BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.

M.Sc. Applied Geology - Course Structure under CBCS

(applicable to the candidates admitted from the academic year 2008-2009 onwards)

Semester	Course	Course Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Extn.	
I	Core Course – I (CC)	Geomorphology and Marine Geology	6	5	3	25	75	100
	Core Course – II (CC)	Geotectonics and Structural geology	6	5	3	25	75	100
	Core Course – III (CC)	Stratigraphy and Palaeontology	6	5	3	25	75	100
	Core Course –IV (CC)	Remote sensing and Photogrammetry	6	5	3	25	75	100
	Core Course – V (CC)	PRACTICAL I - Palaeontology, Structural Geology & Remote Sensing	6	4	4	40	60	100
		Total	**30**	**24**				**500**
II	Core Course– VI (CC)	Advanced Crystallography and Mineralogy	6	5	3	25	75	100
	Core Course – VII (CC)	Engineering Geology, Mining Geology & Ore Dressing	6	5	3	25	75	100
	Core Course – VIII (CC)	Hydrogeology and Groundwater Management	6	5	3	25	75	100
	Core Course – IX (CC)	PRACTICAL II -Crystallography, Mineralogy and Mining Geology	6	4	4	40	60	100
	Elective – I	Environmental Geology & Disaster Management	6	4	3	25	75	100
		Total	**30**	**23**				**500**
III	Core Course – X (CC)	Igneous Petrology	6	5	3	25	75	100
	Core Course– XI (CC)	Sedimentary and Metamorphic Petrology	6	5	3	25	75	100
	Core Course–XII (CC)	PRACTICAL III – Petrology	6	4	4	40	60	100
	Elective - II	Geological, Geophysical and Geochemical exploration	6	4	3	25	75	100
	Elective – III	Computer Applications, GIS and Geo statistics	6	4	3	25	75	100
		Total	**30**	**22**				**500**
IV	Core Course–XIII (CC)	Economic Geology, Mineral Economics and Ore Microscopy	6	4	3	25	75	100
	Core Course – XIV	PRACTICAL IV - Economic Geology, Ore Microscopy, Hydrogeology, Geoexploration and Computer Applications	6	4	4	40	60	100
	Project Work	Dissertation=80 Marks [2 reviews –20+20=40 marks Report Valuation = 40 marks] Viva = 20 Marks	6	5	-	-	-	100
	Elective - IV	Fuel and Industrial Geology	6	4	3	25	75	100
	Elective - V	Report preparation – Survey, Mapping, Instructional tour and In Plant training. – 80marks viva voce - 20marks	6	4	-	-	-	100
		Total	**30**	**21**				**500**
		Grand Total	**120**	**90**				**2000**

Note:

Core Courses include Theory, Practicals & Project

No. of Courses	14 - 17
Credit per Course	4 - 5
Total Credits	70

Elective Courses

(Major based / Non Major / Internship)

No. of Courses	4 – 5
Credit per Course	4 – 6
Total Credits	20

	Internal	External
Theory	25	75
Practicals	40	60

Project

Dissertation	80 Marks	[2 reviews – 20+20	=	40 marks
		Report Valuation	=	40 marks]
Viva	20 Marks			20 marks

Passing Minimum in a Subject

CIA	40%	Aggregate 50%
UE	40%	

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SEMESTER– I

CC I **GEOMORPHOLOGY AND MARINE GEOLOGY**

UNIT 1 **Geomorphology**: Scope of Geomorphology – Fundamental concepts – significance of structure, Process and time – A brief account of concepts of Davis and Penck in the evolution of landforms – Characteristic features of landforms – Characteristics and types of fluvial landforms – Fluvial cycle – concept of peneplains – stream rejuvenation, causes and effects.

UNIT 2 Aeolian landforms – Arid Cycle of erosion – Glacial landforms, periodicity of glaciations and its causes – Geomorphology of the coasts, classification of shorelines and their evolution. Evidences of eustatic changes and their causes – Landforms produced by volcanoes.

UNIT 3 Influence of lithology on relief, karst topography-Relationship of geologic structures to topography. Development of landforms of flat lying, tilted, folded, dome and faulted structures-Development of drainage systems, Drainage Pattens, Drainage analysis in Geological interpretation.

Geomorphic features of India; Application of Geomorphology in groundwater, mineral and oil exploration and Engineering projects.

UNIT 4 **Marine Geology:** Introduction in marine Geology – Characteristics and origin of ocean basin, Oceanographic instruments pertaining to geological operations. Van been grab, petterson grab, gravity corer, piston corer, Boomerang grab, drag dredge, Water sampler – Nansen water sample – Reserving thermometer Bathy thermograph - secchi Disk.

Probing the sea floor – Echo sounding, Seismic shooting, Seismic refraction and reflection, satellite imagery.

Physical and chemical properties of ocean water. General oceanic circulation of water-waves and currents, Long shore, rip and turbidity currents. Geological work of waves and currents – Tsunami, origin and their prediction. Ocean pollution. Natural mineral resources of the ocean.

UNIT 5 Topography and origin of the continental shelf and continental slope. Characters and origin of submarine canyons, characteristics of oceanic trenches and mid oceanic ridges. Seafloor Spreading Seamounts and Guyots, Classification of coral reefs and their characteristics. Theories atoll formation.

Eustatic changes of sea-level (Plate tectonics and origin of ocean basin.

Law of the sea and its implications.

TEXT BOOKS

1. Thornbury,W.D. – 1969 Principles of Geomorphology ,Wiley.
2. Worcester,P.G. – 1948 A text book of Geomorphology
3. Kuenen, Ph. H., 1950 Marine Geology, Wiley.
4. Shepard, F.P., 1973 Submarine Geology, Harper and Row.
5. Fleming, Jhonsons & Strurup Oceans

6. Shepard, F.P., 1960 Earth, beneath the sea, OUP.
7. Petti John, F.S., 1965 Sedimentary Rocks.

REFERENCE BOOKS

1. Lobeck, A.K.- 1932 Geomorphology,McGraw Hill.
2. Ordway, R.J. – 1971 Earth Sciences, Affiliated East – West.
3. Pitty,A.F. –1972 Introduction to Geomorphology, Methuen.
4. King.L.C. – 1962 Morphology of the Earth, Oliver and boyd.
5. Woolridge S.W. & Margan R.S. 1952 – An outline of Geomorphology, Longmans
6. Sparks, b.W. – 1961 Geomorphology, Longmans.
7. Bloom, A.L. –1979 Geomorphology, Prentice Hall.
8. Turekian 1968 Oceans, Prentice Hall.
9. Menard, H.W., 1977 Ocean Sciences – Readings from Scientifica American, Freeman.
10. Kind, A.H., 1979 Introduction to Marine Geology and Geomorphology, Edward Arnold.

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CC II GEOTECTONICS AND STRUCTURAL GEOLOGY

UNIT 1 **Geotectonics: S**tudy of seismic waves – structure and composition of the earth – Radioactivity – radiometric dating. Volcanism – Volcanic zones of the earth. Major tectonic features of the earth-shield areas, mobile, zones, rift Valleys, mid oceanic ridges, continental shelves and slopes, submarine Canons.

UNIT 2 Geosynclines, Isostacy, Island arcs, deep Sea trenches, continental drift, plate tectonics and sea floor spreading. Orogeny and orogenic cycles – Epeirogeny and evolution of plateaus. Structural and tectonic features of India. Quaternary tectonics

UNIT 3 **Structural geology**: mechanical principles – three stages of rock deformation – elastic, plastic and rupture. Concept of stress, strain and the resulting ellipsoids. Mechanics of plastic and ruptural deformation. Factors controlling behavior of rock material. Folds – Brief resume of terminology, Classification and description – Recognition, mechanics and causes of folding – Recognition of top and bottom of beds.

UNIT 4: Faults – Description, classification , recognition criteria and mechanics of faulting. Joints in Quantitative and qualitative classification of joints. Modes of representation of joints – Histograms, Rose diagrams and preparation of stereo grams. Unconformities – types, recognition, significance, distinction from faults and their use in dating structural events.

UNIT 5: Cleavage, Schistosity and Lineation – their description, origin and relation to major structures. Petrofabric analysis – Field and laboratory techniques – petrofabric diagrams and their interpretation. Classification and chacteristics of Tectonites, Diapirs and related structural features.
Writing of field Geological report.

TEXT BOOKS

1. Billing, M.P. (1974) – Structural Geology, Prentice Hall
2. Hobbs, R.F.et.al.1976 – An outline of structural geology, Woiley
3. Hills, E.L.1965 – Elements of Structural Geology, Asia Publication House.
4. Beloussov, v.V. 1954 – Basic problems in Geotectonics, McGraw Hill.
5. De Sotter. :/U. 1956 – Structural geology, McGraw Hill
6. Navin, C.M. 1953 – Principles of Structural Geology, wiley.
7. Lahee, H. 1959 – Field Geology, McGraw Hill.

REFERENCE BOOKS

1. Ragan, D.M. – 1973 – Structural Geology, Wiley
2. Ramsay, J.G. 1967 – Folding and fracturing of Rocks. McGraw Hill
3. Philips, F.C.1954 – The use of Stereographic projection in Structural Geology, Arnold Publishers
4. Compton, R.R. – 1962 – Manual of field geology, Wiley
5. Allan Cox 1973 - Plate tectonics, Freeman &co.

CC III **STRATIGRAPHY AND PALAEONTOLOGY**

UNIT 1 **Stratigraphic Principles:** Study of standard European stratigraphic scale – Principles of Stratigraphy, Geological Time Scale – methods of correlation – Homotaxis and Contemporeinity – Stratigraphic, terminology, nomenclature and classification – Lithostratigraphy, Biostratigraphy, chronostratigraphy and stratotypes – causes of imperfections of geological records.

UNIT 2 **Indian Geology:** Pre Cambrian formations in India – Cuddapah and Vindhyan Super Group – Cambrian of Salt Range – Permo–Carboniferous of Salt Range – Gondwana formations – selected studies pertaining to Triassic of Spiti, Jurassic of Kutch, Cretaceous of Tiruchirapalli

UNIT 3 Deccan traps – inter and infra traps – Siwaliks – Tertiary and Quaternary formations – Age problems pertaining to Indian stratigraphy:- a) Saline series b) Deccan trap, study of the following boundary problems with reference to India:- a)Precambrian – Cambrian, b) Permian – Triassic c) Cretaceous – Tertiary.

UNIT 4 **Organic evolution**: History of the concept of evolution – Preformation theory; Baer's law; Biogenetic law; Lamarckism; Darwanian principles- Natural, Sexual and artificial selections; Theory of pangenesis; Mutation theory (De Vries and Modern version); Orthogenesis; Isolation. Detailed morphology, evolution and stratigraphic importance of the following groups. Corals, Graptolites, Trilobites, Brachiopods and Ammonites. Evolution of plants through ages – Gondwana flora and their stratigraphic significance.

UNIT 5. Brief accounts on the principal groups of vertebrates through geologic time – Devonian fishes and Mesozoic reptiles. Evolutionary histories of Horse, Elephant and Man. Micropalaeontological techniques – Sampling methods, separation of microfossils from matrix, thin sectioning. Types of microfossils – General morphology, Stratigraphic importance and ecological and palaeoecological significance of foraminifera, Ostracoda and spores and pollens. Applications of micropalaeontoligcal studies in environmental interpretation, Petroleum exploration, and marine geological studies.

TEXT BOOKS

1. Krishnan, M.S. 1956 – Geology of India and Burma, Higgin bothams.
2. Wadia, D.N. 1953 – Geology of India , Mc Millan
3. Woods, H. 1959 –Invertebrate Palaeontology, Cambridge.
4. Romer, A.S. 1960 – Vertebrate Palaeontology, Chicago press.
5. Amold, C.A. – 1947 – An introduction to palaeobotany.
6. Pascoe, E.S. – 1968 – A manual of the geology of India and Burma, Government of India, Pub.
7. Gregory, J.N and Barrot, B.H – General stratigraphy, Methuen.
8. Shrock. R.R. and Twenhofel , W.H – 1953 – Principles of invertebrate Palaeontology, Amold publication
9. Moore, R.C. Lalieker, C.D. and Fischer, A.G – 1952 – Invertebrate Fossils Mc Graw Hill.
10. Jones. D.J – 1958 – An introduction to Microfossils, Harper brothers
11. G.Bignot (1985) - Elements of Micro palaeontology Graham Trotman, 1985.
12. B.U. Hag and A. Boersma (1978) Introduction to Marine Micropalaeontology. Elsevier, Netherlands, 376 P.
13. V.J. Gupta – Indian Paleozoic Stratigraphy
14. V.J. Gupta – Indian Mesozoic Stratigraphy
15. V.J. Gupta – Indian Cenozoic Stratigraphy
16. V.J. Gupta – Indian Precambrian Stratigraphy

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CC IV **REMOTE SENSING AND PHOTOGRAMMETRY**

Unit 1: Fundamentals of Remote Sensing: Definition, types - Energy sources and radiation principles – Electromagnetic spectrum – Divisions - Stefan Boltzman's law – Blackbody – Wien's displacement law - Active and passive remote sensing system – various platforms of remote sensing

Energy interaction in the atmosphere: Scattering, absorption, transmission, atmospheric window; Energy interaction with the earth's surface features – spectral reflectance curve; Data Acquisition, Receiving and recording – PIXEL –Path and Row – Swath; Ideal and real remote sensing system; Thermal and Microwave remote sensing

Unit 2 : Photogrammetry – introduction, concept and application; Aerial Remote Sensing: History of aerial photography; Parts of aerial camera, aerial film camera and their types, electronic imaging, Multiband imaging; Types of aerial photographs; Photographic scale – causes for variation; Flight planning; Parallax, Vertical Exaggeration; Stereoscopy - Stereovision – stereoscopes: Lens and mirror stereoscopes – precision study of aerial photos using stereoscope, stereoplotting instruments; Mosaics – Types and construction of mosaics; Annotation - Factors affecting results

Unit 3: Satellite Remote Sensing:History of space imaging; Types of satellites: Polar orbiting, geostationary and spy satellites; Scanning systems and Detectors: Across-track and along-track scanning systems, FOV & IFOV, charge couple devices; Sensors and their resolutions: spatial, spectral, radiometric and temporal; Data products: photographic and digital; Sensor characteristics of Landsat, SPOT, IRS series of satellites and other high resolution satellites; Indian space programme: past, present and future

Unit 4: Satellite Data Interpretation: Visual interpretation: Elements of photo and image interpretation, interpretation strategies and keys

Digital interpretation - Digital image processing: Image rectification and restoration: Geometric correction, radiometric correction, noise removal; Image enhancement: Contrast manipulation – Grey level thresholding, level slicing, contrast stretching; Spatial feature manipulation: spatial filtering, edge enhancement, fourier analysis;

Multi image manipulation: multispectral band ratioing and differencing, Principal, canonical and vegetation components, IHS colour space transformation, decorrelation stretching; Image classification: Supervised classification - training stage, classification stage and output stage; Unsupervised classification; Data merging and GIS interpretation; Hyperspectral image analysis, Biophysical modelling

Unit 5: Remote Sensing Applications in Earth Sciences: Remote sensing interpretation for lithological and structural mapping, geomorphological studies, mineral exploration, groundwater exploration, land use / land cover mapping, hazard zonation mapping: earthquakes, volcanoes, landslides, floods, soil erosion and for pollution studies

TEXT BOOKS:

1. Lillesand, T.M and R.W. Kiefer (2000). Remote sensing and image interpretation. John Wiley & Sons, New York
2. Sabins, F.F (1987). Remote sensing principles and interpretation. Freeman Publishers, New York
3. Miller, V.C (1961). Photogeology. McGraw-Hill Publishers, New York
4. Siegal, B.S and R. Gillespie (1980). Remote sensing in Geology, John Wiley & Sons, New York
5. Curran, P (1988). Principles of remote sensing. Corgman Publishers, London
6. Pandey, S.N (1987). Principles and applications of photogeology. Wiley Eastern Ltd., New Delhi

REFERENCES:

1. Allum, J.A.E (1978). Photogeology and regional mapping, Pergamon Press Ltd., Oxford
2. Barrett, E.C and C.F. Curtis (1982). Introduction to environmental remote sensing. Chapman & Hall publishers, New York.
3. Anji Reddy, M (2001). Textbook of remote sensing and GIS, BSP PS Publications, New Delhi
4. Bruno Marcolongo and Franco Mantovam (1997). Photogeology – Remote sensing applications in earth sciences, Oxford & IBH Publishers Co. Pvt. Ltd., New Delhi
5. Rampal, K.K (1999). Handbook of aerial photography and interpretation. Concept Publishers Company, New Delhi
6. Jean Yves Scanvic (1997). Aerospatial remote sensing in geology. Oxford & IBH Publishers Co. Pvt. Ltd.
7. Agarwal, C.S and Garg, P.K (2000). Textbook on remote sensing in natural resources monitoring and management, Wheeler Publishing Company Ltd., New Delhi
8. Narayan, L.R.A (1999). Remote sensing and its application. Universities Press Ltd., Hyderabad.

PAPER -CC VP PRACTICAL 1: PALAEONOTOLOGY, STRUCTURAL GEOLOGY AND REMOTE SENSING

PALAEONTOLOGY:

Magascopic study of corals, Graptolites, Triobites, Brachiopous, Lamellebranches, Gasterpous, Ammonites and Echinoderms with special reference to their evolutionary characters. Study of plant fossils. Micro-scopic study of some forms and ostracods.

STRUCTURAL GEOLOGY:

Interpretation or complex geological maps, study of actual field geological maps; problems relating to depth and thickness; use for stereographic projection for solution of problems in structural geology. Borehole problems involving determinatio of attitude of tabular bodies(interpretation of lithological data from inclined boreholes, preparation of Latitudinal vertical sections measurement of bore hole devictions.)

REMOTE SENSING:

Elementary exercises relating to photogrammetry, use of pocket and mirror steroscopes, photo scale, overlap, side lap height measurements, annotation of aerial photographs; Interpretation lithology geological structures, landforms, drainage network, landuse/land cover features; generation of digitally enhanced products and feature extraction.

SEMESTER 2

CC VI **ADVANCED CRYSTALLOGRAPHY AND MINERALOGY**

UNIT 1 **Advanced crystallography:**– **Shoenflion** notation. Derivation of 32 Crystal classes and their symmetry projections – Spherical, Stereographic and Gnomonic projections of crystals belonging to normal classes. Calculation of crystal elements using inharmonic ratio- tangent relation, Napier's theorem and equation to normal.

Twinning in crystals – irregularities of crystals – X-rays Derivation of Bragg's law and its application. 14 Bravais space lattices.Powder diffraction method.

UNIT 2 **Optical mineralogy:** Polarisation – Optical properties of crystals – optical ellipsoids – polarizing Microscopes and accessories – Quartz wedge – Mica plate – Gypsum plate – Berek compensator – Micrometer ocular.

Determination of Refractive indices of minerals by immersion method.

Uniaxial minerals – double refraction in calcite – Nicol prism – optic axis – Primary and secondary optic axes; Ray velocity surface – Uniaxial indicatrix – optic sign; interference colour – interference figure – crystal orientation – extinction – Extinction angle - - Sign of elongation - Pleochroism – Birefringence.

UNIT 3 Biaxial minerals – Biaxial indicatrix – optical directions – Primary and secondary optic axes – optic axial angle – Mallard's formula – optic sign – crystallographic orientation – interference figures – Sign of elongation – Extinction – Extinction angle – Pleochroic scheme- Birefringence optical anomalies – Dispersion. U stage techniques for determination of Anorthite content and twin laws in Plagioclase – optic orientation.

UNIT 4 **Descriptive Mineralogy:** Structural classification of silicate minerals – Isomorphism – Exsolution – Order, disorder relations – Polymorphism = Pseudomorphism- Fluorescence in minerals – Metamict state – Staining techniques and micro chemical tests.

Description of chemistry, optical and physical properties, and paragenesis of the following: ortho and ring silicates; olivine group, Garnet Group, Aluminosilicates, Epidote group, Zircon, Sphene, Topax, Staurolite, Beryl, Cordierite and Tourmaline. Chain silicates – Pyroxene group, Amphibole group and Wollastonite.

UNIT 5 Sheet silicates – Mica group, chlorite group and clay minerals. Tekto silicates – Quartz group, feldspar group, feldspathoids and zeolites. Description of chemistry, optical and physical properties and paragenesis of the following: Apatite, Fluorite, Corundum, Spinet and Calcite.

TEXT BOOKS

1. Dana, E.S. – 1955 – Text Book of mineralogy, wiley
2. Wade, F.a. and mattox, R.E – 1960 – Elements of crystallography and Mineralogy, Harmer and brods.
3. Philips, P.C. – 1956 – An introduction to Crystallography, Longmans Green & co.
4. Winchell, A.N. – 1968 – Elements of optical Minerology, parts, I & II Eiley Eastern
5. Wahiatrom, E.E, - 1960 – Optical Crystallography, Wiley.
6. Berry, L.G. and Mason Brain, W.HY. – 1961-Mineralogy, Freern
7. Deer, W.A. Howie, R.A. and Zussman, J- 1966 – An introduction to the Rock forming minerals , Longmans.

REFERENCE BOOKS:

1. Burerger, M.J. – 1956 – Elementary Crystallography, Wiley
2. Naidu, P.R.J. – 1958 – 4-Axes universal stage, commercial printing and publishing house
3. Heinrich, E.W. – 1965 – Microscopic identification of Minerals McGraw Hill
4. Naidu, P.R.J. C.S. – 1971 – Johansen's optical mineralogy, Allied
5. Haribury, C.S. – 1971 - Dana's Manual of Mineralogy, Wiley.
6. Deer, W.A. Howie, R.A. & Zussman, J-1962 – Rock forming MineralogyVols. 1 to 5, Longmans.
7. Grim,R.N. – 1953 – Glay Mineralogy , McGraw Hill
8. Goger, R.G and kerr, P.F. – 1942 – optical Mineralogy, McGraw Hill.
9. Brain Mason – 1952 – Principles of Geo-Chemistry, Wiley.

CC VII ENGINEERING GEOLOGY, MINING GEOLOGY AND ORE DRESSING

UNIT 1 **Engineering Geology:** The role of Geology in Civil Engineering . engineering properties of rocks – Strength and elastic properties. Properties of building stones, concrete aggregates and rail road ballast.
Types of earth movements – Land slides, their causes, Classification and preventive measures.
Geological investigations pertaining to the foundation of bridges, buildings highways and airfields

UNIT 2 Types of Dams – Geological investigations of Dam sites. Dam construction - problems – remedial measures. Spill ways, reservoir problems. Tunnels: problems relating to tunneling in hard and soft grounds. Geological investigations proceeding tunneling. Geological investigations pertaining to harbours, docks and coastal erosion.

UNIT 3 M**ining geology:** Mining terms and their descriptions. Sampling - Principles – Types of sampling – Collection & preparation of samples;
Drilling: Types of drills – methods of drilling – geological logging. Explosives- Blasting – Rock excavations. Methods of stoping. Ventilation. Haulage. Shafts and shaft sinking.
Assaying and evaluation of ore-bodies and their extensions-ore reserve estimation.

Alluvial mining: panning, sluicing, hydraulicking, drift mining and dredging. Opencast mining: Mine machinery-power shovel, bucket wheel excavator, conveyor and spreader. Types of mining- Glory hole, Kaolin mining, Granite mining, sand mining, stripping.

UNIT 4 Subsurface mining (or) Under ground mining;-Stoping : Open stopes – supported stopes, shrinkage stopes. Caving;-Top slicing-sub level caving –block caving. Ground water control – Mine ventilation

Coal Mining: Prospecting and planning – underground mining –Room and pillar method – long wall (advancing & retreating) method –Pillar robbing- Hydraulicking – Power source roofing – transportation; strip mining of coal – Augering-cleaning –Grading – Shipping – Future trends in India.

Mining and environment, Mitigation of mining hazards. Factors controlling the choice of various mining methods.

UNIT 5 **Ore dressing:** Principles and scope of mineral dressing; Physical and chemical properties of minerals as applied to mineral dressing.

Size reduction Fundamentals – Preliminary breaking – Jaw crushers – Gyratory crushers and Stamping; - Fine grinding – Wet and dry – Ball Mills;- Size separation –Screening –Sieve scale, Grizzlies , Vibrating screens;- Settling- Principles of settling, free settling hindered settling, gravity concentration;- Jigs;- Rakes Classifiers; - shaking tables – Wilfley tables – principles of magnetic separation and Electrostatic separation; - Floatation – Definition, principle and application, –Frothing agents – collecting agents – Dispersing agents –floatation Machines – Floatation practice and Filtration.

TEXT BOOKS:

1. Krynine, D.P. and Judd, W.R. 1957 principles of Engineering Geology and Geotochniques, Mcgraw Hill.
2. Legget, R.F. 1962 Geology and Engineering , McGraw Hill
3. Gokhale K.V.G.K and Rao, D.M .1981 Experiments in Engineering Geology, Mcgraw Hill.
4. Arogyaswamy, R.N.P. 1973 Courses in Mining Geeology, Oxford &IBH, New Delhi.
5. Higham, S 1951 An introduction to Metalliferous mining, Lord
6. Gokhale, K.V.G.K and Rao, T.C. 1978 Ore deposites of India distribution and processing, Thomson.
7. Mc Kinstry, H.E 1960 Mining Geology, New york.

REFERENCE BOOKS

1. Fox, C.S 1949 Engineering Geology, New York
2. Blyth, F.C. 1979 A Geology for Engineers, ELBS
3. Gauding, A.M. 1939 Principles of Mineral Dressing , McGraw Hill.
4. Thamus, P.J. 19790 An introduction to mining, Methun.
5. Taggart, A.E. Elements of ore dressing.
6. Stanton, R.L. 1972 Ore Petrology, Mcraw Hill.

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CC VII P PRACTICAL –II CRYSTALLOGRAPHY, MINERALOGY AND MINING GEOLOGY

CRYSTALLOGRAPHY:

Sterographic and Gnomonic projections of natural crystals of normal classess-symmetry projections of 32 classes-calculation of crystal elements to test the knowledge of application of tangent relation . Anharmonic ratio, Napier's theorem and equation of the normal. Use of cantact goniometer in measuring interfacial angles.

MINERALOGY:

Megascopic and microscopic study of important rock forming silicates-determination of dichroic and pleochroic schemes, optic sign of uniaxial and blaxial minerals, sign of elonation optic axial angle by Mallard's method and anorthite content of oriented sections of plagioclase. Identification of pinacoidal sections of pyroxenes and Amphiboles, Determination of Anorthite content and twin laws in plagioclase by stage method.

MINING GEOLOGY:

Calculation of Mineral formula. Problems relating to evaluation of Ore reserves.

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CC IX HYDROGEOLOGY AND GROUNDWATER MANAGEMENT

UNIT I **Hydrogeology** : - Introduction - **Origin**: Meteoric, Juvenile and Connate waters – Hydrogeological Cycle: **Occurrence:** Groundwater occurrence in igneous, sedimentary and metamorphic rocks – Vertical distribution of groundwater in hard rock regions – Water bearing properties of rocks: Porosity, Permeability, Specific yield, specific retention, Transmissibility and storage coefficient. Geologic formations as aquifers; Types of aquifers; Movement of Groundwater – Laminar and turbulent flow – Darcy's law and its applications; Determination of Permeability in the laboratory and in the field.

UNIT 2 Groundwater Detection: **Surface Methods**: Geomorphological, Structural and Biological evidences – **Subsurface Methods**: Applications and limitations of Geophysical methods in groundwater targeting - Detailed account of principles, field procedure, electrode arrangements, instruments and interpretation of resistivity data. Brief study of Electrical Well-logging method of groundwater detection - Application of remote sensing methods in groundwater exploration

UNIT 3 **Well Design and Well development**: Brief introduction about Dug wells, Tube wells, Jetted wells, Infiltration Galleries and Collector wells. Design of Tube well, Well Screening and Artificial Packing – Well development through pumping, Bridging, Surging with air, Back washing, Acidizing – Method of sealing of poor quality wells, Sealing of top, intermediate and bottom zones in tube wells.

Fluctuations of groundwater levels; causes and control, Features of Re-change and discharge areas; Re-charge methods and practices.

UNIT 4 **Pump Tests**: Methodology and need for pump test – Testing of flowing wells: Theim's Method, Theis's method, Jacob's method, Chow's method - Evaluation of aquifer parameters through Pump Tests -

Estimation of water flow from vertical and horizontal Well-pipes – Hydraulic conductivity and field methods for determining the Hydraulic conductivity below the water table.

Groundwater basins; data collection for basin investigations – Water balance studies – Safe yield and overdraft. Conjunctive use of surface and groundwater reservoirs, Sea water intrusion in Coastal areas and its prevention Groundwater province of India –

UNIT 5 **Water Quality**: Geochemical method of groundwater exploration - Quality of water in various rock types – Water quality parameters and their standards for domestic, industrial and irrigation purposes. Physical tests for determining water quality – Chemical tests for estimation of water quality – graphical representation of water quality – Diseases and Virological aspects of underground water and remedial measures.

Groundwater problem in mining, a case study from Neyveli. Rain water harvesting and management.

Text Books:

1. Todd, D.K. 1959 Ground water Hydrology. John Wiley & Sons.
2. Davis, S.N. & Dewiest 1966 Hydrogeology, John Wiley & Sons.wiest R.J.M.
3. Regunath, H.M. 1983 Ground water, Wiley Eastern.
4. Gautam Mahajan- 1989: Evaluation and Development of Groundwater, Ashish Publishing House.
5. Ramakrishnan. S: 1998 – Ground water –By Author.

Reference Books:

1. Tolman., G.F. 1937 Ground water McGraw Hill. New York.
2. Walton, W.C. 1970 ground water Resources evaluation McGraw Hill.
3. Karanath, K.R. 1987 ground water Assessment Development & management Tata McGraw Hill

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EC I **ENVIRONMENTAL GEOLOGY AND DISASTER MANAGEMENT**

UNIT 1 **Environmental Geology** (Introduction: An Overview of our Planetary Environment: Earth in space and time. Objectives and scope - Definition of ecology and environmental Geology. Different ecosystems. Classification of Natural resources. A short account of renewable and nonrenewable resources.

Energy sources of disasters: internal sources of energy – external sources of energy – energy circulation and human risk – human fatalities through geological time.

UNIT 2 Landslides: Causes of Landslides, landslides induced by human activity, factors influencing slope stability, hazards related to landslides, landslide disaster management planning and role of geology, case studies

Soil Erosion: Soil formation processes, soil profiles, soil horizon, soil properties, soil classification, causes of soil erosion, consequences of soil erosion, strategies for reducing soil erosion and role of geology, case studies

UNIT 3 Earthquakes: Causative factors, Seismic waves, earthquake strength, distribution, seismicity in the Indian region, earthquake related hazards, earthquake disaster management planning and role of geology, case studies

Volcanic eruption: Magma sources and types, causative factors, distribution and types of volcanoes, hazards related to volcanic eruption – Disaster management planning and role of geology, case studies

River Flooding: Causes and factors influencing flood severity, flood characteristics, stream hydrographs, flood frequency curves, flood hazards, flood disaster management planning and role of geology, case studies.

UNIT 4 Environmental Problems Associated with Human Activities:

Impact of Mining Activities: Surface mining and its impacts, underground mining and its impacts, strategies for reducing hazards relating to mining activities and role of geology, case studies

Environmental problems associated with coastal zones: Coastal zone processes, hazards related to coastal zones – coastal erosion, coastal flooding, sea water intrusion, coastal pollution, strategies for reducing environmental problems associated with coastal zones and role of geology, case studies.

Tsunamis – origin, significance and prediction.

Nature and rate of human population growth, Impact of population explosion. Urbanisation: Causes of urbanisation, impacts of urbanisation, role of geology and urban planning.

UNIT 5 Pollution: Pollution, types of pollution, Surface and groundwater pollution, pollution due to domestic sewage, industrial effluents, agricultural run off, strategies for reducing pollution, role of geology, case studies. Waste Disposal: Solid, liquid wastes – sources, waste disposal strategies, role of geology, case studies.

TEXT BOOKS

1. Todd, D.K. 1959- Ground water Hydrology, Wiley
2. Tolman, C.F. – 1937, Ground water, McGraw Hill
3. Ragchunath, H.M. - 1983 - Groundwater, Wiley Eastern
4. Davis, S.N. and Dewiest, R.J.M, 1966-- Hydrology, Wiley
5. Keller, E.A (1976).Environmental Geology. Charles E. Merril Publishers, New York
6. Lundgren, L (1986). Environmental Geology. Prentice-Hall Publishers, New Jersey
7. Strahlfer, N, and Strahler, A.H. - 1973 - Environmental Geosciences Wiley Eastern
8. Davis *et.a1*. - 1976 - Environmental Geoscience, Wiley Eastern
9. Howard, A.D &Irwin Remson (1978). Geology in Environmental Planning. McGraw-Hill Publications, New York
10. Coates, D.R (1985). Geology and Society. Cahpman and Hall Publishers, New York
11. Janet Watson (1983). Geology and Man – An Introduction to Applied Earth Sceinces, George Allen and Unwin Publichers, London
12. Miller, G.T.Jr. (1994). Living in the Environment – Principles, Connections and Solutions. Wadsworth Publishing Company, California.
13. Sinha and Pankaj Srivastava (2000). Earth Resources and Environmental Issues, ABD Publishers, Jaipur

REFERENCE BOOKS

1. Meinzer.O.E - 1962 - Hydrology, Dover
2. Garg, S.P. - 1982 - Groundwater and Tube wells, Oxford and IBH
3. Fox, C.S. - 1949 - Geology of Water supply, Technical Press
4. Frederick Betz, J.R. - 1975 - Environmental Geology -Benchmark papers in Geology, V.25, Dowden.

5. Abbott, P.C (2002). Natural Disasters, McGraw-Hill Publications, New Delhi
6. Montgomery, C.W (2000). Environmental Geology, McGraw-Hill Publications, New Delhi
7. Valdiya, K.S (1987). Environmental Geology – Indian Context. Tata McGraw-Hill Publishing Company Ltd., New Delhi

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THIRD SEMESTER

CC X IGNEOUS PETROLOGY

UNIT-1: Igneous activity at the present day – Magma types and their evolution at: The Ocean Floor, Island Arcs, Orogenic Continental Margins, Intracontinental Orogenic Belts, and other Continental provinces. Nature and Physical properties of Magmas. Forms and structures of intrusive and extrusive igneous rocks. Textures of Igneous Rocks - their evolution and petrogenetic significance.

UNIT-2: Classification of Igneous Rocks: CIPW Norm, Niggli Values and Basis, IUGS – Streckeisen's Plutonic and Volcanic rocks classifications. Peacock's Alkali Lime Index and Classification based on Irvine and Baragar. Petrography and Petrogenesis of: Granite – Rhyolite Clan, Syenite – Trachyte Clan, Gabbro – Basalt Clan, Alkaline rocks, Anorthosites, Lamprophyres, Kimberlites, Komatiites, Carbonatites and Charnockite.

UNIT-3: Introduction to principles and laws of thermodynamics. Gibb's Phase rule and its application to igneous petrogenesis. Derivation and application of Lever Rule. Crystallization of Unicomponent magma. Simple Eutectic (Albite-Silica), Solid Solution (Forsterite-Fayalite) and incongruent melting (Forsterite-Silica) behavior of Bicomponent melts. Ternary melt-systems of Diopside – Forsterite – Silica, Diopside- Albite – Anorthite and Anorthite – Forsterite – Silica. Effects of pressure, fluids and vapors (H_2O and CO_2) on melting and cooling behavior of silicate systems. Crystallisation of Basaltic magma.

UNIT-4: Magmatic Differentiation - Liquid immiscibility, Soret effect, Role of volatile components, Fractional Crystallization, Assimilation and Magma mixing - and their roles in magmatic differentiation. Field and laboratory evidences in favor and against the 'Reaction Principles' of Bowen and Osborn. Petrographic provinces of magmatic rocks. The diversity of magmatic rocks, their abundance and distribution on the earth's Crust.

UNIT-5: Chemical petrology: Brief outline of Analytical methods of igneous rocks using Flame photometers, AAS, XRF, ICP and Wet chemical methods. Distribution and behavior of major-oxide elements in rocks. Application of Bivariate (Harker Diagram) and Triangular (AFM Diagram) variation diagrams. REE and Trace elemental distribution in rocks and their application to igneous systems. Isotopes, and their geochemical criteria for discriminating between tectonic environments magmatic systems..

Text Books:

1. Tyrrell. G.W.(1963)- Principles of Petrology – Asia Publishing House.
2. Turner.F.J and Verhoogen.J –1960.- Igneous and Metamorphic petrology – McGraw Hill.
3. MacKenzie.W.S. et.al.,-(1982); Atlas of Igneous rocks and their textures – Longman.
4. Bowen.N.L.(1928)- The evolution of the Igneous Rocks. Dover Publications.
5. Middlemost. A.K.(1985) – Magmas and Magmatic Rocks.- LONGMAN.
6. McBirney.A.R.(1994) – Igneous Petrology – CBS Publishers and Distributors.
7. Raymond.L.A.-2002- Petrology – McGraw Hill.
8. Hall- A (1992) – Igneous Petrology – ELBS.
9. Barth, F.W. – 1962 – Theoretical Petrology, Wiley.

References:

1. Shand –S.H.(1949)- Eruptive Rocks.
2. Morse.S.A – (1980)- Basalts and Phase diagrams –Springer – Verlag.
3. Winter. J.D.- (2001) – Igneous and Metamorphic Petrology –Prentice Hall.

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CC XI SEDIMENTARY AND METAMORPHIC PETROLOGY

UNIT 1 Sedimentation - Textures and structures of sedimentary rocks - Classification and composition of sedimentary rocks –– Study of residual deposits – Terra rosa, Clay with flints, Laterite, Bauxite, Residual clays. Study of Clastic rocks – Rudaceous – Conglomerate – Breccia – Arenaceous – Sandstones – Classification - Volcaniclastic deposits – Siltstones – Mudstones. Study of Nonclastic rocks - Lime stones and Dolomites - Siliceous deposits – Ferruginous deposits – Carbonaceous deposits – Phosphatic deposits – Evaporites. Heavy minerals and their significance-provenance of sediments –sedimentary differentiation, Lithification and Diagenesis.

UNIT 2 Sedimentary environments – Marine environments – Non – marine environments – Mixed environments. Modern sedimentary environments.

Tectonics & sedimentation - Sedimentary basins – Downwarp basins – Rift basins – Interior basins- Foreland basins – Subduction basins – Pullapart basins – Delta type basins – Composite basins – Geosynclines - Types – Characteristics of sediments. Plate tectonics – Basin formation – Basins in compressional zones – Basins in Stike slip zones – Basins in transform fault zones.

UNIT 3 Stratigraphy and Sedimentation – Seismic Stratigraphy - Sequence stratigraphy. Basin analysis – Paleocurrents

Techniques in Sedimentology Collection and analysis of field data - Mechanical analysis of sediments – Graphical representation of size analysis data – statistical parameters and their geological significance. Microscopical techniques – Cathodoluminesence – X – ray diffraction – Scanning electron microscope - Application of trace element, rare earth element and stable isotope geochemistry to sedimentological problems.

UNIT 4 **METAMORPHIC PETROLOGY**

Agents of metamorphism – Types of metamorphism – Metamorphic textures and structures – Study of Cataclastic metamorphism - Grades, Zones and facies of metmorphism – A critical review of facies concept – Facies of Contact Metamorphism – Facies of Regional metamorphism – Facies of Burial metamorphism - Graphical representation of facies, ACF, AKF, AMF diagrams. Classification of metamorphic rocks based on texture and mineralogy; chemical composition.

UNIT 5 Goldschmidth's mineralogical phase rule and its application – stress and antistress minerals – Retrograde metamorphism – Metamorphic diffusion and differentiation – Metasomatism – Granitisation and Migmatites – Metamorphism in relation to magma and orogeny – Paired metamorphic belts. Application of trace element, rare earth element and stable isotope geochemistry in metamorphism.

TEXT BOOKS

1. Tyrrell, G.W. 1963 – Principles of Petrology, Asia Publishing House
2. Turner, F.J. & Verhoogen, J – 1960 – Igneous and Metamorphic Petrology, McGraw Hill.
3. Huang, W.T. – 1962 – Petrology, McGraw Hill.
4. Williams, H. Turner, F.J. & Billbert, C.M. – 1954 – Petrography, Freeman.
5. Pettijohn, F.J.- 1967 – Sedimentary Rocks, Harpers and Bros
6. Bayly, B. – 1968 – Introduction to Petrology, Prentice Hall.

REFERENCE BOOKS

1. Barth, F.W. – 1962 – Theoretical Petrology, Wiley.
2. Wahistrom, e.e. – 1962 – Theoretical Igneous Petrology, Wiley.
3. Hatch, F.H. Wells, A.K. & Wells, M.K. – 1949 – Petrology of Igneous Rocks, Thomas Murby.
4. Johannsen, A. – 1962 – Descriptive Petrography of Igneous Rocks, Vots. I to IV Allied Pacific.
5. Shand, S.H. – 1949 – Eruptive Rocks.
6. Krumbein, W.C. & Pettijohn, F.J. – 1938 – Manual of Sedimentary Petrography, Appleton century co.
7. Krumbein, W.C. & Sloss, L.L. – 1951 – Stratigraphy and Sedimentation, Freeman.
8. Harker, A – 1950 – Metamorphism, Methuen.
9. Winkler, H.G.F. – 1967 – Petrogenesis of Metamorphic Rocks, Springer and Werlog.
10. Hyndman, D.W. – 1972 – Petrology of Igneous and Metamorphic Rocks, McGraw Hill.
11. Miyashire, A – 1973 – Metamorphism and Metamorphic Rocks, George Allen & Unwin.

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CC XII P PRACTICAL – III : PETROLOGY

- Megascopic and Microscopic study of igneous, sedimentary and metamorphic rocks.
- Modal analysis of rocks.
- Mechanical analysis of sediments and statistical studies of data.
- Petrochemical calculations – C.I.P.W. Norm.

- Niggi values.
- Von wolff plots and variation diagrams,
- Harker's diagram and Niggli variation diagram, ACF diagram.

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EC II GEOLOGICAL, GEOPHYSICAL AND GEOCHEMICAL PROSPECTING

UNIT –1: Geological Exploration: Criteria controlling the choice of sites for geological prospecting- Marginal information of topo sheets and study of field equipment. Field documentation and basic field procedures. Pitting, trenching, drilling and exploratory mining. Mineralogical, structural, stratigraphical and geomophological guides to ore search. Ore reserve estimation techniques.

UNIT – 2: Geophysical Exploration: A concise account of limitations and applications of various geophysical exploration methods; The problem of ambiguity in geophysical interpretations; The principle, types, origin, instruments, field procedure and interpretations of self potential method. The principles involved, instruments used, field procedures adopted and interpretations applied in electrical resistivity methods. The principle, types, origin, field procedure and interpretation of induced polarization method. A brief account of electromagnetic, telluric, AFMAG techniques. A brief study of electrical well logging techniques.

UNIT – 3: Geodesy of the earth. Newton's law and its application. The earth's gravitational field. Gravity corrections. The gravity measuring instruments. Density of rocks and the methods of density measurements. Gravitational effects over subsurface bodies of different shapes. Gravity survey at land and sea. Interpretation of gravity data and depth problems. Brief account of density logging. Elastic properties of the earth materials. Types of seismic waves, their propagation and characteristics. Geophones, types of shooting methods, seismic energy source. Principle of refraction – interpretation of - horizontal two layer, multilayer and dipping layers. Principle of reflection seismic survey. Problems in seismic survey. Brief outline of sonic logging.

UNIT – 4: Basic concepts and principles of magnetic prospecting. Magnetism of the earth and palaeomagnetism. Magnetic susceptibility of rocks. Magnetic effects from buried magnetic bodies. Instruments employed in magnetic prospecting. Magnetic survey on land and sea. Air-borne magnetic survey. Corrections and interpretation of magnetic data. Principles of radioactive prospecting. Radioactive decay, radioactivity of rocks and minerals. Instruments, field procedure and interpretations employed in radioactive survey.

UNIT – 5: Geochemical Exploration: Origin and abundance of elements in the earth's crust. Mobility of elements; factors controlling mobility; mobility in surficial and deepseated environment; geochemical dispersion; recognition of surficial and deep seated dispersion pattern; geochemical anomaly; background and threshold values; recognition of anomaly; significant and non significant anamolies; bedrock and soil geochemical surveys. Geochemical explorations for gold, copper and base metals. Application of

geochemistry in: Mineral exploration, Oil prospecting, Ground water targeting, Soil studies, Atmospheric pollution studies. Outline of biogeochemical exploration.

Text Books:

1. McKinstry H.E. (1960) - Mining Geology: Asia Publishing House
2. Mathur S.M. (2001) – Guide to Field Geology: Prentice Hall of India.
3. Ramachandra Rao M.B.(1975) – Outlines of Geophysical Prospecting - A manual for Geologist: University of Mysore.
4. Dohr.G. (1984): Applied Geophysics- English Book Depot.
5. Lowire. W. (1997) - Fundamentals of Geophysics. Cambridge Low price Editions.
6. Dobrin M.B.(1981) Introduction to Geophysical prospecting. McGraw – Hill International Book Company.
7. Kearey.P and Brooks.M (1984) An Introduction to Geophysical Exploration- ELBS.
8. Hawkes H.E. and Webb. U.S - (1962)- Geochemistry in mineral Exploration. Harer & Row.
9. Mason.B (1966); Principles of Geochemistry – Willey Toppan.

References:

1. Burger. H.R. (1992)- Exploration Geophysics of the Shallow Subsurface: Prentice Hall
2. Robinson. E.S. and Coruh.C. (2002)- Basic Exploration Geophysics– John Wiley.
3. Gunter Faure. (1998) – Principles and applications of Geochemistry–prentice Hall.
4. Krauskope.B.K.- (1988) ;Introduction to Geochemistry.

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EC III COMPUTER APPLICATIONS, GIS AND GEO STATISTICS

Unit 1: **Computer fundamentals** - Principles - Historical development - general characteristics - construction and organization of computers; Classification of computers – Computer hardware – input and output devices – storage devices – printers and plotters; Binary arithmetic and coding; Computer software – flow chart and algorithm; Computer language – machine language, assembly language and high level language; Operating System – MS-DOS and Windows.

Unit 2: **Programming language: Basic–** Structure of programme – character set, constant, variables and operators – arithmetic expressions – library functions – classification of programme statements - input and output statements, control statements – writing programme in basic statistical operation. **C –** Structure of programme – character set, constant, variables and operators – arithmetic expressions – library functions – classification of programme statements - input and output statements, control statements – writing basic and C programmes in basic statistical operation.

Unit 3: **MS-Office: MS Word –** word processing – cursor navigation - functions – main menu and sub menu – tool bars – documents creating – editing, formatting and printing. **MS Excel –** Electronic spread sheet –

navigation - main menu and sub menu – tool bars – functions – worksheet and chart - database and data processing.

MS Power point – operations – main menu and sub menu – tool bars – slides creating – editing, templates - formatting and presentation.

Unit 4: **Geographical Information System:** Introduction – definition of GIS, historical development; Basic principles – concepts and usefulness of GIS; Component of GIS – Hardware, software modules and user; Spatial data in GIS – vector and raster data – spatial data structure and data modeling – data sources; Projection and registration; Attribute data management - Data input and editing – Data analysis and manipulation in GIS; Surface modeling – TIN and DTM; Out put from GIS; Global Positioning System – concepts – segments – its application; Application of GIS in Geological studies and natural resource management.

Unit 5: **Statistics**: Concepts – Definition - Merits and limitation – Tabular and diagrammatic illustration: Bar diagram and pie diagram – histogram and frequency polyson – ogives; Measures of central tendency - AM , Median, Mode, Dispersion – standard deviation – skewness, kurtosis – Karl Peason's coefficient of Skewness; Correlation and Regression-Concepts, Karl persion's coefficient of correlation – Rank correlation Regression, lines of regression; Probability – Meaning and Uses Addition and Multiplication theorems – Baysian rule - A brief note on statistical software.

Distribution of sample variance and chi square distribution; probaility; testingnormal distribution; students 't' test, 'f' test; confidence interval, analysis; calculation of varience- covariance, simple linear models; cluster analysis

TEXT BOOKS

1. John C.Davis - 1973 - Statistics and Data Analysis in Geology, John Wiley & Sons.

2. Krumbein and Graybill 1965 - An introduction to Statistical methods in Geology, Mc Graw Hill.

3. Burrough, P.A.-1986- Principles of Geographical information system for land resource assessment.

REFERENCE BOOKS

1. Rober L. Miller and James Stevenkahn -1962, Statistical analysis in the Geological Sciences, John Wiley & sons, Inc.

CC XIII ECONOMIC GEOLOGY, MINERAL ECONOMICS AND ORE MICROSCOPY

UNIT 1 **Economic geology:** Processes of formation of mineral deposits – Magmatic, sublimation, contact metasomatic, Hydrothermal (Cavity, filling and replacement) Sedimentation, evaporation, residual and mechanical concentration, Oxidation and supergene enrichment and metamorphism.

UNIT 2 Classification of Mineral deposits, controls of Ore localisation – structural stratigraphic, physical and chemical; Metallogenetic epochs and provinces – Plate tectonics and Ore genesis -Geologic thermometry-Geobarometry, stable and radiogenic isotopes of ores and the host rocks – Geological and Geochemical modeling of ore deposits.

UNIT 3 Study of the following ore deposits with regard to their mode of occurrence, distribution in India, Origin and uses; Asbestos, Barite, Bauxite, Chromite, Copper, Gold, Iron, Lead and Zinc, Magnesium, Manganese.

UNIT 4 **Mineral Economics:** Definition and scope – Significance of minerals in National economy, peculiarities inherent in mineral industry, Tenor, grade and specifications for minerals. Mines and Minerals legislation of India. India's national mineral policy. Strategic, Critical and essential minerals with reference to India. Mineral conservation and substitution.

UNIT 5 **Ore Microscopy:** Construction of ore Microscope. Polishing and mounting of ores, Physical properties of Ore minerals, Determination of micro hardness; Factors affecting microhardness.

Study of optical properties – Colour, reflectivity, bi-reflectance, Isotropism, natstotropism, Polarisation Colours, Rotation properties, Internal reflections and relation sense. Instrumentation and methods of determination of reflectivity, Polarisation figures of Isotropic and anisotropic Ore minerasl, Micro – chemical techniques, ore textures and paragenesis, application of Ore Microscopy.

Text Books:

1. Bateman, A.M. – 1995 – Economic Mineral Deposits, Willey.
2. Lindgren, W – 1993 – Mineral Deposits, McGraw Hill.
3. Cameron, E.N. – 1961 – Ore Microscopy, Wiley.
4. Sinha, R.K. & Sharma, N.L. – 1976 – Mineral Economics Oxford and IBH.
5. Graig, J.R. – Ore Microscopy and Ore Petrography.

Reference books :

1. Coggin, B & Dey, A.K. – 1995 – India's Mineral Wealth, OUP.
2. Park, C.F. & Macdiarmid, R.A. 1970 – Ore deposits, Freeman.
3. Deb, S, 1980 – Industrial Minerals and rocks of India, Allied.
4. Gokhale; K.V.G.K. & Rao, T.C. – 1978 – Ore deposits of India, their distribution and Processing, Thomson Press.
5. Stanton, R.L. 1972 – Ore Petrology, McGraw Hill.

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CC XIV P

PRACTICAL – IV ECONOMIC GEOLOGY, ORE MICROSCOPY, HYDROGEOLOGY, GEOPHYSICS, GEOCHEMISTRY AND COMPUTER APPLICATIONS.

ECONOMIC GEOLOGY, GEOPHYSICS AND GEOCHEMISTRY

Megascopic identification of important ore minerals. Interpretation of maps and calculation of ore minerals. Interpretation and study of geological and geophysical data and field maps. Blow pipe tests and chemical analysis of selected ores. Volumetric analysis.

ORE MICROSCOPY

Study of optical properties and identification selected ores by reflected light- Description and interpretation of ore textures. Etching and microchemical techniques.

HYDROGEOLOGY

Study of hydrological data and their interpretations. Interpretation of pumping test data. Representation of water analysis data on different types if diagrams.

COMPUTER APPLICATIONS

Writing of simple computer programmes pertaining to geological problems

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EC IV FUEL AND INDUSTRIAL GEOLOGY

UNIT I Coal Geology

Definition and origin of coal. Sedimentology of coal bearing strata, types of seam discontinuities and structures associated with coal seams. Chemical analysis of coal (proximate and ultimate analysis).

Coal Petrology:- Classification and optical properties of macerals and microlithotypes. Techniques and methods of coal microscopy. Application of coal petrology. Classification of coal in terms of Rank, Grade and Type. Indian classification for coking and non-coking coals. International classifications (I.S.O. and Alpern's classification). Elementary Idea about coal preparation, coal carbonization, coal gasification, coal hydrogenation, coal combustion and fertilizer form coal. Coal as a source rock in petroleum generation. Geological and geographical distribution of coal and lignite deposits in India. Coal exploration and estimation of coal reserves. Indian coal reserves and production of coal in India.

UNIT II Petroleum Geology

Petroleum – its composition. origin (Formation of source rocks-kerogen, organic maturation and thermal cracking of kerogen) and migration of petroleum. Reservoir rocks-porosity and permeability. Reservoir traps – structural, stratigraphic and combination traps. Oilfield fluids – water, oil and gas. Methods of prospecting for oil and gas (geological modeling). Elementary knowledge of drilling and logging procedures. Oil shale. An outline of oil belts of the world. Onshore and offshore petroliferous basins of India. Geology of productive oilfields of India. Oil policies of India.

UNIT III **Coalbed methane** – a new energy resource. Elementary idea about generation of methane in coal beds, coal as a reservoir and coalbed methane exploration.

Atomic fuel- Mode of occurrence and association of atomic minerals in nature; atomic minerals as source of energy; methods of prospecting and productive geological horizines in India; nuclear power stations of the country and future prospects; atomic fuels and environment.

UNIT IV Physical and chemical properties, mode of occurrence and distribution in India of the minerals required for the following industries, Refractory, Abrasive, Fertilizer, Cement, Paints, Glass and Pigments.
Mineral wealth of TamilNadu.

UNIT V: Classification of gemstones, systematic description of crystallography, physical properties, optical properties, absorption spectra, chemical properties, special gemmological features, diagostic features and occurrences of common and less common gemstones. New instruments and techniques used to identify and testing the gemstones. Synthetic gemstones, history of synthesis, methods of manufacture, methods of differentiation between natural and synthetic stones.

Text books: Reference books

1. Chandra, D., Singh, R.M. Singh, M.P., 2000: Textbook of Coal (Indian context). Tara Book Agency, Varanasi.
2. Singh, M.P. (Ed.) 1998: Coal and organic Petrology. Hindustan Publishing Corporation, New Delhi.
3. Scott, A.C., 1987: Coal and Coal-bearing strata: Recent Advances. The geological Society of London, Publication no. 32, Blackwell scientific Publications.
4. Stach, E., Mackowsky, M-Th., Taylor, G.H., Chandra, D., Teichumullelr, M. and Teichmuller R., 1982: Stach Textbook of Coal petrology. Gebruder Borntraeger, Stuttgart.
5. Holson, G.D. and Tiratso, E.N., 1985: Introduction to Petroleum Geology. Gulf Publishing, Houston, Texas.
6. Tissot, B.P. and Welte, D.H., 1984: Petroleum Formation and Occurrence, Springer – Veralg.
7. Selley, R.C., 1998: Elements of Petroleum Geology. Academic Press.
8. Durrance, E.M. 1986: Radioactivity in Geology-principles and application. Ellis Hoorwool.
9. Dahlkamp, F.J., 1993: Uranium Ore Deposits. Springer Verlag.
10. Boyle, R.W., 1982: Geochemical prospecting for Thorium and Uranium deposits, Elsevier.
11. Taylour, G.H., Teichmuiler,M., Davis, A., Diessel, C.F.K. and others (1998) Organic Petrology
12. Durrance, E.M.(1986) Radioactivity in Geology: Principles and Applications\
13. Beginner s Guide to Gemmology by P.G. Read.
14. Practical Gemmology by R. Webstar.
15. Gem Testing by S.W.Anderson.
16. Gemstones of the world by W.Schumann.

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