS **9**

Heterogeneity of the earth's crust. Major tectonic features of the Oceanic and Continental crust. Continental drift. Seafloor spreading and Plate Tectonics. Island arcs, Oceanic islands and volcanic arcs. Isostasy, orogenic and epi-orogeny. Seismic belts of the earth. Seismicity and plate movements. Geodynamics of the Indian plate.

L: 45

BOOKS FOR REFERENCE

1. Barber D. J. & Meredith, Deformation processes in minerals, ceramics and rocks, Unwin Hyman, Boston,1990.
2. Billings, M. P. Structural Geology, Prentice-Hall, Inc,New Jersey, USA, 1972.
3. Condie, K. C. Plate Tectonics & Crustal Evolution, 4th Edition, Butterworth-Heinemann, Boston, 1977.
4. Hobbs, B. E., Means, W. D., & Williams, P. E. An Outline of Structural Geology, John Wiley & Sons, Inc, Australia 1976.
5. Hull, D. & Bacon, D. J. Introduction to Dislocations, 3rd Edition, Pergamon Press, New York 1984.

MA 9114 APPLIED MATHEMATICS FOR GEOLOGISTS

L T P C
3 0 0 3

1. SYSTEM OF LINEAR EQUATIONS AND INTERPOLATION 9

Simultaneous linear equations – Direct method - Gauss elimination,Gauss - Jordan methods – Iterative method – Jacobi and Gauss-eidal methods.Difference table – Newton's forward and backward interpolation – Newton's divided differences – Lagrangian interpolation**.**

2. NUMERICAL INTEGRATION AND ORDINARY DIFFERENTIAL EQUATIONS 9

Numerical integration – Trapezoidal and Simpson's 1/3 rules. Taylor serie and Euler methods- Runge – Kutta method of fourth order – Adam– Bashforth Predictor - Corrector method.

3. EMPIRICAL STATISTICS 9

Types of Sampling - Description of discrete and continuous data – Measures of Central tendency and dispersion for grouped and ungrouped data – Measures of position – Box and Whisker plot.

4. ESTIMATION THEORY 9

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines.

5. TESTING OF HYPOTHESES 9

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, χ^2 and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

L: 45

BOOKS FOR REFERENCE

1**.** Grewal ,B.S. and Grewal ,J.S. ," Numerical methods in Engineering and Science ", 6th Edition, Khanna Publishers , New Delhi ,2002
2. P.S. Mann, "Introductory Statistics", John Wiley and Sons. Inc 5th edition, 2004.
3. D.C. Montgomery and G.C. Runger, "Applied Statistics and Probability for Engineers", Wiley Student Edition, 2007.
4. Balagurusamy ,E," Numerical Methods ", Tata Mc Graw Hill Pub.Co. Ltd, New Delhi, 1999.
5 . Walpole,R.E. and Myers R.H, Myers ,S.L. and Ye, K,"Probability and Statistics for Engineers and Scientists ", Pearson Education, Asia, 8th edition, 2007.

AG 9115 SEDIMENTOLOGY AND SEDMENTARY PETROLOGY

L	T	P	C
3	0	0	3

1. INTRODUCTION **9**

Weathering process and products, principles of sedimentation process, scope, applications, classification of sedimentary rocks, Basin forming processes, sediment transport by fluids, by gravity.

2. SEDIMENTOLOGY **9**

Provenance and diagenesis of sediments, sedimentary structures-Primary, secondary and biological structures. Sedimentary textures, Frame work matrix and cement of terrigenous sediments. Definition, measurement and interpretation of grain size. Roundness and sphericity, elements of hydraulics, Paleocurrent analysis.

3. SEDIMENTARY PETROLOGY **9**

Description of Siliciclastic and carbonate sedimentary rocks: mineral composition, provenance, classification, texture, structure, origin and diagenesis and depositional environment of sandstones, conglomerate, breccia, shale, limestone and dolomite. Chemical/biochemical and carbonaceous sedimentary rocks: evaporates, cherts, phosphorites and iron bearing sedimentary rocks.

4. SEDIMENTARY PROCESS AND FACIES **9**

Facies modeling for marine, non-marine and mixed sediments, Tectonics and sedimentation, cyclic sediments. Sedimentary basin analysis, structure contours and isopach map. Depositional process and environment.

5. SEDIMENTARY TECHNIQUES **9**

Sieving analysis- grain size analysis, histogram, CM curves, frequency curves, statistical computational methods, identification of deposition environment. Heavy minerals and its applications in provenance study. Preparation of panel diagrams-construction of sedimentary facies map, SEM analysis- identification of physical and chemical features; transportation history. Paleocurrent analysis, XRD analysis and interpretation methods. Clay mineral separation techniques. Identification of carbonate minerals using staining technique. Applications of Cathode luminescence in diagenesis studies.

BOOKS FOR REFERENCES

1. Tucker, M.E., Sedimentary Petrology, Blackwell Science U.K., 2001.
2. F.J. Pettijohn., Sedimentary Rocks third edition, CBS Publishers & Distributors, Reprint 2002.
3. Sam Boggs, Principles of Sedimentology and Stratigraphy. Pearson, USA, 2000.
4. Donald R. Prothero, Frederic Schwab., Sedimentary Geology: An Introduction to Sedimentary Rocks and Stratigraphy W H Freeman, USA, 2003.
5. A. Bhattacharyya, C. Chakraborty., Analysis of sedimentary Successions.,Oxford and IBH Publishing Co. Pvt Ltd, New Delhi,2000
6. Mike D Blum,Susan B. Marriot, Suzanne F.Leclair, Fluvial Sedimentology ,2005., Blackwell Publishing.,London
7. Kenneth J Hsu., Physics of Sedimentology, 2004, 2nd edition., Publisher: Springer Verlag, London
8. Michael McLane Sedimentology, 1995., Oxford University Press,London

AG 9116 MINERALOGY AND STRUCTURAL GEOLOGY LAB AND GEOLOGICAL MAPPING

L T P C
0 0 4 2

1. CRYSTALLOGRAPHY AND PROPERTIES OF MINERALS 12

Stereographic projections – axial ratios – Napier's theorem and problems - Habit – cleavage – hardness – specific gravity – colour – luster – streak – fusibility – fluorescence – magnetic property - Systematic microscopic study of common rock forming minerals – RI – Birefringence – extinction angles – optic sign etc.

2. MINERAL CALCULATION AND 4- AXES UNIVERSAL STAGE 12

Calculation of structural formula for important rock forming mineral groups. Determination of anorthite content and twin law in plagioclase feldspars.

3. STRIKE, DIP AND THICKNESS PROBLEMS 12

Studies of contours and different land forms – Strike, true dip and apparent dip problems - Measurement of thickness and width of the outcrops

4. STRUCTURAL MAPS AND STEREOGRAPHIC PROJECTIONS 12

Completion of outcrops in geological maps - Three point problems - Drawing of profiles and studies of geological maps - Determination of true and apparent dip, plunge and pitch of linear structures

.5. GEOLOGICAL MAPPING TECHNIQUES 12

Map, toposheet, study of topographic features, map scale mapping instruments – Clinometer, brunton compass, odometer, altimeter, GPS, Map measurer, and Geologist's kit. Procedures for geological mapping at Igneous, Sedimentary and Metamorphic terrains Outcrop study, method of traverses, lithological descriptions, structural mapping, joints pattern measurements, faults identification, fold analysis, sample collection. Preparation of geological map.

P: 60

RS 9117 **SURVEY PRACTICAL**

L	T	P	C
0	0	6	3

1. CHAIN SURVEYING **12**

Ranging - Chaining – Traverse.

2. COMPASS SURVEYING **6**

Traverse

3. PLANE TABLE SURVEYING **18**

Intersection - Traverse - Three-point problem.

4. LEVELLING **18**

Fly leveling using Dumpy level - Fly leveling using Tilting level

5. THEODOLITE SURVEYING **24**

Measurement of angles by reiteration and repetition –
Measurement of vertical angles – Heights and Distances :
Single plane method

6. DEMONSTRATION **12**

EDM instrument – Electronic theodolite – Total station instrument - GPS

P : 90

AG 9121 EXPLORATION STRATIGRAPHY AND MICROPALAEONTOLOGY

L T P C
3 0 0 3

1. PHYSICAL STRATIGRAPHY 9

Introduction, scope, international stratigraphic code, litho, bio and chronostratigraphy units, correlation, Walther's law. Geological time scale (2008). Geological, physical and biological events through geological time.

2. EXPLORATION STRATIGRAPHY 9

Applications of stratigraphy in mineral, metal, non-metal, coal and hydrocarbon explorations, study of principles of seismic stratigraphy, sequence stratigraphy, Chemostratigraphy, Magnetostratigraphy and applications.

3. INDIAN STRATIGRAPHY 9

Litho-Chrono stratigraphic classification of Archaean to Recent, Sedimentary basins of India. Origin and distribution of mineral and fossil fuel deposits of India through geological time.

4. APPLIED PALEONTOLOGY 9

Review of Invertebrate and vertebrate paleontology and its significance in paleoenvironment studies. Morphology, classification, Paleoecology and geological significance of fauna and floral fossil records. Correlation of biostratigraphic events, Biozonation, sequence biostratigraphy and chronostratigraphy concepts. Fossil dating techniques, Usage of Paleontology tool in interpretation of geo-history of sedimentary basins of India.

5. MICROPALEONTOLOGY. 9

Evolution, morphology and taxonomy of benthic and planktic of multi microfossil groups- Foraminifera, Ostracoda, Nannofossil, Algae and palynomorphs. Interpretation of paleobathymetry and sedimentary depositional studies. Exercises on stratigraphy boundary demarcation based on long range and short range forms. Trilinear diagram-plotting of fossil abundance and determination of environment of deposition. Preparation of biofacies map –panel diagram. Preparation of spatial and temporal charts.

BOOKS FOR REFERENCE

1. Ramakrishnan, M and Vaidhyanathan Indian Geology Geological Society of India, Publication, Bangalore, 2007
2. Krishnan, M.S., Geology of India and Burma III Ed.IBH Publishers, New Delhi, 1984
3. G. Emery D and Myers, K Sequence stratigraphy, Blackwell Science, Publ. UK,1996
4. Shorock and Twenhofel Principles of Invertebrate Palaeontology, IBH New Delhi, 1983
5. Ravindra Kumar, Fundamentals of historical Geology and stratigraphy of India, Wiley Eastern Ltd. New Delhi, 1985
6. G.Bignot. Elements of Micropaleontology, Graham and Trotman, International student edition Bordas, Paris, 1982

AG 9122 IGNEOUS AND METAMORPHIC PETROLOGY

L T P C
3 0 0 3

1. IGNEOUS PETROLOGY 9

Structure of the earth and origin of magmas, .Characteristics of Magma. Intrusive and extrusive igneous rocks. Textures of igneous rocks. Magma differentiation. Crystallization of magma. Ascent and emplacement of magmas. General classification of Igneous rocks

2. PHASE DIAGRAMS & IGNEOUS ROCKS OF DIFFERENT TECTONIC SETTINGS 9

Two component phase diagrams: Definitions – Phase Rule – Two component eutectic systems – Incongruent melting – Solid solution systems – Exsolution. Ternary phase diagrams: Crystallisation in ternary systems. Igneous rocks of Ocean basins. Igneous rocks of convergent margins – Igneous rocks of Continental Lithosphere.

3. DESCRIPTIVE PETROLOGY 9

Geochemistry, Petrography and Field relations of Calc-Alkaline Volcanic Suits, Calc-Alkaline Plutonic suits, Sub alkaline Basaltic and ultramafic suits, and Alkaline Suits. Distribution and tectono magmatic setting of important igneous complexes of India.

4. METAMORPHIC PETROLOGY 9

Texture and structure of metamorphic rocks. Nomenclature and description of metamorphic rocks. Basic concepts of metamorphic reactions. Diagrammatic representations of mineral reactions and mineral paragenesis – ACF, AKF, AFM diagrams.

5. METAMORPHIC FACIES & METASOMATISM 9

Facies classification and systematic description of regional and thermal metamorphism pelitic, basic-ultabasic and impure calcareous rocks. Metasomatism, ultametasomatism and anatexis. Metamorphism and plate tectonics. Paired metamorphic belts – EPMA Studies – PT Estimates –ITD

P : 45

BOOKS FOR REFERENCE

1. Barker A.J. Introduction to Metamorphic Textures and Microstructures. 1st ed., Blackie, Glasgow; 2nd ed., Stanley Thornes, Cheltenham, 1998.
2. Best M.G., Igneous and Metamorphic Petrology, 2nd ed. Blackwell. UK, 2002.
3. Hall, Anthony, Igneous Petrology. Longman, UK1996.
4. Mason R., Petrology of the Metamorphic Rocks, 2nd ed. Unwin Hyman, London, 1990.
5. Tony Philpotts Principles of Igneous and Metamorphic Petrology, Cambridge University Press, UK, 2006

AG 9123 EXPLORATION GEOPHYSICS

L T P C
3 0 0 3

1. INTRODUCTION & ELECTRICAL METHODS 9

Scope of exploration geophysics – physical properties of the earth – Electrical methods – SP, IP, EM and Resistivity - methods of electrode arrangement – field methods – interpretation – application

2. GRAVITY METHODS 9

Principle – field methods – gravimeters – corrections – interpretation of gravity data – determination of shape and depth of ore bodies –– corrections & applications

3. MAGNETIC METHODS 9

Magnetic methods – principle - field procedure – magnetometers – interpretation of magnetic data – size and shape of bodies – correction of magnetic data - applications - airborne geophysical surveys

4. SEISMIC METHODS 9

Seismic waves – travel velocity in various geological formations – principles – field operation – refraction and reflection survey – correction of seismic data – methods of interpretation – determination of attitude and depth of formations – various types of shooting

5. RADIOACTIVITY METHODS AND GEOPHYSICAL WELL LOGGING 9

Fundamentals of radioactivity – principle of radioactivity methods – types of counters – field methods and interpretation – Well logging - Self potential – resistivity – radioactivity logging methods – caliper and other miscellaneous logging methods – field procedure and interpretation of data

L:45

BOOKS FOR REFERENCES:

1. Arnaud Gerkens, J. C. d'. Foundation of exploration geophysics. Amsterdam ; New York : Elsevier ; New York, NY, U.S.A, 1989.
2. Burger, H.R., Exploration Geophysics of the Shallow Subsurface, Prentice Hall, 1992.
3. Dobrin, M.B An introduction to geophysical prospecting, McGraw Hill, New Delhi,1984
4. Ramachandra Rao, M.B. Outline of geophysical prospecting. Wesley press, Mysore, 1975
5. Rama Rao, B.S and Murthy I.B.R Gravity and magnetic methods of prospecting. Arnold Heinmann Pub. New Delhi, 1978
6. Robinson, Edwin S., Cahit Coruh, Basic exploration geophysics. New York : Wiley, 1988.

AG 9124 **GEOCHEMISTRY**

L T P C
3 0 0 3

1. PRINCIPLES OF GEOCHEMISTRY **9**

Introduction - Geochemistry of the Earth; The birth of matter - formation of the solar system and geochemical history of the earth. The geochemical cycle- Distribution of elements in rocks.

2. GEOCHEMISTRY OF MINERALS, ROCKS AND WATERS **9**

Mineral stability, Polymorphism, compositional changes in minerals. River water, Seawater, Seafloor hydrothermal systems; Groundwater and Lakes. Characteristics of Magma, Melting of rocks, Water in Magmas, eutectic and melting. Distribution of trace components between rocks and melts. Soil formation; Digenesis, Diffusion, Fluid flow, ore deposits, Rock alteration, **C**hemical controls on soil formation, diagenesis and hydrothermal ore deposit chemistry.

3. ISIOTOPE GEOCHEMSIRTY **9**

Radioactive Decay, Determining Isotope Decay time, Samarium-Neodymium Systematics, Uranium-Thorium-Lead Systematics, Artificial Isotopes. Types of Isotope- Fractionation, isotope Exchange between minerals and water, Carbon and Sulphur isotopes, First-order decay and growth equations, rates from irreversible thermodynamics, oxidation, reduction and organic geochemistry

4. EXPLORATION GEOCHEMISTRY **9**

Introduction – Primary dispersion pattern, Secondary dispersion pattern – background values. Geochemical anomaly – geochemical sampling. Principles and techniques used in the design and implementation of an exploration geochemical survey.

5. ENVIRONMENTAL GEOCHEMISTRY **9**

Anthrosphere aquatic environment – Marine and fluvial, glaciers; aerosols, soils. Perturbations caused by human: chemical distributions in anthropogenically “perturbed” systems.

L:45

BOOKS FOR REFERENCE

1. John V. Walther, Essentials of Geochemistry, Jones and Bartlett Publishers, 2005, Boston.
2. Girard, Principles of Environmental Chemistry, Jones and Bartlett Publishers, 2005, Boston.
3. Faure, G, Principles and applications of Geoche4msitry, Pearson Education, 1998, INC, Australia.
4. Arthur Brownlow, Geochemistry (Second edition), Pearson Education, INC., Australia, 1996.
5. Faure, G., Principles and applications of Geochemistry, Pearson Education, INC, Australia, 1998.
6. Nelson EBY, G., Principles of Environmental Geochemistry, Thomson Brooks/Cole, UK,2004.
7. Criss, R.E. Principles of stable Isotope distributions. Oxford University Press, U.K., 1999.
8. Lajtha, J. and Michener, R. Stables isotopes in ecology and environmental Science, Blackwell, U.K., 1994.

AG 9125 **GEOPHYSICS LAB**

L T P C
0 0 3 2

1. ELECTRICAL METHODS **9**

Resistivity surveys – Wenner and Schlumberger methods – electrical sounding and profiling – problems on these methods –methods –calculation of auxiliary point

2. FIELD SURVEY USING RESISTIVITY METER **9**

Filed survey – sounding and profiling – SP methods - Interpretation of data – curve matching use of standard computer packages in interpretation

3. SEISMIC METHODS **9**

Problems on refraction and reflection methods – 3 layer and inclined beds – calculation based on intercept time and cross over distance

4. MAGNETIC AND GRAVITY METHODS **9**

Problems on magnetic and gravity methods – preparation of anomaly maps – methods of corrections

5. RADIOACTIVE METHODS **9**

Problems on well logging – interpretation of data

P : 45

AC 9127 **GEOCHEMISTRY LAB**

L	T	P	C
0	0	3	2

1. ANALYSIS OF ORES **16**

Dolomite, Galena, Haematite by titrimetric / gravimetric methods

2. ANALYSIS OF WATER **20**

Acidity, alkalinity, hardness by titrimetry, total dissolved solids by gravimetry, iron by spectrophotometry, sodium and potassium by flame photometry

3. DEMONSTRATION EXPERIMENTS **9**

PH, conductometry, IR, UV-visible spectrophotometry, AAS

P : 45

BOOKS FOR REFERENCE

1. Jeffery, G.H., Bassell, J.Mendham, J and Denney, R.C (1994) Vogel's text book of quantitative chemical analysis, ELBS 5th Edn. England

AG 9127 PETROLOGY LAB

L	T	P	C
0	0	4	2

1. IGNEOUS PETROGRAPHY 9

Study of textures and structures of igneous rocks. - Systematic megascopic and microscopic study of the following igneous rocks: granite, granodiorite, syenite, diorite, gabbro, dolerite, basalt and rhyolite.

2. SEDIMENTARY PETROGRAPHY 9

Megascopic and microscopic identification of common sedimentary rocks, structures, textures

3. METAMORPHIC PETRGRAPHY 9

Study of textures and structures of important metamorphic rocks - Systematic megascopic and microscopic study of important and common metamorphic rocks: Microscopic study of hornblende schist, mica-granite-schist, marble, quartzite, amphibolite, Charnockites etc.

4. PETROCHEMICAL CALCULATIONS 9

Norm calculation and interpretation of chemical analysis of representative rocks using variation diagrams – Niggli – Maniar Picolli – Harker's – Niggli basis – CIPW Norms.

5. SEDIMENTARY TECHNIQUES 24

Sieving analysis practices- River, lake and marine sediment grain size analysis, interpretation- CM plotting, histogram, calculation of statistical parameters and interpretation of sediment depositional environment. Clay mineral separation from sedimentary mixture. Determination of sand-silt-clay ratio. Identification of clay minerals using XRD. Description of sedimentary rocks. Identification of sedimentary structures and its interpretations. Interpretation of SEM – recognisition of physical and chemical etch marks- determination of transportation and porosity. Identification of heavy minerals and interpretation of provenance history. Sediment core logging, staining technique and identification of carbonate minerals

P:60

AG 9131 **HYDROGEOLOGY**

L T P C
3 0 0 3

1. INTRODUCTION 9

Scope - Hydrologic cycle – hydrograph - origin and source - distribution of groundwater – aquifers – aquifer compressibility -porosity - rock properties – specific yield, storage coefficient – groundwater occurrence in various geological formations – geological structures - regional hydrogeology

2. GROUNDWATER FLOW 9

Darcy's law – validity of Darcy's law – hydraulic gradient - hydraulic conductivity – field mapping - flow nets – K estimation in lab and by tracer techniques - transmissivity – homogeneity and heterogeneity – isotropic and anisotropic formations – groundwater resources evaluation – unsaturated flow

3. ESTIMATION OF AQUIFER PARAMETERS 9

General groundwater flow equation – steady and unsteady radial flow towards wells – confined, unconfined and semi confined aquifers – impact of boundaries – multiple wells - estimation of aquifer parameters by pump tests – slug tests – well loss - groundwater recharge – groundwater modelling

4. GROUNDWATER ABSTRACTION TECHNIQUES 9

Advantage of groundwater use –
Construction of wells – shallow and deep wells – methods of well completion and development – testing for yield - safe yield – horizontal wells – galleries - interference between wells and aquifer boundaries - aquifer response to pumping - land subsidence

5. GROUNDWATER QUALITY 9

Constituents in groundwater – dissolved ions – chemical analysis – reporting of results – groundwater quality for various uses - geochemical evolution of groundwater - sources of contaminants – solute and particle transport – remediation - seawater intrusion

L:45

BOOKS FOR REFERENCES

1 Domenico P.A. and F.W. Schwartz, Physical and chemical hydrogeology. John Wiley 1990.
2 Fetter,C. W.,Applied Hydrogeology,(3rd edition),New York,Macmillan,1994
3 Freeze, R.A and Cherry, J.A, Groundwater, Prentice Hall, 1979
4 Elango, L and Jayakumar, R (Eds.) Modelling in Hydrogeology, Unesco-IHP Publications, Allied Publ, 2001
5 Todd, D.K Groundwater Hydrology, John Wiley, 1979
6 Hiscock, K, Hydrogeology: Principles and Practice, Wiley-Blackwell, 2005

AG 9132 GEOLOGICAL REMOTE SENSING AND GIS

L	T	P	C
3	0	0	3

1. REMOTE SENSING AND PHOTOGRAMMETRY 12

Introduction to remote sensing. Aerial and space borne platforms. Photogrammetry – principles and concepts. Image interpretation elements. Reflectance Properties of Geologic features in the various parts of EMR. Lithologic and structural mapping.

2. GIS 9

Introduction to GIS. Type of data – spatial and non spatial data – data structure – vector and raster formats – hardware for GIS –– scanner – digitizer – standard GIS packages - database concepts – data input – retrieval – Assigning rank and weightage for geologic studies, overlay analysis.

3. GEOMORPHIC MAPPING 8

Introduction to Geomorphology, Significance of landforms - Image characters of landforms. Role of aerial photographs and satellite images in Geomorphic mapping.

4. GEOLOGICAL APPLICATIONS 8

Remote sensing and GIS for mineral exploration, ground water exploration and petroleum exploration. Case studies with methodology.

5. REMOTE SENSING AND GIS FOR GEO HAZARDS AND ENVIRONMENTAL STUDIES 8

Integrated surveys using Remote sensing and GIS for mineral exploration, Groundwater studies, Coastal erosion and accretion, Landslides and Earthquake studies, Coastal Zone Management.

L : 45

BOOKS FOR REFERENCE

1. George Joseph, Fundamentals of Remote Sensing, Second Edition, Universities Press (India) Private Limited, 2005 ISBN 8173715351, 9788173715358
2. Lillesand. TM.,Kiefer, R.W and Chipman, K.W. Remote sensing and image imterpretation Fifth Edition. Wiley. 2007.
3. Ravi P. Gupta, Remote Sensing Geology, Springer-Verlag New York, 2002.
4. Burrough, PA; and RA McDonnell. Principles of Geographic Information Systems. Oxford Press, U.K., 1998.
5. Wolf. P. R. Elements of Photogrammetry. Mc Graw Hill, Japan, 1993.
6. G. Rees. Physical Principles of Remote Sensing. Cambridge University Press, U.K., 2000.
7. SN Pandey, Principles and Applications of Photogeology: New Age International (P) Ltd., New Delhi. 1988.

AG 9133 **PETROLEUM GEOLOGY**

L T P C
3 0 0 3

1. INTRODUCTION **9**

Fundamental concepts of organic and inorganic theories of hydrocarbon. Sedimentary processes and accumulation of otganic matter- diagenesis, catagenesis and metagenesis of organic matter, fossils and their significance in hydrocarbon formation. Migration of oil, occurrence and distribution of hydrocarbons in sedimentary basins of India.

2. BASIN ANALYSIS AND TECTONICS **9**

Integrated interpretation of surface and subsurface litho , bio and chrono stratigraphic units. Charactersisation of sediments to its petrophysical nature, diagenesis signatures, porosity, frabric constituents etc., accommodation, rate of sedimentation, thickness, maturity, basin structure, sequence stratigraphy, tectonic history of the sedimentary basins.

3. DEPOSITIONAL SYSTEMS AND SEISMIC STRATIGRAPHY **9**

Kinds of depositional systems and its significance in petroleum exploration. Seismic method of hydrocarbon reservoir exploration. Seismic profiles interpretation techniques, stratigraphic cycles, seismic reflection patterns and decipher the depositional and structural evidences of the potential basins of hydrocarbon deposits.

4. GEOPHYSICS, GEOCHEMISTRY AND BIOSTRATIGRAPHY IN PETROLEUM EXPLORATION **9**

Seismic prospecting method, magnetostratigraphy, well logging techniques, types of logs, interpretation of logging charts, evaluation of oil well potentially for exploration, Geochemical parameters, determination of TOM, TOC, VRO,TTI,TAMR. Studies of geochemical characteristics of oil bearing sediments. Biostrtigraphy, study of planktic and benthic foraminifera, paleobathymetry anaysis. Bio-steering techniques, correlation .

5. OIL FIELD DEVELOPMENT **9**

Well site geological investigations, field techniques of seismic data acquisition, drilling methods, drilling fluids, formation test, casing and cementation, well completion, crude oil types, oil product separation methods, oil reservoir evaluation, principles of management of hydrocarbon resources.

L: 45

BOOKS FOR REFERENCE

1. A. T. Levorsen Geology of Petroleum CBS publishers and distributors, Delhi, II Edition 1999.
2. Tissor and D. H. Welte Petroleum formation and occurrence Springer Velag, Tokyo, 1984.
3. D. W. Lewis and Mc Conchie Analytical Sedimentology Chapman & Hall, New york, 1994.
4. JH Doveton Geological log interpretation Society of sedimentary geology, Tulsa 1994.
5. G. Henery Geophysics of sedimentary basins, Technip, Rue Ginoux, Paris 1994.

AG 9134 ENGINEERING GEOLOGY

L	T	P	C
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1. ENGINEERING PROPERTIES OF ROCKS AND SOILS 9

Geology and civil engineering – Rock description and classification - Rock mass classification - engineering classification of rocks – weathering and its significance in engineering geology- rock strength – Description of discontinuities RMR - RQD – geological information for slope stabilization – rock excavation – Soil properties.

2. SURFACE AND SUBSURFACE GEOLOGICAL INVESTIGATIONS 9

Field investigations, geophysical methods in foundation engineering, lab investigations, instruments used, working principles of instruments and methods of determination of properties, quality and durability assessment

3. GEOLOGICAL INVESTIGATIONS FOR DAMS AND TUNNEL CONSTRUCTION 9

Dams and tunnels – Design and construction, geological investigations, geotechnical problems related to groundwater investigation, methods of bridge and building site investigations.– methods of site investigation.

4. GEOLOGIC HAZARDS 9

Coastal processes- coastal erosion and accretion-coastal protection structures. Landslide - Classification, causative factors, control measures. Earthquake engineering – aseismic design – geologic considerations –Liquefaction- PGA and its significance.

5. CONSTRUCTION MATERIAL OF GEOLOGICAL ORIGIN 9

Building materials and its properties, pavement rocks, road metals, concrete aggregates, soil and fill materials

L: 45

BOOKS FOR REFERENCE

1. Krynine and Judd. Principles of Engineering Geology and Geotechnology. McGraw Hill, New York, 1962.
2. Chandler. R.J. Slope Stability and Engineering Developments 1992.
3. Waltham, T. Foundations of Engineering Geology, SPON Press, London 2002, ISBN 0-415-25449-3,,.
4. Bell F G Engineering Geology, Second Edition by, 2007. Butterworth-Heinemann, Oxford
5. Sathya Narayanaswami. Engineering Geology. Dhanpat Rai and Co. 1710, Nai Sarak, Delhi- 110006.. 2000
6. Waltham, A.C. Foundations of Engineering Geology, Blackie Academic Professional Pub., I Ed.,UK,1994.

AG 9135 **ECONOMIC GEOLOGY**

L T P C
3 0 0 3

1. IGNEOUS PROCESSES **9**

Introduction – magmas and metallogeny – partial melting and crystal fractionation as ore forming processes – liquid immiscibility as an ore forming process – mineralization processes in mafic magmas – model for mineralization in layered mafic intrusions – magmatic hydrothermal ore forming processes. process

2. HYDROTHERMAL PROCESSES **9**

Introduction – fluids in the earth crust, movements and their origins – factors affecting metal solubility – fluid/ rock interaction – hydrothermal alteration – metal zoning and paragenetic sequence – modern analogues– mineral deposits associated with aqueo – carbonic metamorphic fluids – ore deposits associated with near surface meteoric fluids.

3. SEDIMENTARY / SURFICIAL PROCESSES **9**

Introduction – Principles of chemical weathering – lateritic deposits- clay deposits – calcrete- hosted deposits – supergene enrichment of Cu and other metals in near surface deposits – clastic sedimentation and heavy mineral concentration – placer deposits – chemical sedimentation – banded iron formations – phosphorites and evaporates..

4. GLOBAL TECTONICS AND METALOGENY **9**

Patterns in the distribution of mineral deposits – continental growth rates - crustal evaluation and metallogenesis – metallogeny through time – plate tectonics and ore deposits. Application of fluid inclusion study and stable isotope geochemistry in understanding ore forming processes. Ore textures and paragenesis

5. MINERAL DEPOSITS AND ECONOMICS **9**

Metallic and non-metallic mineral deposits, mode of occurrence – genesis and distribution of Copper, Manganese, Iron, Lead, Zinc, Graphite, Asbestos, Mica and Gemstones with their Indian examples – mineral used in ceramic, refractory and cement industries – Mineral economics and its concept – mining laws and law of the sea bed for marine mineral resources – significance of minerals in national economy – strategic – critical and essential minerals- conservation and substitution – national mineral policy.

L: 45

BOOKS FOR REFERENCE

1. Bateman, A. M. and Jensen, M. L. Economic mineral deposits, John Wiley and sons, New York. 1981.
2. Gailbert, J.M., Park, C. P. Jr. and Freeman, W. H. The geology of ore deposits, John Wiley and sons, New York. 1986.
3. Krishnaswamy, S. India's mineral resources, Oxford and IBH publishing, New Delhi. 1979.
4. Edwards, R. and Atkinson, K. Ore deposit geology, Ist Edition, Chapman and Hall. New Delhi, 1986.
5. Robb, L. Introduction to ore-forming processes, Blackwell publishing, U.K., 2005.
6. Anthony Evans, Ore Geology and Industrial Mineral, Jhon Wiley & sons, USA, 1993
7. R.M. Umathay, Mineral Deposits of India, Dattsons, New Delhi, India, 2006

AG 9136 HYDROGEOLOGY AND REMOTE SENSING LAB

L T P C
0 0 4 2

1. POROSITY AND HYDRAULIC CONDUCTIVITY **8**

Problems using Porosity and Specific yield – Hydraulic conductivity – groundwater gradient estimation – flow velocity – properties of various geological formations

2. AQUIFER PARAMETERS **8**

Determination of hydraulic conductivity in lab – problems on groundwater flow to wells - steady and unsteady flow – estimation of transmissivity and storage coefficient of wells

3. WATER BUDGETING **8**

Unsteady flow - Theis recovery methods - Use of computer codes to understand groundwater flow in aquifers – water budgeting

5. GROUNDWATER QUALITY **6**

Determination of ion balance error – problems on hydrochemistry – preparation of water quality diagrams

6. REMOTE SENSING **20**

Setting up of pocket and mirror stereoscopes – Orientation of aerial photographs – transfer of details – simple photogrammetric measurements using parallax bar. Lithological, structural and geomorphic interpretation using aerial photographs. Preparation of geologic and geomorphic maps from satellite images. Ground truth investigation,.

7. GIS **10**

Digitizing the thematic maps related to geology, geomorphology and structure to prepare vector maps Simple overlay and GIS analysis for groundwater exploration and geotechnical studies.

P: 60

AG 9151 **COAL GEOLOGY**

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1. CHARACTERISTICS 9

Coal as rock – types of coal – mode of occurrence – structure in coal streams – coals through ages – physical and chemical characteristics of coal – macropetrographics – microlithotypes.

2. GENETICS AND EXPLORATION 9

Origin - classification of coal – Indian coal grading – exploration of coal – Modern techniques – drilling and logging- assessment of coal reserves - calculation of coal reserves.

3. PREPARATION AND UTILISATION 9

Coal Preparation - cleaning – sizing – washing – supporting operations – Beneficiation of Indian coals – Coal utilization - combustion – carbonization – gasification – hydrogenation.

4. RESOURCES AND ENVIRONMENT 9

Resources – Production and consumption pattern – Energy policy, conservation – environment pollutant – reduce environmental hazards – mining hazard in India, world coal resources – principal coal fields of the world.

5. INDIAN COALFIELDS 9

Occurrences – geological and geographical distribution – Gondwana coalfields – Tertiary coalfields – lignite deposits in India.

BOOKS FOR REFERENCE

1. Chandra, D., Singh, R. M. and Singh, M. P. Text book of coal (Indian context). Tara book agency, Varanasi. 2000.
2. Stach, E. Mackowsky, M. Th., Teichmuller, M., Taylor, G.H., Chandra, D. and Teichmuller, R. Stach's Text book of coal petrology, Gebnudar Borntraeger, Stuttgart, 1982.
3. Wilfrid Francis. Coal its formation and composition . Edward Arnold (Publishers)Ltd. London 1961.
4. Van Kreuelen. Coal – Typology – Chemistry – Physics Constitution. Elsievier publishing company, London 1961.

AG 9152 ORE GEOLOGY AND MINERAL TECHNOLOGY

L T P C
3 0 0 3

1. ORE MICROSCOPY 9

Introduction to ore microscopy – preparation of samples and specimen - mineral identification – examination of optical properties – under reflected light – reflectance measurement of microindentation hardness.

2. ORE FABRICS 9

Ore textures – fabric property on geometry pattern on minerals – texture of primary precipitation – transformation textures – schngiderhom's classification of ore textures and structures – magnetic sedimentary – metamorphic paragenesis.

3. FLUID INCLUSION 9

Ore mineral assemblages in igneous rocks and metamorphic rocks – fluid inclusion studies – nature and location of fluid inclusion – preparation of samples – observation – composition and changes since trapping – fluid inclusion geothermo-metry – application of fluid inclusion studies.

4. MINERAL TECHNOLOGY 9

Ore microscopy usage in mineral technology – information from mineralogical studies – mineral dressing processes.

5. MINERAL BENEFICATION 9

Ore microscopy in mineral beneficiation of copper ores – gold ores – chromium ores – iron ores – titanium oxides – manganese ores.

L: 45

BOOKS FOR REFERENCE

1. Craig, J. R. and Vaughan, D. J. Ore microscopy and ore petrography. Wiley interscience publication, New York. 1981.
2. Ramdohr, P. The ore minerals and their intergrowth, II ed. Vol. I and Vol. II, Pergamon press, New York, 1980.

AG 9153 MINING GEOLOGY

L T P C
3 0 0 3

1. MINERAL EXPLORATION 9

Triangulation, Establishment of Local Base from National Grid Base-Review of Surface Mapping, Underground Mapping, Different Plans and Sections-Search for ore–Surface and Concealed Guides to ore - Persistence of ore in depth–Preliminary Investigations–Trenching, pitting, Data Interpretation – Drilling from pits.

2. MINERAL PROSPECTING 9

Macro/Micro Economic Considerations-Sampling – Types, Sampling Quantity, Spacing, Sampling error of Mean, Sample Data Processing, Interpretation. Surface/underground Definition Drilling – Core, Diamond Drilling arrangement, Core logging, Compositing, Preparation of Slice Plan, Maximising Drill Data Vis-à-vis Cost of Drilling-Preparation of Assay Plans/Sections - Cut off Grade, Determination of Mineable Limits

3. MINERAL RESERVE ESTIMATION 9

Reserves and Resource – Types and Classification -Geological / Techno economic Considerations in Reserve Classification-Reserve Estimation Methods – Surface and Underground Deposits

4. OREBODY MODELLING 9

Integrating Surface/ Underground mapping Drilling Sampling to evolve a 3D Model - Fold/Fault Interpretation from Maps and Bore hole Data - GIS Applications in mining and Mineral Projects.

5. SURFACE AND UNDERGROUND MINING 9

Surface Mining – Development of Bench Mining Concept, Height/Width/Slope of Benches, Manual and Mechanised Strip/Terrace/Open pit Mining, Initial Mine Cut, Production per Blast, Blasting Ratio, Stripping Ratio, Breakeven Stripping Ratio, Ultimate depth, Pit Limit for Different cut-off Typical Opencast Layout. Placer, Alluvial Mining, Delineation of Pay Streak, Estimation of Grade Coal Mining Methods. Underground Mining – Stoping/Development activities, Typical Stoping Block, General idea of Important Stoping Methods

L:45

BOOKS FOR REFERENCE

1. McKinstry, H.E. Mining Geology, Newyork: Prentice-Hall, Inc. 1970.
2. Deshmukh, D.J.. Elements of Mining Technology, Dhanbad: Vidyaprakshan, 1998.
3. Bruce, A.K.. Surface Mining, Colarodo: Society for Mining, Metallurgy and Exploration Inc. 1990.
4. Hustrulid, H.V and Mark Kuchta, Open Pit Mine Planning and Design Fundamentals, Brookfield USA: A.A Balkema, 1995.
5. Hartman. Howard L,. Introduction to Mining Engineering, New York: John Wiley and Sons, 1987.

AG 9154 **QUATERNARY GEOLOGY**

L T P C
3 0 0 3

1. INTRODUCTION 9

Introduction to Quaternary period and types of Quaternary deposits. End of the tertiary period and prologue to the Quaternary period, tectonic movements, magnetic polarity reversal, colluviums, alluvium, Aeolian deposits, glacial, action of the sea and littoral sedimentation, salars, tufa and travertine, soil types, shallow water reserves and sediments used in human activities.

2. QUATERNARY STUDY TECHNIQUES 9

Relative chronologies and correlation, use of flora and fauna, non radioactive techniques, radioactive techniques. dating methods- radiocarbon, U/Th, Pb-Pb with case studies and dendrochronology

3. CHARACTERISTICS OF THE QUATERNARY PERIOD 9

Causes of Quaternary climate change, manifestation of Quaternary climate change and current issues in climate change, Human and Quaternary climate change, fauna at the Pliocene-Quaternary transition, emergence of hominids and evolution of Man.

4. QUATERNARY CLIMATE CHANGE 9

The climate between 2.5 yr and 130,000 yr, ice ages, glaciations, last glaciations and the last glacial maximum, the deglaciation and the Holocene, Ocean and deep sea environments, terrestrial environments, lake and desert environments, soils. Humid tropical environments, subtropical arid zones and warm deserts, fluctuation in the polar region and Mediterranean environments.

5. DEFORMATION DURING THE QUATERNARY PERIOD 9

Recent crustal movements and young magmatism, post glacial crustal uplift, analysis of Quaternary sediments from borehole data, climate modeling and prediction of climate change.

BOOKS FOR REFERENCE

1. Bradley, R.S. Quaternary paleoclimatology, methods of paleoclimate reconstruction, Allen and Unwin, US 1985.
2. Riser, J.A.M., Quaternary Geology and the Environment, Springer, Praxis Publishing, Chichister, UK. 2001.

AG 9155 GEOPROSPECTING

L T P C
3 0 0 3

1. GEOLOGICAL PROSPECTING 9

Geological prospecting- field survey and mapping techniques - field equipments- methods of mapping- pits and trenches- sampling-geological map preparation.

2. ELECTRICAL METHODS 9

Geophysical prospecting- electrical methods- resistivity, self potential methods- interpretation -application in mineral prospecting – groundwater targeting electrical logging methods in oil exploration.

3. SEISMIC METHODS 9

Seismic methods- refraction and reflection method- interpretation of seismic data- application-identification of geological structures-oil fields location- analysis of 3-D seismic data in oil exploration.

4. MAGNETIC AND GRAVITY METHODS 9

Magnetic method - types of magnetometer-field survey- anomaly- interpretation and prospecting - gravity methods- gravimeter-identification of size and shape of bodies-correction of the data- application in mineral exploration.

5. GEOCHEMICAL PROSPECTING 9

Geochemical prospecting- anomaly- background values- mobility of ions- associated elements-path finder elements-surface indicators - geobotanical methods – application in mineral exploration.

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BOOKS FOR REFERENCE

1. Lahee, Field geology, CBS pub, New Delhi, 1987.
2. Dobrin, Geophysical prospecting, McGraw hill, New Delhi ,1981.
3. Mason, B., Introduction to geochemistry, John Wiley, USA, 1982.
4. Chaussier, J.B., and Mores, J Mineral Prospecting manual, North Oxford Academic press,1987.
5. Butler, B.C.M and Bell, J.D, interpretation of geological maps, Longman Scientific & technical Publ.,1st ED., New Delhi, 1988.

AG 9156 NUCLEAR GEOLOGY

L T P C
3 0 0 3

1. INTRODUCTION AND THE PHYSICS OF THE NUCLEUS 9

Radioactive Decay - Nucleosynthesis Geochronology, Basics of Radiogenic Isotope Geochemistry, The K-Ca-Ar system - The K-Ar and Rb-Sr systems - The Sm-Nd system - The U-Th-Pb system - The U-Th-Pb system: Zircon dating - U-Th decay series dating - Other decay systems.

2. ISOTOPOES IN GEOCHRONOLOGY 9

Fission Track Dating **-** analytical Methods**,** Radiogenic isotope geochemistry - The Mantle the Pb Picture. Mantle Models Mantle Plumes. Subcontinental lithosphere. The continental crust. Isotope Geochemistry of subduction zone Magmas - isotope cosmochemistry. Evolution of the atmosphere and cosmogenic radionuclides.

3. STABLE ISOTOPE GEOCHEMISTRY 9

Stable Isotope Theory: Equilibrium fractionations - kinetic fractionations Hydrologic system, biological system. Fractionations of stable isotopes. Stable isotope applications. Assimilations fractional crystallization - Assimilation and subduction - hydrothermal Activity, metamorphism and ore deposits.

4. STABLE ISOTOPES AND APPLICATIONS IN PALAEOCLIMATE STUDY 9

Paleontology and Archaeology, application to paleoclimatology-deep sea, continental records. The Carbon Cycle. Isotopes, and climate Tree ring studies

5. CARBON ISOTOPE AND PETROLEUM GEOCHEMISTRY 9

Sulphur isotopes, diffusion experiments in isotope geology with case studies..

L: 45

BOOKS FOR REFERENCE

1. Fraure, G, Principles of isotope geology, John Wiley, Second edition. 1986.
2. Bradely, R.S, Quaternary paleoclimatology, methods of paleoclimatic reconstruction, Allen and Unwin Inc., US, 1985.
3. Criss, R.E. Pricinciples of stable Isotope distributions. Oxford University press, 1999.
4. Lajtha, J. and Michener, R. Stable isotopes in ecology and environmental Science, Blackwell, 1994.
5. Griffiths, K., Stable Isotopes: Interpretation of biological, ecological and geochemical processes, 1998.

AG 9157 NATURAL HAZARDS AND MITIGATIONS

L T P C
3 0 0 3

1. DISASTER PHENOMENON 9

Disaster threat - characteristics-parameters – mapping aspects for earthquake, landslides, cyclones flood, drought and epidemics.

2. MITIGATION 9

Geological and hydrological hazards - Reduction of hazard proneness – reducing structural vulnerability – changing the functional characteristics of settlement – building code provisions.

3. ASSESSMENT 9

Elements of risk – vulnerability analysis on dam and other infrastructures – risk assessment – plan area – organizational aspects, planning and mapping levels – socio-economic aspects – cost of risk reducing measures.

4. MANAGEMENT 9

Prevention – preparedness – response – recovery – resource utilization – international assistance – policy and legislation – training – public awareness.

5. CASE STUDIES AND ADVANCED TOOLS 9

Post disaster review – role of remote sensing and GIS – sequence of activities for global, national and state level case studies on various disasters

L: 45

BOOKS FOR REFERENCE

1. Nick Carter, W. Disaster management, A Disaster manager's Handbook, Publisher: Asian development bank, Manila, 1992.
2. Mitigating natural disasters: Phenomena, effects and options, Publisher: United Nations, Hew York, 1991.

AG 9158 INDUSTRIAL GEOLOGY

L	T	P	C
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1. ECONOMICS IN MINERAL EXPLORATION 9

Economic Considerations in Mineral Exploration; Systematic approach to Exploration Expenditure; In-situ and Mineable Reserves; Pit Optimization; Bulk Sampling; Pilot Plant Studies; Demand and Price Projections.

2. MINERAL/MINE ECONOMICS AND FINANCE 9

Source of Mine Finance; Factors governing profitability; Concepts of Depreciation, Depletion, Present value, Cash Flow and DCF; Costs-Capital, Fixed / variable, Ownership; P & L Account; Balance Sheet.

3. MINERAL PROJECT EVALUATION 9

Time Value of Money; Project Evaluation Technique-Pay Back, Discounted Pay Back, DCF,IRR; Project Ranking; Sensitivity analysis; Feasibility study-Prospect and Operating Mines; Preparation of Mine Plan under Mineral Concession Rules.

4. MINERAL CONSERVATION 9

Growth of the awareness; Means of conservation; Limitations in Scope; Wealth from Mineral waste; Co-products and By-products; Substitute for Minerals.

5. MINERAL POLICIES AND ENVIRONMENT 9

National Mineral Policy; Prospecting License and Mining Lease; Mines Act, CMR, MMR, Mines Rules, MMRD Act and Rules, EMP, EIA.

L: 45

BOOKS FOR REFERENCE

1. Gentry, D.W & O'Neill J.O 1984. Mine Investment Analysis, New York: Society of Mining Engineers of American Institute of Mining, Metallurgical and Petroleum Engineers.
2. Ian Runge, C. 1998 Mining Economics and Strategy, Littleton USA: Society of Mining, Metallurgy and Exploration, Inc.
3. Chatterjee, Kaulir Kishore, 2003, Introduction to Mineral Economics, Chennai, Wiley Eastern Limited and Lakshmi Publications.
4. Bruce, A.K. 1990 Surface Mining, Colorado, Society for Mining, Metallurgy and Exploration, Inc. Published Mines/Minerals Legislations
5. Ghosh A.K. & Bose, L.K. 2003, Mining in the 21st Century, New Delhi, Oxford & IBH Published Company Pvt Limited.

AG 9159 MICROPALAEONTOLOGY AND PALYNOLOGY

L T P C
3 0 0 3

1. INTRODUCTION 9

Introduction to Micropaleontology-scope, use and its applications in oil industries and Paleo-ecology studies, Methodology – separation of microfossils from matrix; mounting technique; identification and classification procedures.

2. MICROFOSSILS AND ITS APPLICATIONS 9

Study of microfossils from Precambrian- Quaternary; applications – age determination, paleofacies; Interpretation of tectonics from micro faunal evidence.

3. FORAMINIFERA 9

Foraminifera – Diamorphism, structure and test, classification of foraminifera; distribution through geological ages; ecology of foraminifera. Uses in sequence biostratigraphic studies.

4. OSTRACODA 9

Ostracoda-classification, ornamentation, orientation of carapace, microfossiles utility-environment significance; marine, non-marine environments and mixed environments.

5. PALYNOLOGY 9

Introduction–definition, concept, potential and prospects; Palynofossils classification; affinity of spore, pollen, diatoms and dinoflagellate. Maceration technique; general morphology of acritarchs, fungi, stratigraphic importance Palynology in coal and oil exploration.

L: 45

BOOKS FOR REFERENCE

1. G. Bignot. Elements of Micro paleontology, Graham and Trotman International Student edition. Bordas Dunod Paris. 1992.
2. Tschudy, R. H. & Scott, R. A. Aspects of Palynology, wiley interscience, New York. 1999.
3. N.K.N. Aiyengar, K. N. Prasad, An Introduction to Invertebrate Paleontology, New Delhi. 1996.
4. Jones, D. J., Introduction to microfossils, Harper & Brothers, New York. 1997.
5. Headly, R. H., Adams, C. S. (Eds) Foraminifera Vols., Academic press, London. 1984.

AG 9160 ADVANCED REMOTE SENSING TECHNIQUES AND GIS FOR GEOLOGIC APPLICATIONS

L T P C
3 0 0 3

1. HIGH RESOLUTION SENSORS AND HYPER SPECTRAL IMAGING DEVIC 9

Introduction - need for high resolution data.- Characteristics, specifications and applications of IRS 1C PAN, IKONOS, AVIRIS, ATM and CASI sensors. Spectrographic imagers-hyper spectral sensors- airborne and space borne. - Derivative spectral analysis techniques for analysis of hyper spectral data.

2. IMAGE PROCESSING AND INFORMATION EXTRACTION 9

Concept of pure and mixed pixels Sub-pixel classification techniques, per-pixel and per-parcel classification. Hard and soft classification - Sub-pixel classification techniques - spectral unmixing- linear and non-linear, Fuzzy logic - Fuzzy land cover boundaries, Fuzzy pattern classifiers and fuzzy classification techniques. Neural network - fundamentals- NN neural networks and their applications in improving classification accuracy. Feature extraction techniques - Feature extraction and selection.

3. GEOGRAPHIC INFORMATION SYSTEMS (GIS) 9

Introduction - map - characteristics - projection - Computer Assisted cartography. GIS - Components of GIS - Integration of GIS with remote sensing. Data Base Structures, Spatial, Non spatial, Tesselation, Raster - Run length, Run order, Block, Pi, Quadtree - Vector - Arc Node, DIME, DLG, Polygon - Topology - Data base - Hierarchical, Network & Relational.

4. DATA ANALYSIS & MODELLING USING GIS 9

Analysis of Non-spatial data - SQL - Integrated analysis of spatial & Non-spatial data - Retrieval, Surface Topographic & connectivity operations - Modeling.

5. APLICATIONS OF GIS 9

Application to groundwater / recharge studies - landslides - Mineral investigation - Petroleum exploration using GIS - GIS and ore- body modeling - coastal studies - Environmental applications of GIS.

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BOOKS FOR REFERENCE

1. Schowengerdt, R. A., Remote sensing - Models and methods for image processing. Academic press. London.1997.
2. Richards,J.A, Remote Sensing Digital Image Analysis.,Springer-Verlag, London 1986,
3. Duda R.O & Hart PE,Pattern classification & Scene Analysis.. Wiley,New York, 1973.
4. Morton Nadia & Eric Smith P, Pattern Recognition Engineering. John Wiley, New York, 1993.
5. Robert Laurini and Derek Thompson, Fundamentals of Spatial Information Systems, Academic Press. London. 1996.

AG 9161 **MARINE GEOLOGY**

L T P C
3 0 0 3

1. PHYSICAL FEATURES OF THE OCEAN 9

Introduction and scope of Marine Geology; oceanic profile, oceanic features; beaches, coastal classification, erosion and accretion; waves, currents and tides, coastal protection structures

2. OCEAN RESOURCES 9

Classification of marine mineral deposits. Origin and depositional system of marine resources; beach placers, shelf deposits, deep ocean Phosphatic, Polymetallic nodules, sulfate deposits, hydrocarbon deposits Sea water as a resource.

3. OCEANOGRAPHIC INSTRUMENTATIONS 9

Descriptions of research vessels, cruise, position fixing in the sea; sampling devices – Grab samplers, bottom samplers, dredges, sediment traps, boomerang samplers, water samplers, Winches, temperature measurement instruments, tools for studying ocean floor topography. POD, COD, GOD and BOD tools kit.

4. PHYSICAL AND CHEMICAL OCEANOGRAPHY 9

Concept of sea level changes, seismic stratigraphy; sequence stratigraphy, physical and chemical properties of seawater. Marine pollution- pathways, residence time, pollutants in the marine environment.

5. OCEANIC CRUST, SEDIMENTS AND LAW OF THE SEA 9

Origin of oceanic crust, ocean sediments, classification, digenesis, Ocean tectonics. Law of the sea, EEZ. Remote sensing applications to ocean science.

L: 45

BOOKS FOR REFRENCE

1. J.J. Bhatt. Oceanography – Exploring the Planet Ocean. D. Van. Nostrand Company, New York, 1994.
2. Shepard, F. P. Submarine Geology, Harper and Row Publ. New York, 1994.
3. Kerth. S, Ocean Science, John Wiley and Sons. Inc. New York. 1996.
4. James, K, Marine geology Prentice Hall, Inc. Englewood Clifs. N. J. 07632.
5. Eric. C. Bird Coasts: an introduction to coastal geomorphology, III ed. Basil Black well Publ. 1984.

AG 9162 APPLIED HYDROGEOCHEMISTRY

L T P C
3 0 0 3

1. GROUND WATER CHEMISTRY 9

Equilibrium and redox reaction – activity coefficients – solution – precipitation – saturation indices with respect to common minerals adsorption – ion exchange processes in ground water.

2. SAMPLE COLLECTION AND PARAMETERS 9

Chemical parameters – sampling and influence of well conditions- sampling for environmental isotopes – pore water sampling – calculation of parameters – representation of results – hydrochemical sections – statistical diagrams and techniques.

3. GROUND WATER CHEMICAL EVOLUTION 9

Hydrochemical sequences – major – ion evolution – groundwater in carbonate terrain – crystalline rocks – sedimentary deposit – interpretation of isotope data.

4. FLOW AND TRANSPORT 9

Transport processes – advection – dispersion – diffusion – hydrochemical processes during flow – influence of saline waters.

5. HYDROGEOCHEMICAL STUDIES 9

Chemical processes in relation to hydrogeology – regional Hydro geochemical studies – mixing of waters – Hydro geochemical models – case studies.

L: 45

BOOKS FOR REFERENCE

1. Lloyd, J. W. and Heathcote, J. A. National inorganic hydrochemistry in relation to groundwater, Oxford University press, 1985.
2. Freeze, R. A. and Cherry, J. A. Groundwater, Prentice Hall, 1979.
3. Stumm, W. and Morgan, J. J. Aquatic chemistry, An introduction emphasizing chemical equilibria in natural waters, Wiley interscience, New York, 1981.
4. Garrels, R. M. and Christ, C. L. Solutions, minerals and equilibria, Harper and Row, New York. 1965.

AG 9163 ENVIRONMENTAL HYDROGEOLOGY

L T P C
3 0 0 3

1. INTRODUCTION 9

Hydrological cycle - geological formations as aquifers - aquifer parameters - their estimation - groundwater flow and recharge - environmental impacts related to hydrogeology

2. HYDROGEOLOGICAL IMPACTS 9

Mass movements - land subsidence - causes - hydro compaction – sink holes – natural compaction - groundwater problems in mines and slopes

3. GEOLOGICAL ASPECTS OF WASTE DISPOSAL SITES 9

Physiographic - nature of rock types - structure - hydrogeological considerations - data required - formation fluid tests - transport mechanisms of polluted groundwater

4. GROUNDWATER CONTAMINATION 9

Water quality standards – transport processes – sources of contamination – oil spills – deep well disposal site locations – sea water intrusion - hydrogeological systems and monitoring

5. GROUNDWATER PROTECTION 9

Groundwater contamination - methods of assessment - application of groundwater modeling - damage prevention - remediation of aquifers – bio remediation of contaminated aquifers

L: 45

BOOKS FOR REFERENCE

1. Soliman, M.M et al . Environmental Hydrogeology, Lewis Publ., 1997
2. Freeze, R.A and Cherry, J.A Groundwater, Prentice Hall, 1979
3. Coates,D.R. Environmental Geology, John Wiley, 1981
4. Keller, E.A, Environmental Geology, Columbus, 1985
5. Marcel van der Perk, Soil and Water Contamination: From Molecular to Catchment, Scale, Taylor and Francis, 2006
6. Appelo, C.A.J. and D. Postma, Geochemistry, Groundwater and Pollution, Taylor & Francis; 2 edition,, 2005.

AG 9164 **SEQUENCE STRATIGRAPHY**

L T P C
3 0 0 3

1. INTRODUCTION 9

Introduction to sequence stratigraphy, scope, applications in exploration of hydrocarbons, stratigraphic terminology, problems and research trends, stratigraphic architecture, facies and sea level cycles.

2. METHODS FOR STUDYING SEQUENCE STRATIGRAPHY 9

Construction of sequence framework, importance of unconformities, assessing regional and global changes in sea level, areas and volumes of stratigraphic units, hypsometric curves, backstripping, integrated tectonic stratigraphic analysis.

3. SEQUENCE DEPOSITIONAL MODEL 9

Depositional systems and systems tracts, sequence boundaries, litho-log analysis, sedimentary facies, fossil assemblages, counts and their controls, paleoecology & Milankovitch processes.

4. STRATIGRAPHIC CYCLES 9

Types of stratigraphic cycles, tectno-stratigraphic model, Eustasy, epiorogeny, global cycle chart, tectonic mechanisms.

5. SEQUENCE BIOSTRATIGRAPHY, CHRONOSTRATIGRAPHY AND CORRELATION 9

Determination of the biostratigraphic framework, diachroneity of the biostratigraphic record, dating and correlation of stratigraphic events, time in sequence stratigraphy. Applications of sequence bio stratigraphy.

L: 45

BOOKS FOR REFERENCE

1. Andrew D. M. Geology of stratigraphic sequences Springer Publications, New York 1997.
2. Weimer and Posmentier, Sedimentary Geology, Elsevier Publications, Netherlands 1993.
3. Emery, D., and Myers, K, Sequence Stratigraphy, Blackwell Science, Publ. 1996.
4. Seismic stratigraphy – Applications to hydrocarbon exploration, AAPG Memoir No. 26. 1977.
5. Van Wagonar., P. R. Vail an overview of the fundamentals of sequence stratigraphy and key definitions. Sea level changes – an integrated approach. SEPM Publ. No. 42, 1988.

AG 9165 **SOIL SCIENCE**

L T P C
3 0 0 3

1. INTRODUCTION TO SOIL SCIENCE 9

Nature and importance of soil, soil formation, soil survey, physical chemical and biological characters of soil. Relationship between Soil plants and animal.

2. SOIL TYPES 9

Soil types and classification, soil genesis, Soil mineralogy and geochemistry of soil types: laterites, bauxites, ardisols, vertisols, camborthids. Application of soil micro morphology and landscape evolution. Radiometric age determination of soils

3. SOIL AND CROP PRODUCTION 9

Elements essential for plants and animals, soil nutrients, nitrogen, phosphorus, potassium, calcium, magnesium and sulphur in soil and their and its significance in plant growth, micronutrients.

4. SOIL QUALITY AND LANDSCAPE 9

Soil and water relation, organic matter in soil, functions of organic matter, organic matter and soil structure, organic matter and essential elements, tillage, cropping systems and fertility and case studies.

5. SOIL MANAGEMENT AND CONSERVATION 9

Introduction, irrigation, drainage soil management for field crops, gardens, lawns, pastures, rangelands and forests. Conservation factors and implementation methods.

BOOKS FOR REFERENCE

1. Nyle C. Brady, Ray R. Weil, The Nature and Properties of Soils (13th Edition) Prentice Hall , 2002.
2. Donald L. Sparks, Environmental Soil Chemistry, 2002.
3. Raymond B. Daniels, Richard D. Hammer., Soil Geomorphology, John Wiley & Sons, 2000.
4. M.E. Sumner, Hand book of soil Science, 1992.
5. Donald Sparks, Donald L. Sparks D, Environmental Geochemistry, Academic Press, 2002.

AG 9166 ENVIRONMENTAL GEOCHEMISTRY

L T P C
3 0 0 3

1. PRINCIPLES OF ENVIRONMENTAL GEOCHEMISTRY 9

The science of Geochemistry – Its objectives, its relationship to other geosciences and its methodology. The natural workings of the Earth: Natural distributions of chemicals in global and local environments. Geochemistry of the Earth: The birth of matter in our solar nebula, formation of the solar system and early geochemical history of the earth. The geochemical cycle – Distribution of elements in rocks

2. THE CONTINENTAL ENVIRONMENT 9

Hydrologic cycle – Dissolution and precipitation of silica, aluminum and iron hydroxides - Geochemistry of surface and ground waters – Rivers, ground water and lakes. Complex formation and chelation. Metals and nonmetals. Radioactive isotopes and radioactive waste.

3. MARINE ENVIRONMENT 9

Physical and chemical properties of open ocean seawater chemistry. Trace metals in sea waters. Types of metal distributions. Geochemistry of marine sediments. Marginal marine environments. Perturbations caused by humans: chemical distributions in anthropogenically "perturbed" systems.

4. ENVIRONMENTAL MINERALOGY 9

Basic mineralogy – Definition of a mineral – Types of minerals – Crystal chemistry – X – ray Crystallography. Basic silicate structures – zeolites – asbestos minerals – health effects of asbestos exposure. Mineral-microorganism interactions.

5. GEOCHEMICAL EXPLORATION ENVIRONMENT 9

Introduction – Primary Dispersion pattern Secondary dispersion pattern. Background values – Geochemical anomaly – Geochemical sampling - Weathering – Soils.

L: 45

BOOKS FOR REFERENCE

1. Arthur Brownlow, Geochemistry (Second edition), Pearson Education, INC., 1996.
2. Faure, G., Principles and applications of Geochemistry, Pearson Education, INC., 1998.
3. Nelson EBY, G., Principles of Environmental Geochemistry, Thomson Brooks/Cole, 2004.
4. Fraure, G, Principles of isotope geology, John Wiley, Second edition. 1986.

AG 9167 EARTHQUAKE DISASTER AND MITIGATIONS

L T P C
3 0 0 3

1. FUNDAMENTALS OF SEISMICITY 9

Earth structure and plate tectonics – Strain accumulation – elastic rebound and faulting – energy release and seismic waves – physical parameters of earthquake source – magnitude – seismic moment and fault plane solution – geological and seismological input for Seismicity evaluation on magnitude – frequency relations.

2. SEISMIC RISK ANALYSIS 9

Intensity and earthquake strong motion – seismic hazard analysis and estimation of design ground motions – seismic hazard mapping – seismic zonation and response – design codes – protective and reducing measures for infrastructures and structures – regulation of land use – risk assessment – vulnerability analysis.

3. APPLIED SEISMIC HAZARD ASSESSMENT 9

Assessment of geological seismic hazards – site response and seismic microzonation – mapping of hazards de to liquefaction and earthquake – induced landslides – use of Geographical Information System for hazard mapping and seismic risk assessment.

4. CASE STUDIES 9

Case studies – National and International major events – dam failures – induced Seismicity – structural damage – lessons learnt – techniques for field investigations.

5. SOCIO-ECONOMIC SYSTEM 9

Impact of disasters on national development – disaster legislation – public education – need, types of training – public awareness – information channels – organization of programs – sociology, psychology and economics of disasters – cost of mitigation measures – cost analysis.

L: 45

BOOKS FOR REFERENCE

1. Bell, F. G. Geological hazards: Their assessment, avoidance and mitigation. E and FN SPON, Routledge, London, 1999.
2. David Alexander. National disasters. UCL Press, London. Research press New Delhi, 1993.
3. Moores, E. M. and Twiss, R. J. Tectonics. W. H. Freeman and company, New York, 1995.
4. Nick Carter, W. Disaster management- A disaster manager's handbook. Asian Development Bank, Phillippines, 1991.
5. Penelis, G. G. and Kappos, A. J. Earthquake-resistant concrete structures, E and FN SPON, London, 1997.

AG 9168 OIL EXPLORATION AND PRODUCTION L T P C

3 0 0 3

1. SEISMIC PROSPECTING 9

Seismic reflection prospecting – data acquisition – receiver design and characteristics – Energy source– seismic instrumentation - survey positioning– establishment of field parameters; Seismic processing–processing steps and associated pitfalls– signal migration–improving the signal – to noise ratio – velocity stacking and verification – displaying seismic data-Interpretation– structural– stratigraphy – facies, sequence and depositional environment – hot spots for oil and gas; 3 D surveying.

2. RESERVE ESTIMATION AND DRILLING OPERATION 9

Volumetric oil and gas reserve estimation – proved, probable and possible reserves – Deterministic methods, Three point estimates- Expressing uncertain in the input to volumetric estimation - Rotary Drilling rig components – Basic operations – operational practices and procedures – Drill stem and assembly – descriptions, care, maintenance and handling practices -Drill stem Design – installation of blowout prevention

3. DRILLING MUD 9

Drilling mud – function, composition, properties, classification of drilling mud – Foam drilling – Packer fluids – solid removal – drilling complications and importance of mud - heaving shale , plastic flow shale – lost circulation, blowouts, Procedure for designing hydraulic program – Minimum annular velocity , circulation rate, pump characteristics calculation of system pressure losses – Equations used in hydraulic calculation – Hydraulics worksheet

4. CASING AND CEMENTATION 9

Casing–types, policy, specifications , forces acting–Casing design – preparation of casing to be lowered. Cementation–composition, properties, types, cementation-procedures applications.

5. WELL LOGGING RESERVOIR ENGINEERING AND PRODUCTION 9

Well logging – basic concepts – well bore environments – Logging Methods-Interpretation - calculation of saturation, gas saturation, water saturation porosity, permeability- finding oil, gas and water. Perforation techniques - well completion – fittings of well head, casing head housings, casing test, - transportation of oil, Reservoir engineering - principles- Oil recovery – primary, secondary enhanced oil recovery techniques – chemical methods – miscible methods - thermal method – Petroleum management and economics.

L: 45

BOOKS FOR REFERENCE

1. Brian J. Evans A Hand book for seismic data acquisition in exploration. Geophysical Monograph Series Publisher:
2. Society of Exploration Geophysics, Tulsa, U.S.A., 1997.
3. Robert E. Sheriff. Seismic stratigraphy, Publisher: International Human Resources Development Corporation, Boston 1980.
4. Bhagwan Shtay, Petroleum Exploration and Exploration practices, Allied Publishers Ltd., 2001.
5. Frank John, Mark Cook &Mark Gratan. Hydrocarbon exploration and production, Elsevier 2003.
6. Drilling: The mannal of methods, application & management. Australian Drilling Industry Training Committee Ltd., Publisher : Lewis publishes, 1997.

AG 9169 MINERAL EVALUATION AND MANAGEMENT

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1. PRE FEASIBILITY STUDIES **9**

Application of Geo Statistics Variogram Range, Kriging -Ore body Optimisation-Bulk Sampling, pilot Plant Saturation Prospecting, Categorisation curve-Block Recovery -grade Vis-à-vis In-situ grade

2. MINE MINERAL ECONOMICS **9**

Source of Capital Funds-Factors Governing Profitability -Time Value of Money - Evaluating Net Profit-Capital Cost Owning Cost, Operating Cost, Amortisation - Concepts of Depreciation, Cash Flow, DCF, PV, NPV-Project and Loss Account, -Balance sheet

3. MINERAL PROJECT FEASIBILITY **9**

Project Evaluation Techniques – Pay Back Discounted Pay Back, DCF, NPV, IRR Sensitivity Analysis WRT Grade, Price, Cut off grade, Recovery, Cost of Production -Feasibility Studies for Prospects and Operating Mines

4. MINERAL PROCESSING/BENEFICIATION **9**

Scope, Application, Brief Description of Concentrating/ Processing Methods Viz Gravity, Electrostatic, Electromagnetic, Flotation, Chemical, Ion Exchange, Roasting, Smelting-Mineral/Metal Recovery, Ratio of Concentration Selectivity Index-Flow Sheets of Important ore Minerals, Strategic Minerals

5 MINERAL POLICIES **9**

Synopsis of Mineral Related Acts, Rules, Regulations - Mining Plan under MCR1961, EMP, EIA, National Mineral Policy, Mineral Conservation, PL&ML - Wealth from waste, Co Products, By-Products - Turnaround Strategy for Sick Mineral Based Industries from Geologists Perspective.

L: 45

BOOKS FOR REFERENCE

1. McKinstry, H.E. Mining Geology, Newyork: Prentice-Hall, Inc. 1970.
2. Deshmukh, D.J.. Elements of Mining Technology, Dhanbad: Vidyaprakshan, 1998.
3. Bruce, A.K.. Surface Mining, Colarodo: Society for Mining, Metallurgy and Exploration Inc. 1990.
4. Hustrulid, H.V and Mark Kuchta, Open Pit Mine Planning and Design Fundamentals, Brookfield USA: A.A Balkema, 1995.
5. Hartman. Howard L,. Introduction to Mining Engineering, New York: John Wiley and Sons, 1987

AG 9170 ENVIRONMENTAL GEOLOGY

L T P C
3 0 0 3

1. GEOLOGIC ENVIRONMENTS 12

Concept and scope of environmental geology – understanding earth processes and landforms; Geological characteristics of various environmental regimes – fluvial, coastal, marine, Aeolian, desert, and glacial. - Landforms as ecosystem units – Geomorphic controls on biodiversity and its conservation.

2. TERRESTRIAL ENVIRONMENT 8

Environmental degradation due to mining and ore beneficiation – impact and management – Indian case studies - soil and mineral resources and their conservation

3. AQUATIC ENVIRONMENT 8

Geological factors influencing the formation of surface, groundwater and marine Waters – geological basis of groundwater, surface and marine water pollution and management with Indian case studies

4. GEOLOGY IN ENVIRONMENTAL PLANNING AND MANAGEMENT 8

Environmental impact assessment – geological appraisal of waste disposal sites - geology in planning and siting of land fills - problems of deep well disposal, radioactive waste management - land use planning in EIA

5. GEOLOGICAL HAZARDS AND GLOBAL ENVIRONMENTAL CHANGE 9

Causes, types, Mitigation and Management of earthquakes, landslides, tsunami and volcanoes. **;** Causes and Indicators of global environmental change

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BOOKS FOR REFERENCE

1. Montgomery, C.W. Environmental Geology, Won. C. Brown, Publishers, Iowa, 1989.
2. Dorothy Merritts, Andrew de Wet, Kirsten Menking, Environmental Geology W. H. Freeman & Co. and Sumanas, Inc. USA, 1997
3. Valdiya, K. S, Geology, Environment and Society, Universities Press, India, 2004