DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Curriculum under Choice Based Credit &

Grading System

M.Sc. I & II Year

Semester–I to IV

Geology

[Effective from 2015-16 & onwards]

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

SYLLABUS for M. Sc. GEOLOGY
Choice Based Credit & Grading System
(CBCGS Semester Pattern)
Effective from 2015-2016

A] Salient Features of the Credit & Grading System:

1. Master's degree course in Geology would be of 100 credits, where four credit course of theory will be of one clock hour per week running for 15 weeks and two credits for practical course will consist of laboratory exercise of six hours per week running for 15 weeks.
2. Student will have to take admission in Geology Department and complete 96 credits incorporated in the syllabus structure of Geology. The remaining 4 credits shall be chosen from courses offered by the Geology Department or other Departments of the University with credit system structure.
3. Every student shall complete 100 credits in four semesters of M.Sc. Course

INSTRUCTIONS FOR THE STUDENTS (CREDIT & GRADING SYSTEM)

The students seeking admission to M.Sc. Geology course are hereby informed that they are supposed to adhere to the following rules:

1. A minimum of 75 % attendance for lectures /practicals is the pre-requisite for Grant of Terms.
2. There shall be tutorial / practical tests /seminar as a part of internal assessment in each semester. The students are supposed to attend all the tests as per the timetable.
3. Fieldwork of is a compulsory component of the syllabi. The students are supposed to attend all field work tours organized by the Geology Department from time to time. This will include geological excursion /field work / field cum-laboratory workshops, visit to geologically important places, mines, geological and scientific organisations. Candidates should submit the field report at the end of excursion along with the geological specimens collected during the programme.
4. From Elective GL304 and GL305 candidates have to select only one elective of 4 credits.
5. From Elective GL 404 andGL405 candidates have to select only one elective of 4 credits.
6. Theory Examinations would be conducted at the end of odd as well as even Semesters.
7. Practical examinations will be conducted at the end of even Semesters.
8. Students may take project work and submit in lieu of **two practical courses** (*Mining Geology*- CCGL 408 & *Statistical Geology Computer Applications in Geology and Research Methods*- CCGL 409 or *Physics and Chemistry of Earth*- CCGL 410), weighing 100 marks (4 Credits). Although this is submitted in lieu of stated courses, actual project may or may not be directly related to these two courses. Project should however, be directly related to any of the aspects of

sixteen theory courses or remaining fourteen practical courses. The allotment of project work will be finalized by the departmental committee in the concerned Department.

B] Evaluation of students:

a) **College Assessment**: Internal assessment for each course would be continuous and dates for each tutorials/ practical tests will be pre-notified in the time table for teaching or placed separately as a part of time table. Departmental Internal Assessment Committee will coordinate this activity.

- **i) Theory Courses**: There will be a minimum two test in a theory course comprising of 20 marks and will compose multiple choice and or short answer questions.
- **ii) Practical Courses**: Practical courses will be conducted annually and evaluated by external examiner in university practical examination.
- **iii) Field Work Components**: The field work is compulsory. The evaluation will be based on: Performance of the student in the field, punctuality, enthusiasm and aptitude of students while completing the field work, tour report and Viva-voce

b) **University Assessment:** The term end examination will be conducted by university.

Note : GL 101, 102,…; 201,202,.....; 301,302,.....; 401,402,.....410.–Geology paper corresponding to first semester to fourth semester respectively; CC- Core Course; EC- Elective Course ; SC- Service Course; CCGL-Core Course Geology; ECGL-Elective Course Geology; L-Lecture; T- Tutorial; Th-Theory; Pr.-Practical; WL/wk- Work Load per week; CA- College Assessment; UA-University Assessment

C] Scheme of teaching and examination under semester pattern Choice Based Credit and Grading System (CBCGS) (Semester Pattern) for M.Sc. Program in Geology.

M.Sc. GEOLOGY I year (Semester I)
Theory Papers

Course Type	Course Code	Theory / Practical	Teaching Scheme (Hrs/ week)				Credits	Examination Scheme					
			L	T	Pr.	WL/ wk in Hrs		Max. Marks		Total Marks	Min. Passing Marks		Duration (Hrs)
								CA	UA		Th	Pr.	
CC	CCGL101	Mineralogy and Crystallography	3	1	--	4	4	20	80	100	40	-	3
CC	CCGL102	Stratigraphy and Paleontology	3	1	--	4	4	20	80	100	40	-	3
CC	CCGL103	Structural Geology and tectonics	3	1	--	4	4	20	80	100	40	-	3
CC	CCGL104	Sedimentary Petrology	3	1	--	4	4	20	80	100	40	-	3
		Total	**12**	**4**	**--**	**16**	**16**	**80**	**320**	**400**	**160**	**-**	**12**

Practicals Papers based on theory papers of semester –I

Course Type	Course Code	Theory / Practical	Teaching Scheme (Hrs/ week)				Credits	Examination Scheme					
			L	T	Pr.	WL/ wk in Hrs		Max. Marks		Total Marks	Min. Passing Marks		Duration (Hrs)
								CA	UA		Th	Pr.	
CC	CCGL105 Practical. based on CCGL 101	Mineralogy and Crystallography	-	-	6	6	2	-	50	50	--	20	3
CC	CCGL106 Practical based on CCGL102	Stratigraphy and Paleontology	-	-	6	6	2	-	50	50	--	20	3
CC	CCGL107 Practical. based on CCGL103	Structural Geology and tectonics	-	-	6	6	2	-	50	50	--	20	3
CC	CCGL108 Practical based on CCGL104	Sedimentary Petrology	-	-	6	6	2	-	50	50	--	20	3
		Total	**--**	**--**	**24**	**24**	**08**	**--**	**200**	**200**	**--**	**80**	**12**

M.Sc. GEOLOGY I Year (Semester II)

Theory Papers

Course Type	Course Code	Theory / Practical	Teaching Scheme (Hrs/ week)				Credits	Examination Scheme					
			L	T	Pr.	WL/ wk in Hrs		Max. Marks		Total Marks	Min. Passing Marks		Duration (Hrs)
								CA	UA		Th	Pr.	
CC	CCGL201	Igneous Petrology	3	1	--	4	4	20	80	100	40	-	3
CC	CCGL202	Metamorphic Petrology	3	1	--	4	4	20	80	100	40	-	3
CC	CCGL203	Geochemistry	3	1	--	4	4	20	80	100	40	-	3
CC	CCGL204	Ore Geology and Instrumentation and Analytical Techniques	3	1	--	4	4	20	80	100	40	-	3
		Total	**12**	**4**	**--**	**16**	**16**	**80**	**320**	**400**	**160**	**-**	**12**

Practicals Papers based on theory papers of semester –II

Course Type	Course Code	Theory / Practical	Teaching Scheme (Hrs/ week)				Credits	Examination Scheme					
			L	T	Pr.	WL/ wk in Hrs		Max. Marks		Total Marks	Min. Passing Marks		Duration (Hrs)
								CA	UA		Th	Pr.	
CC	CC GL205 Practical based on CCGL 201	Igneous Petrology	--	--	6	6	2	-	50	50	--	20	3
CC	CC GL206 Practical based on CCGL 202	Metamorphic Petrology	--	--	6	6	2	-	50	50	--	20	3
CC	CC GL207 Practical based on CCGL 203	Geochemistry	--	--	6	6	2	-	50	50	--	20	3
CC	CC GL208 Practical based on CCGL 204	Ore Geology and Instrumentation and Analytical Techniques	--	--	6	6	2	-	50	50	--	20	3
		Total	**--**	**--**	**24**	**24**	**08**	**--**	**200**	**200**	**--**	**80**	**12**

M.Sc. GEOLOGY II Year (Semester III)

Theory Papers

Course Type	Course Code	Theory / Practical	Teaching Scheme (Hrs/ week)				Credits	Examination Scheme					
			L	T	Pr.	WL/ wk in Hrs		Max. Marks		Total Marks	Min. Passing Marks		Duration (Hrs)
								CA	UA		Th	Pr.	
CC	CCGL 301	Hydrogeology	3	1	--	4	4	20	80	100	40	-	3
CC	CCGL 302	Fuel Geology	3	1	--	4	4	20	80	100	40	-	3
CC	CCGL 303	Geo-exploration	3	1	--	4	4	20	80	100	40	-	3
EC	ECGL 304 or ECGL 305	Geomorphology, Remote Sensing and GIS Or Quaternary Geology and Applied Micropalaeontology	3	1	--	4	4	20	80	100	40	-	3
		Total	**12**	**4**	**--**	**16**	**16**	**80**	**320**	**400**	**160**	**-**	**12**

Practicals Papers based on theory papers of semester –III

Course Type	Course Code	Theory / Practical	Teaching Scheme (Hrs/ week)				Credits	Examination Scheme					
			L	T	Pr.	WL/ wk in Hrs		Max. Marks		Total Marks	Min. Passing Marks		Duration (Hrs)
								CA	UA		Th	Pr.	
CC	**CCGL 306** Practical based on CCGL301	Hydrogeology	-	-	6	6	2	-	50	50	--	20	3
CC	**CCGL 307** Practical based on CCGL302	Fuel Geology	-	-	6	6	2	-	50	50	--	20	3
CC	**CCGL 308** Practical based on CCGL 303	Geo-exploration	-	-	6	6	2	-	50	50	--	20	3
EC	**CCGL309** Practical based on ECGL 304 Or **CCGL310** Practical based on ECGL ECGL 305	Geomorphology, Remote Sensing and GIS Or Quaternary Geology and Applied Micropalaeontology	-	-	6	6	2	-	50	50	--	20	3
		Total	**--**	**--**	**24**	**24**	**08**	**--**	**200**	**200**	**--**	**80**	**12**

M.Sc. GEOLOGY II Year (Semester IV)

Theory Papers

Course Type	Course Code	Theory / Practical	Teaching Scheme (Hrs/ week)				Credits	Examination Scheme					
			L	T	Pr.	WL/ wk in Hrs		Max. Marks		Total Marks	Min. Passing Marks		Duration (Hrs)
								CA	UA		Th	Pr.	
Theory													
CC	CCGL 401	Environmental Geology	3	1	--	4	4	20	80	100	40	-	3
CC	CCGL 402	Engineering Geology	3	1	--	4	4	20	80	100	40	-	3
CC	CCGL 403	Mining Geology	3	1	--	4	4	20	80	100	40	-	3
EC	ECGL 404 Or ECGL 405	Statistical Geology and Computer applications in Geology and Research Methods Or Physics and Chemistry of Earth	3	1	--	4	4	20	80	100	40	-	3
		Total	**12**	**4**	**--**	**16**	**16**	**80**	**320**	**400**	**160**	**-**	**12**

Practicals Papers based on theory papers of semester –IV

Course Type	Course Code	Theory / Practical	Teaching Scheme (Hrs/ week)				Credits	Examination Scheme					
			L	T	Pr.	WL/ wk in Hrs		Max. Marks		Total Marks	Min. Passing Marks		Duration (Hrs)
								CA	UA		Th	Pr.	
CC	**CCGL 406** Practical based on CCGL 401	Environmental Geology	-	-	6	6	2	-	50	50	--	20	3
CC	**CCGL 407** Practical based on CCGL 402	Engineering Geology	-	-	6	6	2	-	50	50	--	20	3
CC	**CCGL 408** Practical based on CCGL 403	Mining Geology	-	-	6	6	2	-	50	50	--	20	3
EC	**CCGL 409** Practical based on ECGL 404 Or **CCGL 410** Practical based on ECGL 405	Statistical Geology and Computer applications in Geology and Research Methods Or Physics and Chemistry of Earth	-	-	6	6	2	-	50	50	--	20	3
		Total	**--**	**--**	**24**	**24**	**08**	**--**	**200**	**200**	**--**	**80**	**12**

SERVICE COURSE

Service Course Theory

(Students have to select any one service course)

Course Type	Course Code	Theory / Practical	Teaching Scheme (Hrs/ week)				Credits	Examination Scheme					
			L	T	Pr.	WL/ wk in Hrs		Max. Marks		Total Marks	Min. Passing Marks		Duration (Hrs)
								CA	UA		Th	Pr.	
SC (Inter/ Intra)	**SCGL 001**	Water and Land Resource Management	3	1	--	4	4	20	80	100	40	-	3
SC (Inter/ Intra)	**SCGL 002**	Natural Hazards and Disaster Management	3	1	-	4	4	20	80	100	40	-	3
Service Course Practical													
SC (Inter/ Intra)	**SCGL003** Practical based on SCGL001	Water and Land Resource Management	--	--	2	6	2	--	50	50	--	20	3
SC (Inter/ Intra)	**SCGL004** Practical based on SCGL002	Natural Hazards and Disaster Management	-	-	2	6	2	--	50	50	--	20	3

M.Sc. GEOLOGY I year (Semester I)

THEORY PAPER - CCGL101- MINERALOGY AND CRYSTALLOGRAPHY

UNIT I

Silicate structures of minerals; physical and chemical properties of minerals.

UNIT II

Structural formulae, classification, atomic structure, polymorphs/structural states, chemistry, substitution of elements/solid solution and experimental work on pressure-temperature stability of the minerals, modes of occurrence and alterations. of the following group of rock- forming minerals - olivine,humite, garnet, kyanite, pyroxene, amphibole, talc, mica, chlorite, feldspar, cordierite, kaolinite, serpentinite feldspathoids, alumino-silicate and metallic oxides.

UNIT III

Birefringence, pleochroism and interference phenomena in minerals; extinction angles; optical indicatrix; concept of uniaxial and biaxial indicatrix; dispersion in minerals; optical anomalies; and optical accessories like quartz, mica and gypsum plate.

UNIT- IV

Concept of symmetry; space lattice and point groups; 32 classes of symmetry.

UNIT –V

Goniometry, twinning and; X- rays and its application in crystallography

PRACTICAL PAPER CC GL105
BASED ON CCGL 101 –MINERALOGY AND CRYSTALLOGRAPHY

Study of rock- forming minerals in hand specimen; study of rock- forming minerals in thin sections; optical properties of uniaxial and biaxial minerals- pleochrism, extinction, interference colours and optical angle; calculation of chemical formula of minerals and its plotting; twin laws; anorthite content of plagioclases; 32 classes of crystal symmetry; method of plotting of poles by stereographic projections.

RECOMMENDED BOOKS

1. Dana:- Elements of Mineralogy
2. Deer, Howie and Zusmann:- Rock forming minerals
3. Kerr:- Optical mineralogy
4. Winchell:- Elements of Optical Mineralogy (Part I, II and III)
5. Wahlstrom:- Optical crystallography
6. Phillipes:- An introduction to crystallography
7. Barry and Mason:- Mineralogy
8. Klein and Hubert:-Manual of mineralogy
9. Spear, F. S.:-Mineralogical phase equilibrium and Pressure- Temperature- Time paths
10. Phillips, W. R. and Guffen, D. T. - Optical mineralogy

THEORY PAPER CCGL102-STRATIGRAPHY AND PALAEONTOLOGY

UNIT I

Approaches to measurements of Geological time. Concepts of Sequence stratigraphy; brief ideas of quantitative-, magneto-, seismic-, chemo- and event stratigraphy. Approaches to palaogeography. Stratigraphic correlations. stratigraphic code.

UNIT II

Precambrian stratigraphy ,Precambrian geochronology. Chronostratigraphy of the Precambrian of Dharwar Craton, Eastern Ghats Belt, Southern Granulite Belt and Singhbhum-Chhotanagpur-Orissa Belt. Proterozoic stratigraphy of Son Valley, Cuddapah-Kurnool and Chatisgarh basins. Precambrian-Cambrian boundary.

UNIT III

Stratigraphy and correlation of the Gondwana rocks; Mesozoics of Peninsular India; Cenozoic stratigraphy, Problems of Cretaceous- Eocene boundary of India; Tertiary rocks of India and their correlation; Quaternary stratigraphy of India; Neogene- Quaternary boundary problem. Cretaceous-Tertiary boundary. Palaeogene and Neogene systems, Epoch boundaries of the Cenozoic in India.Stratigraphy, facies, and fossil contents of the Palaeozoic rock formations of India. Palaeozoic of Himalayas Permian-Triassic boundary.

UNIT IV

Origin and evolution of fossils, Collection, preparation, preservation and maintenance of palaeontological record; microfossils; types of microfossils-foramenifera, calcareous, nanno , silicious, phospatic, organic walled , application of micropaleontology in ocean science, palynology and its application.

UNIT V

Modern Taxonomy, Identification of fossils, Describing a fossil specimen, Ontogenic variation. Classification of Brachiopoda, Bivalvia, Ammonoidea and Cindaria (corals); Evolutionary trends and Geological history of Brachiopoda, Bivalvia, Gastropoda, Ammonoidea, Trilobita, Echinoidea and Cnidaria (corals). Palaeoecology/Functional morphology of Bivalves and Brachiopods. Evolution of fishes, equade, elephant, dinosaur and man. Trace fossils: Kinds and classification; their significance in paleoenvironmental reconstruction

PRACTICAL PAPER CCGL106
BASED ON CCGL102 –STATIGRAPHY AND PALAEONTOLOGY

Exercises on stratigraphic classification and correlation; study of paleogeographic maps of all the geological periods; plotting of rock formations on maps; study of important genera of invertebrate, vertebrate and plant fossils; study of fossils in thin sections; study of microfossils.

RECOMMENDED BOOKS

1.Krishnan, M. S.: - Geology of India and Burma
2.Wadia, D.N.: - Geology of India
3.Ravindrakumar: - historical Geology
4.Dunbar and Rogers: - Principles of Stratigraphy
5.Krumbein and Sloss: - Stratigraphy and Sedimentation
6.Willey,M. J.: - Stratigraphic principles and practice
7.Naqui and Rodgers: - Precambrian Stratigraphy of India
8.Swinnerton:- Outlines of Paleontology

THEORY PAPER CCGL 103 - STRUCTURAL GEOLOGY AND TECTONICS

UNIT I

Mechanical principles and properties of rocks and their controlling factors; theory of rock failure; concept of stress and strain; two dimensional strain and stress analysis; types of stress and strain ellipses and ellipsoids, their properties and geological significance; strain marks in natural and tectonics deformed rocks.

UNIT II

Folds- Geometric classification of folds; mechanics of folding and buckling; folding in shear zones; distribution of strains in folds; structural analysis in terrain with multiple deformations.

UNIT III

Faults- Causes and dynamics of faulting; strike- slip faults; normal faults; overthrust and nappe

Fractures and joints- their nomenclature; age relationship; origin and significance, introduction to petrofabric analysis.

UNIT IV

Fundamental concepts of geotectonic; recent advances, pros and cons; dynamic evolution of continental and oceanic crust; tectonics of Precambrian orogenic belts of India; tectonic framework of India; seismicity in India

UNIT V

Formation of mountain roots; anatomy of the orogenic belts; structure and origin of the Alpine- Himalayan belt, Appalachian- Caledonian belt, Andes and North- American Cordillera.

PRACTICAL PAPER CCGL107
BASED ON CCGL 103 –STRUCTURAL GEOLOGY AND TECTONICS

Relation of structural- geology problems by orthographic and stereographic methods; completion of outcrops; drawing of structural sections and interpretation of geological maps; graphical solutions.

RECOMMENDED BOOKS:

1. Badgley, P.C. (1965): - Structure and Tectonics
2. Ramsay, S.G. (1967): - Folding and Fracturing of Rocks
3. Davis, G.R. (1984): - Structural Geology of Rocks and Region
4. Price, N.J. and Cosgrove, J.W. (1990): - Analysis of Geological Structures
5. Bayly, B.(1992): - Mechanics in Structural Geology
6. Moors, E. and Taiss, R.J. (1995) Tectonics
7. Keary, P and Vine, F.J. (1990); - Global Tectonics
8. Valdiya, K.S. (1998): - Dynamic Himalaya

THEORY PAPER CCGL104 - SEDIMENTARY PETROLOGY

UNIT I

Processes of transport and formation of sedimentary rocks; classification of sedimentary rocks; sedimentary textures and structures.

UNIT II

Sedimentary environments and facies; continental environments - alluvial, lacustrine, desert- aeolion and glacial sedimentary systems. Marginal marine environments – deltaic, beach and barrier- islands, estuarine and lagoonal, tidal –flat system

UNIT III

Grain size, Textural Parameters and their Significance. Textural and compositional maturity. Petrography and Digenesis origin of Sandstones, Limestones and Mudrocks. Evolution of sedimentary basins- tectonics and sedimentation

UNIT IV

Heavy Minerals and their Importance in Determination of Provenance. Deep sea basins; clastic petrofacies; palaeoclimate and palaeoenvironment analysis

UNIT V

Major diagenetic processes; diagenetic environments; Petrogenetic significance of textures and structures, Major Carbonate Minerals; Carbonate Grains of Biological origin.

PRACTICAL PAPER CCGL108
BASED ON CCGL104 – SEDIMENTARY PETROLOGY

Study of sedimentary rocks in hand specimen; study of sedimentary rocks in thin section; study of primary, grain-size analysis by sieving method: Plotting of size-distribution data as Frequency and Cumulative Curves; Computation of statistical parameters and interpretation. Heavy Mineral Separation, their microscopic characters, graphic representation and interpretation. Secondary and biogenic sedimentary structures in hand specimen; aerial photographs and field exercises related to paleocurrent data from different environments; exercises related to analysis and interpretation of depositional sedimentary environments; determination of porosity in clastic and carbonate rocks; staining and mineral identification in carbonate rocks; detailed study of diagenetic features in thin sections; preparation of thin section of sedimentary rocks.

RECOMMENDED BOOKS

1. Allen, J.R.L: -Principles of physical sedimentation
2. Nichols, G.: -Sedimentology and Stratigraphy
3. Reading, H.G.: -Sedimentary environments
4. Reineck, H.R. and Singh, I.B.:-Depositional sedimentary environments
5. Miall, A.D.: -Principles of sedimentary basin analysis
6. Eincele,G.:-Sedimentary basins
7. Pomerol, C.: -The Cenozoic Era: Tertiary and Quaternary
8. Tucker, M.: -Techniques in Sedimentology

SEMESTER II

THEORY PAPER CCGL 201 - IGNEOUS PETROLOGY

UNIT- I

Definition of Magma, constitution of magmas, generations of magmas; source rock composition upper mantle and lower crust; nature of magma and evolution of magma.

UNIT- II

Phase equilibrium of unicomponent, binary, ternary and quaternary silicate systems; its relation to magma genesis and crystallization in the light of modern experimental works.

UNIT- III

Criteria for classification of Igneous rocks; CIPW- norms, Niggli values, IUGS classification.

UNIT- IV

Petrology, geochemistry and genesis of major igneous rocks types of mafic ultramafic, alkaline rocks, ophiolites, carbonatites, lamprolite, kimberlite, pegmatites and lamprophyres;.

UNIT- V

Crystallization of basaltic and granitic magmas; mid oceanic ridge volcanism, continental flood basalts, Deccan basalt, basalt magmatism associated with subduction zone.

PRACTICAL PAPER CC GL205
BASED ONCCGL 201 IGNEOUS PETROLOGY

Study of igneous rocks in hand specimen; study of igneous rocks in thin sections; structures and textures in igneous rocks; calculation of CIPW norms and Niggli values; plotting of chemical data on different variation diagrams for evaluation of magma and rock types; field mapping in basaltic terrain; preparation of igneous rock slides.

RECOMMENDED BOOKS

1. Barth:- Theoretical Petrology
2. Bowen:- Evolution of Igneous Rocks
3. Turner and Verhoogan:- Igneous and Metamorphic Petrology
4. Carmicheal, Turner and Verhoogan:- Igneous Petrology
5. Hatch, Wells and Wells:- Petrology of Igneous rocks
6. Brain:- Igneous Petrology
7. Best:-Igneous Petrology
8. Mc Berney :-Igneous Petrology
9. Bose:-Igneous Petrology

THEORY PAPER CC GL 202 - METAMORPHIC PETROLOGY

UNIT I

Types of metamorphism; Depth zones, metamorphic grades; mineralogical phase rule of closed and open systems; application of phase rule.

UNIT II

Role of temperature, pressure and fluids in metamorphism; a detailed description of each facies of low pressure, medium to high pressure and very high pressure with special reference to characteristic metamorphic zones and subfacies;

UNIT III

Progressive, contact and regional metamorphism of quartzofelspathic, argillaceous and basic igneous rocks.

UNIT IV

Metamorphic differentiation, metasomatism; anatexis and origin of migmatites; regional metamorphism and pair metamorphic belts in reference to plate tectonics.

UNIT V

Ocean floor metamorphism, metamorphism related to ophiolites, metamorphism and continental collision petrogenetic significance of textures and structures

PRACTICAL PAPER CC GL206
BASED ONCCGL 202 METAMORPHIC PETROLOGY

Study of metamorphic rocks in hand specimen; study of metamorphic rocks in thin sections; structures and textures in metamorphic rocks; interpretation of reaction texture; plotting of chemical data on ACF, AKF and AFM diagrams; preparation of metamorphic rock slides.

RECOMMENDED BOOKS

1. Harkar:- Metamorphism
2. Turner:- metamorphic Petrology
3. Winkler:- Petrogenesis of metamorphic rocks
4. Miashiro:- Metamorphism and metamorphic rocks
5. Turner and Verhoogan:- Igneous and Metamorphic Petrology
6. Philipots:- Igneous and Metamorphic Petrology
7. Bucher and Feg:- Petrogenesis of metamorphic rocks

THEORY PAPER CC GL203 - GEOCHEMISTRY

UNIT I

Introduction of Geochemistry and Cosmochemistry. Chemical composition and properties of Earth's layers. Atmosphere: its layers, chemical composition and evolution of Atmosphere. Meteorites. Gold- Schmidt geochemical classification.

UNIT II

Isotope geochemistry; kinds of isotopes; Radiogenic isotopes. Decay scheme of K-Ar, U-Pb ,V-Pb, Sm- Nd and Rb-Sr; Radioactive dating of single minerals and whole rocks; Stable isotope geochemistry of Carbon and Oxygen and its application in Geology. Geochemistry of Uranium and Lithium.

UNIT III

Concept of enthalpy, free energy; chemical potential; fugacity,Structure and types of atoms. Internal structure of atoms, atomic weights. Types of chemical bonding. Ionic radii. Coordination number. Lattice energy. Ionization potential. Electronegativity. Pauling's rule. Isomorphism and polymorphism. Principles of ionic substitution in minerals.

UNIT IV

Eh and pH diagrams , limits of Eh and pH in nature;; oxidation and reduction in sedimentation.
Geochemical cycle; Minor cycle and Major cycle.Geochemical classification of elements. distribution of elements in igneous, metamorphic and sedimentary rocks. Periodic table with special reference to rare earth elements and transition elements.

UNIT V

Concept of geochemical- biogeochemical cycling and global climate;Hydrosphere: the hydrological cycle, composition of natural waters, some characteristics of river waters and ground water; Biosphere: Introduction: the mass of the biosphere: composition of the biosphere: biogenic deposits; geochemical cycle of carbon.

PRACTICAL PAPER CC GL207
BASED ON CCGL 203 GEOCHEMISTRY

Preparation and interpretation of geochemical maps; Rock/ sediments/ water/ soil analysis; Preparation of classificatory and variation diagrams, REE normalized plots and their interpretation

BOOKS RECOMMENDED

1.Mason, B.and Moore, and C.B.: - Introduction to Geochemistry
2.Faure, G.: -Principles of Isotope Geology
3.Hoefs, J.: -Stable Isotope Geochemistry
4.Marshal, C.P. and Fairbridge, R.W.: -Encyclopedia of Geochemistry
5.Govett, G. J.S.: -Handbook of Exploration Geochemistry
6.Kraustopf, K.B.: - Introduction to Geochemistry

THEORY PAPER CC GL204
ORE GEOLOGY, INSTRUMENTATION AND ANALYTICAL TECHNIQUES

UNIT I

Modern concept of ore genesis; spatial and temporal distribution of ore deposits- a global perspective; processes of formations of ore mineral deposits; ore deposits and plate tectonics; mode of occurrence of ore bodies- morphology and relation of host rocks; texture, paragenesis and zoning of ores and their significance; concept of ore- bearing fluids, their origin and migration; wall- rock alteration; structural, physiochemical and stratigraphic control of ore localization. Geothermometry and geobarometry of ore assemblage.

UNIT II

Chemical composition of ores- bulk chemistry, trace elements; REE and isotopes (stable and radiogenic); organic matter in ores and their significance; petrological ore associations with Indian examples wherever feasible: Orthomagmatic ores of mafic- ultramafic associations - diamond in kimberlite; REE in corbonatites; Ti- V ores; chromite and PGE; Ni ores; Cyprus type Cu- Zn ores of silicic igneous rocks- Kiruna type Fe- P; pegmatites; greisens; skarn. Ore of sedimentary affiliation- chemical and clastic sedimentation; stratiform and stratabound ores deposits(Mn, Fe, non- ferrous ores); places; ores of metamorphic affiliation- metamorphism of ores; ore related to weathering- laterite, bauxite, Ni/ Au laterite.

UNIT III

Study of following Indian ore deposits with reference to their mineralogy, mode of occurrence, origin, geological association and geographical distribution: iron, manganese, gold, aluminum, chromium, copper, lead, zinc, tin, tungsten, titanium, nickel, molybdenum; fuels: coal, petroleum and radioactive minerals, gemstones

UNIT IV

Sampling and sampling preparation; thin section and polished section making; dissolution procedures in geological and environmental samples; sample etching; staining and modal count techniques.

UNIT V

Principles and geological application of cathodeluminescence, thermoluminescence; atomic absorption spectroscopy; inductively coupled plasma- atomic emission spectrometry, x-ray fluorescence spectrometry, scanning and transmission electron microscopy; electron- probe microanalysis; x- ray diffractometry; thermal ionization and gas source mass spectrometry.

PRACTICAL PAPER CC GL208
BASED ONCCGL 204 -ORE GEOLOGY, INSTRUMENTATION AND ANALYTICAL TECHNIQUES

Megascopic study of structures and fabrics of different ores and their associations; mineralogical and textural studies of common ore minerals under petrological microscope and ore microscope; exercises on the determination of reflectivity and micro-hardness of common ore minerals; determination of elemental composition of minerals and rocks by flame photometer and atomic absorption spectrometer; preparation of thin sections and polished sections; etching and staining.

RECOMMENDED BOOKS

1. Craig and Vaughan (1981): - Ore Petrography and Mineralogy
2. Evans (1993): - Ore Geology and Industrial Minerals
3. Sawkins (1984): - Metal Deposits in Relation to Plate Tectonics
4. Klemm and Schneider (1977): - Time and Strata- bound Deposits
5. A.M. Evans (1987): - An introduction to ore geology
6. Park and Mac Diarmid (1975): - Ore deposits

SEMESTER III

THEORY PAPER CCGL 301 - HYDROGEOLOGY

UNIT I

Ground water, origin, types, importance, occurrence, reservoirs and movement; renewable and non- renewable groundwater resources; hydrologic properties of rocks: porosity; permeability; specific yield; specific retention, hydraulic conductivity, transmissivity, storage coefficient

UNIT II

Groundwater quality, estimation of parameters, groundwater quality map of India; hydrographs; water table contour maps; hydrostratigraphic units.

UNIT III

Well hydraulics: confined, unconfined, steady, unsteady and radial flow; water level fluctuations; causative factors and their measurements; methods of pumping test and analysis of text data; evaluation of aquifer parameters

UNIT IV

Methods of artificial groundwater recharge; method of rainwater harvesting, problem of over exploitation of groundwater; groundwater legislation; water management in rural and urban areas, salt water intrusion in coastal aquifers; remedial measures.

UNIT V

Surface and sub surface geophysical and geological methods of groundwater exploration; hydrogeomorphic mapping using various Remote Sensing techniques; radioisotopes in hydrogeological studies, concept of watershed management, ground water management technical and social aspects.

PRACTICAL PAPER CCGL 306
BASED ON CCGL301- HYDROLOGY

Delineation of hydrological balance on water – table contour maps and estimation of permeability; analysis of hydrographs; geophysical and geological methods of ground water exploration; pumping test; time draw down and time recovery tests and evaluation of aquifer parameters; step drawdown tests; estimation of TDS using resistivity and SP logs; electric resistivity sounding for delineation of fresh and saline aquifers.

BOOKS RECOMMENDED

1.Todd, D.K. (1980): -Groundwater Hydrology
2.Davies, S.N and De Wiest, R.J.M (1966): - Hydrogeology
3.Freeze, R.A. and Cherry, J.A. (1971): -Groundwater
4.Fetter, C.W. (1990): -Applied Hydrology
5.Raghunath, N.M. (1982): -Groundwater
6.Karanth, K.R. (1987): - Groundwater assessment, Development and Management
7.Alley, W.M. (1983): -Regional groundwater quality
8.Subramaniam, V.(2000) :-Water

THEORY PAPER CCGL 302 – FUEL GEOLOGY

UNIT I

Petroleum- its composition and different fractions; origin, nature and migration (primary and secondary) Of oil and gas; transformation of organic matter into kerogene; surface and subsurface occurrence of petroleum and gas.

UNIT II

Characteristics of reservoir rocks and traps (structural, stratigraphic and correlation); Prospecting for oil and gas, drilling and logging procedures; oil-bearing basins of India; geology of the productive oil fields of India; position of oil and natural gas in India; future prospects and the economic scenario.

UNIT III

Coal- Definition and origin of kerogen and coal; sedimentology of coal bearing strata; rank, grade and type of coal; Indian and International classifications of coal; macroscopic ingredients and microscopic constituents; concept of maceral and microlitho types.

UNIT IV

Chemical characterization: proximate and ultimate analysis; coal petrology and its application in solving industrial and geological problems; preparation of coal for industrial purposes; coal carbonization (coke manufacture) coal gasification and coal hydrogenation

Coal bed – methane: a new energy resource. Hydrocarbon evaluation.

UNIT V

Atomic fuel- Mode of occurrence and methods of prospecting and productive geological horizons in India; nuclear power stations of the country and future prospects; mud engineering, drilling fluid, gas sampling, mud logging , sample catching and its examination and interpretation

PRACTICAL PAPER CCGL 307
BASED ON CCGL 302 FUEL GEOLOGY

Megascopic characterization of banded coals; proximate analysis of coals; completion of outcrops in the given maps and calculation of coal reserves; microscopic examination of polished coal pellets (identification of macerals in coal)Megascopic and microscopic study of cores and well cuttings; study of geological maps and sections of important oilfields of India; calculation of reserves

BOOKS RECOMMENDED

1.Taylour, G.H., Teichmuiler, M., Davis, A., Diessel, C.F.K. and others: - Organic Petrology
2.Selley, R.C.: -Elements of Petroleum Geology
3.Chandra, D., Singh, R.M and Singh, M.P.: -Textbook of Coal
4.Singh, M.P.: - Coal and Organic Petrology
5.Stach, E, Macknowsty, M.T.H; Taylor, H.H and others: - Stach's Textbook of Coal Petrology
6.Durrance, E.M.: -Radioactivity in Geology: Principles and Applications

THEORY PAPER CCGL 303- GEO EXPLORATION

UNIT I

Variation of gravity over the surface of the earth; principles of gravimeters; gravity field surveys; various types of corrections applied to gravity data; preparation of gravity anomaly maps and their interpretation in terms of shape, size and depth.

UNIT II

Geomagnetic field of the earth; magnetic properties of rocks; working principles of magnetometers; field surveys and data reductions; quantitative interpretation; magnetic anomalies due to single pole, dipole; introduction to aeromagnetic surveys

UNIT III

Resistivity methods; basic principles; various types of electrode configurations; field procedure profiling and sounding.

UNIT IV

Seismic methods; fundamental principles of wave propagation; refraction and refraction surveys; concept of seismic channels and multy- channel recoding of seismic data; End- on and split spread shooting techniques; CDP method of data acquisition; sorting; gather; stacking and record section; seismic velocity and interpretation of seismic data

UNIT V

Application in mineral and petroleum exploration; description of bore- hole environment; brief outline of various well- logging techniques; principles of electrical logging and its application in petroleum; groundwater and mineral exploration; prospecting for radioactive minerals.

PRACTICAL PAPER CCGL 308
BASED ON CCGL 303-GEOEXPLORATION

Interpretation of geophysical logs for geological purpose; application of geophysical data in mineral exploration-gravity data, magnetic data, electrical data; utility of seismic reflection data in recognition of subsurface structures; interpretation of seismic data.

BOOKS RECOMMNDED

1.Sharma, P.V. (1986) : -Geophysical Methods in Geology
2.Dobrin, M.B. (1976) :-Introduction to Geophysical Prospecting
3.Paransis, D.S. (1975) : -Principles of Applied Geophysics
4.Stanislave, M. (1984) :-Introduction to Applied Geophysics
5. Rao, M.B.R. :-Outlines of Geophysical Prospecting Manual for Geologists

THEORY PAPER ECGL 304
GEOMORPHOLOGY, REMOTE SENSING AND GIS

UNIT I

Fundamental concepts of remote sensing; geneneral idea about electromagnetic spectrum; spectral bands, resolutions and reflectance curves; interaction of EMR with atmosphere, rocks, minerals and soils; aerial photographs and their geometry; recognition of photo-elements; recent advancement and application

UNIT II

Satellite remote sensing; global and Indian space missions; different satellite exploration programs and their characteristics: LANDSAT, METEOSAT, SEASAT, SPOT and IRS; visual interpretation of satellite images; computer application in Remote sensing.

UNIT III

Imageries and IRS products; use of remote sensing in groundwater exploration, petroleum exploration, engineering geology; use of satellite images in monitoring natural hazards and environment.

UNIT IV

Dynamics of geomorphology; geomorphic processes and resulting landform geomorphic features of Maharashtra and geomorphology of Indian sub continents;

UNIT V

Geomorphological mapping based on genesis of landforms; morphometric analysis and modeling terrain evaluation for strategic purpose; principles and applications of Geographic Information System.

PRACTICAL PAPER CCGL 309
BASED ON CCGL304 -GEOMORPHOLOGY, REMOTE SENSING AND GIS

Study and nature of aerial photographs resolution, mosaics, symbols, gully, pattern and drainage analysis, image parallax; determination of scale, height, dip, slope, vertical exaggeration and image distortion; detailed study of imageries.

RECOMMENDED BOOKS

1. Miller (1961): - - Photogeology
2. Sabbins (1985): - Remote Sensing- Principles and Applications
3. Ray (1969): - Aerial Photographs in Geological Interpretations
4. Drury (1987): - Image Interpretation in Geology
5. Moffitt and Mikhail (1980): - Photogrammetry
6. Lillesand and Kieffer (1987): - Remote Sensing and Image Interpretation
7. PandeyS.N. (1987) Principles and Application of Photogeology
8. Gupta (1990): - Remote Sensing Geology
9. Thornbury: - Principles in Geomorphology
10. Summerfield (2000): - Geomorphology and Global Tectonics

THEORY PAPER ECGL 305
QUATERNARY GEOLOGY AND MICROPALAEONTOLOGY

Quaternary Geology:

UNIT I

Quaternary as chronostratigraphic unit, Standard sub-divisions of the Quaternary period and their climatic significance, standard global stratotype sections, Plio-Pleistocene boundary. The concept of local, regional and global climatic changes, the long term and abrupt changes during Quaternary with special emphasis to tropical-Subtropical climate.

UNIT II

An overview of the processes and mechanism of the Quaternary sedimentation over Indian sub-continent in relation to its climatic and/or tectonic controls. Stratigraphic relations of the Quaternary deposits in India with special emphasis on its regional and global correlations. Climate adaptability and extinction of species during Quaternary period. Quaternary Geochronology and Stratigraphic Correlation methods.

Micropaleontology:

UNIT III

Sea floor morphology and life Introduction, History of development of micropaleontology, classification of living organisms, Collection of samples, Sample preparation for microscopic study. Laboratory studies thin sections, faunal slides, sorting and picking of microfossils. Identification of microfossils using light microscope; SEM microphotography.

UNIT IV

Introduction of microfossils; Preparation of samples and study techniques; morphology, classification, ecology of:- foraminifera-, diatoms, ostracoda, calcareous nannofossils, Conodonts; and their geological distribution and applications with respect to India and world

UNIT IV

Organic Walled Microfossils: Introduction. Acritarchs and Chitinozoa; Dinoflagellates; Spores and Pollens.

Calcareous algae (Rhodophyta and Chlorophyta): Broad classification, morphology and internal structure; significance of calcareous algae.

PRACTICAL PAPER CCGL 310

BASED ON ECGL 305-QUATERNARY GEOLOGY AND MICROPALAEONTOLOGY

Study of quaternary sediments , Preparation of Qutaternary geological maps; Calculation of ages using luminescence dating, Pb_{210}, tree rings etc. Clay mineralogy from XRD data and its relation to weathering pattern. Environmental Magnetism practicals. Multiparametric inferences using proxy climatic parameters

Techniques of separation of microfossils from matrix; Study of morphological characters of various benthic and planktic fossils like -Foraminifera, Ostracoda, Diatoms, Calcareous Algae; Preparation of oriented sections of larger benthic foraminifera, nannofossils, radiolaria and diatoms. Exercises on Biostratigraphy and interpretations. Study of microfossil assemblages from various geological formations and interpretation of environment, geological age. Scanning Electron Microscope (SEM) applications in Micropaleontology.

RECOMMENDED BOOKS:

1. Alastair G. Dawson- Ice Age Earth: Late Quaternary Geology and Climate (Physical Environment)
2. Bell, M. & Walker, M.J.C.1992. Late Quaternary Environmental Change; Physical and human perspective. Longman Scientific and Technical, New York.

3. Geological Society of India: Quaternary of India
4. Krishnan, M. S. : Geology of India
5. Lowe, J.J. & Walker, M.J.C., 1997: Reconstructing Quaternary Environments Longman. ISBN 0-582-100166-2. Pp. 1-16, 148-373.
6. Ruddiman: "Earth"s Climate, Past and Future"
7. Wadia: Geology of India and Burma
8. Research articles on each of the above issues available in: Journals related to Quaternary

9. Agashe, Shripad N. (1995) Paleobotany, Oxford and IBH Publ., New Delhi. Stewart,
10. Armstrong, H. and Brasier, M.D., 2005. Microfossils. Blackwell Publishing.
11.Arnold (2002) Quaternary Environmental Micropaleontology (Ed. Simon K. Haslett), Oxford University Press, New York.
12. Bergland, B.E. (1986) Handbook of Holocene paleoecology and paleohydrology, John Wiley, 13. Bignot, G., 1985. Elements of Micropaleontology. Graham and Trotman.
14. Glaessner, M.F., 1945. Principles of Micropaleontology. Hafner Publishing Company.
15. Haq, B.U. and Boersma, A., 1998. Introduction to Marine Micropaleontology. Elsevier.
16. Jones, D.J., 1969. Introduction to Microfossils. Hafner Publishing Company, New York.
17. Jones, R.W., 1996. Micropaleontology in Petroleum Exploration. Oxford.
18. Kathal, P.K., 1997. Microfossils and their applications. CBS Publishers and Distributors.
19. Martin, R.E. 2000. Environmental Micropaleontology. Springer.
20.Wray, J.L. (1977) Calcareous Algae, Elsevier. London.

SEMESTER – IV

THEORY PAPER CCGL 401- ENVIRONMENTAL GEOLOGY

UNIT I

Introduction, Environmental dilemmas, fundamental concepts of environmental geology. Environmental protection – legislative measures in India

UNIT II

Chemistry of green house gases, emission of Co2, consequences of green house gases, control and remedial measures, global warming a serious threat, global warming caused by CO_2 increase in present atmosphere due to indiscrete exploitation of fossil fuels

UNIT III

The concept of earth system cycles in earth system- The energy cycle (energy inputs, solar radiations, geothermal energy, tidal –energy). The rock cycles (heat transfer in earth, plate tectonics and earth's external structure).

UNIT IV

Assessing geological hazards and risks, types of hazards earth quakes, volcanic eruptions, floods, subsidence, landslides, hazards of oceans and weather- preventive and precautionary measures. Environmental impacts of mining, surface blasting etc. Impact assessment of mining; dumping of ores; mine waste and fly ash

UNITV

Impact assessment of degradation and contamination of surface water and groundwater quality due to industrialization and urbanization; organic and inorganic contamination of groundwater and its remedial measures; water logging problems. Soil profiles and soil quality degradation

PRACTICAL PAPER CCGL 406
BASED ON CCGL 401- ENVIRONMENTAL GEOLOGY

Study of seismic and flood prone in India; hydrochemistry analysis surface water and subsurface water; classification of groundwater for use in drinking, irrigation and industrial purposes; presentation of chemical analysis; data and plotting; chemical classification diagram; evaluation of environmental impact of air pollution and groundwater pollution; deforestation; landslides.

BOOKS RECOMMNDED

1.Keller, E.A.:- Environmental Geology
2.Buyant, E.: -Natural Hazards
3.Valdiya, K.S.: -Environmental Geology- Indian Context
4.Patwarrdhan, A.M.: -The Dynamic Earth System
5.Bell, F.G.: -Geological Hazards
6.Smith, K.: -Environmental Hazards
7.Subramaniam, V.: -Textbook in Environmental Hazards
8.Tank, R.W.: -Focus on Environmental Hazards
9.Strahler and Strahler: -Environmental Geology
10.Truk and Truk: -Environmental Geology

THEORY PAPER CCGL 402- ENGINEERING GEOLOGY

UNIT I

Role of engineering geology in civil construction; engineering properties of rocks and soils; rock discontinuities; building stones; metal and concrete aggregates as construction material; use of aerial photography, groundwater investigation; subsurface exploration

UNIT II

Geological consideration for evaluation of dams and reservoirs sites; classification of dams; dam foundation problems; reservoir problems

UNIT III

Geotechnical evaluation of tunnels; classification of tunnels; methods of tunneling and tunnel design; support in tunneling; roads, bridges and bridge foundation; airfields, highways.

UNIT IV

Mass movements; landslides; stability of slopes; causes of slides; creep movement; earth flow and subsidence - precautionary measures and mitigations of hazards.

UNIT V

Earthquake and seismicity; seismic zones of India; aseismic design of building; engineering problems related to precautionary measures and mitigations of hazards; beach engineering.

PRACTICAL PAPER CCGL 407
BASED ON CCGL 402-ENGINEERING GEOLOGY

Suitable dam sites, selection for sites of tunnels; seismic zones in India; compressional strength, tensile strength of rock and building materials; hardness test; roughness test; magnetic, seismic and electrical resistivity methods of exploration as applied to engineering investigations; interpretation of drilling data for engineering construction.

BOOKS RECOMMENDED

1.Krynine and Judd: - Principles of Engineering Geology
2.Richeny, J.E.: - Elements of Engineering Geology
3.Lagget: - Geology and Engineering
4.Trefethen, Joseph- Geology of Engineers
5.Gupte, R: -Textbook of Engineering Geology

THEORY PAPER CCGL 403 MINING GEOLOGY

UNIT I

Intersecting loci and ring targets; guides to ore localization.

UNIT II

Subsidence and the support of mine excavation; timber treatment; methods of breaking rocks; drilling blast holes; explosives used in mining; blasting practices; shaft sinking; mine drainage; ventilation; illumination

UNIT III

Alluvial, open- pit and underground mining methods; drifting; cross cutting; winzing; stoping; room and pillaring; top –slicing; sub- level caving and block caving; ocean bottom mininig, mine organization and operation; mine hazards.

UNIT IV

Factors in evaluating a mineral deposit; mine examination; theory and methods of sampling; sampling calculations; recoverable values

UNIT V

Cost of mining; future costs and profits; life of mine; present value of mine and its determination by compound interest and Hoskold formula methods; amortisation; calculations pertaining to valuation of mines of uniform and non uniform annual income; sale of mineral products; metal prices and mine valuation; valuation of prospects: developed mines and working mines; valuation report.

PRACTICAL PAPER CCGL 408
BASED ON CCGL 403- MINING GEOLOGY

Determination and evaluation of ores in mines; different sampling calculations; recoverable values; cost of mining; future cost and profits; life of mine; determination of present value of mines; cross section of mines with the help of available data.

BOOKS RECOMMENDED

1.Young, G.J.: - Elements of Mining
2.Lewis, R.A. and Clark, G.A. :- Elements of Mining
3.Arogyaswami : - Mining Geology
4.Mckinstry, H.E.: - Mining Geology
5.Sheryanthov, L.: - Mining of Mineral deposits

THEORY PAPER ECGL 404- STATISTICAL GEOLOGY AND COMPUTER APPLICATIONS IN GEOLOGY AND RESEARCH METHODS

Statistical Geology

UNIT I

Statistical methods; mean; median and mode; standard deviation; skewness and kurtosis and their interrelationship; scatter diagrams; frequency distribution; histogram; coefficient of correlation and regression

UNIT II

Nature of geological data; scales of measurement; concepts and types of models in geology; sample population; population distribution and population density function and their properties

UNIT III

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

Computer Applications in Geology

UNIT IV

Information systems; general – purpose applications; input- output devices; operating systems; memory; microprocessor; ports; utilities; secondary storage. Browsers; connectivity- communications; internet and intranet; web utilities; application to petrological and geochemical problems; use of standard software analysis and interpretation of geological data; writing of simple programs to apply some elementary statistical techniques to geological data; GIS

Research Methodology

UNIT V

Research institutes, research schemes (minor and major), preparation of research scheme proposals, formats, funding agencies, scientific writing: research article, dissertation, review, abstract, synopsis, technical report. Literature search; analysis of scientific report, compilation of data, presentation and interpretation of experimental data, tables, graphs, histograms, field and laboratory photographs, and line drawings.

PRACTICAL PAPER CCGL 409
BASED ON ECGL404-
STATISTICAL GEOLOGY AND COMPUTER APPLICATIONS IN GEOLOGY AND RESEARCH METHODS

Interpretation of histograms, cumulative curves, scatter diagrams; problems on the student, 't' test, chi square test. mean; median and mode; standard deviation; skewness and kurtosis and their interrelationship. Application of computer to petrological and geochemical problems

BOOKS RECOMMENDED

1.J.C.Davis: - Statistics and data analysis in Geology
2.B.L.Raktoe and J.J. Hubert: - Basic applied Statistics
3.P.Mukhopadhya: - Mathematical Statistics
4.H.E. Klugh: - Statistics- the essential for research
5.E.B. Mode: - Elements of statistics

THEORY PAPER ECGL 405 PHYSICS AND CHEMISTRY OF EARTH

Unit I

Density distribution, Density vs. depth profile. The Earth's figure and Gravity, Gravity anomalies, Geoid and their interpretation.

UNIT II

Introduction to Geodesy, Geodetic Datum and Co-ordinate Systems. Application of Global Positioning System in crustal deformation studies.Seismology and interior of the Earth. Elastic Rebound Theory. Seismic waves and their propagation. Travel-time Tables and Velocity-depth Curves. Seismic waves and Internal Structure of the Earth. Concept of Seismic Tomography. Study of Seismograms

UNIT III

Heat-flow measurements.Temperatures in the Primitive Earth and Core of the Earth.Heat-flow and Radioactivity, The thermal history of the Earth.Composition and evolution of the crust, mantle and core, Geoelectricity.Introduction to Rock Mechanics.Geomagnetism and palaeomagnetism. Introduction to Geomagnetism and Magnetic Field of the Earth. Physics of Magnetism and Rock Magnetism. Palaeomagnetism-Principles, methods and applications. Rock Magnetic Applications in Geosciences. Magnetic Survey

UNIT IV

Origin and components of solar system.Galaxies their classification, Stars and star formation processes. Meteorites and their classification. Theories of origin of solar system. Abundance of elements. Nucleosynthesis and stellar evolution. Orbital dynamics of earth-moon system.

UNIT V

Geochemistry of hydrosphere and atmosphere. Law of Radioactivity. Principles of isotopic dating, decay schemes. Derivation of equation age. Rb/Sr, U-Rh-Pb methods of dating the rocks. Age of the earth. Geochemical classification and distribution of elements in the earth. Structure and atomic properties of elements. The periodic table. Laws of Thermodynamics and phase diagram.

PRACTICAL PAPER CCGL 410
BASED ON ECGL405-PHYSICS AND CHEMISTRY OF EARTH

1. Rapid analyses of rocks for determination of major oxides by volumetric/ gravimetric/colorimetric methods.
2. Introduction to the use of instrumental techniques of analyses of rocks, soils & water.
    a. Spectrophotometry
    b. Flame photometry
    c. Atomic Absorption Spectrophotometry
    d. High Performance Ion Chromatography
3. Plotting of chemical data on variation diagrams.
4. Problems related to seismic, geomagnetic, gravity data & its interpretation.
5. Problems related to use of isotopic methods & determinations of age of the rocks.

SERVICE COURSE

Service Course -SCGL 001 (Inter/ Intra)
WATER AND LAND RESOURCE MANAGEMENT

UNIT I

Watershed - concept - classification - characteristics importance of water resources in watershed problems of India - Approaches to soil and water conservation.

UNIT II

Water balance equation for watershed, sustainability of water resources, conjunctive use of surface and groundwater, significance of geology in watershed, surface and groundwater quality.

UNIT III

Soil erosion, types of soil erosion, controlling soil erosion, soil conservation practices, vegetative practices, mechanical practices, soil quality.

UNIT IV

Need for water conservation, water conservation measures , water harvesting, principle and techniques, salient features of development measures like contour bunding, gully plugs, stream bunds, percolation tank, subsurface dams, Afforestation etc.

UNIT V

Concept of watershed management in relation to water resources, role of NGO and State Government in watershed management, concepts of peoples' participation in community base watershed management.

PRACTICAL PAPER SCGL 003
BASED ON SCGL 001 - WATER AND LAND RESOURCE MANAGEMENT

Salient points for the construction of contour bunds, stream bunds, percolation tank subsurface dams, etc. ;Use of morphometric analysis in planning watershed development; Calculation of water balance for a watershed;Soil Quality Determination; Surface and Groundwater Quality determination.

RECOMMENDED BOOKS:

1. R. Suresh -Soil and Water Conservation Engineering
2. Ghanshyam Das -Hydrology and Soil conservation Engineering.
3. E.M. Tideman- Watershed Management - Guideline for Indian Conditions Scientific.
4. Dhruva Narayanan V.V. Sastry, G. and Patanaik-Watershed management
5. Gurumel Sing, venkataraman, C. Sastry, G., Joshi - Manual of soil and water conservation practices.
6. Panda S C-Principles and practices of water management.
7. Shashidhar, K.C., -Watershed management
8. Suresh Lal- watershed development management and technology,
9. Watt K. E. F., - Principles of Soil Science.

Service Course - SC GL002 (Inter/ Intra)
NATURAL HAZARDS AND DISASTER MANAGEMENT

Unit-I
Concepts related to physical system and human interference: Types and genesis of natural disasters; Remedial measures for preventing and minimizing disasters; Hazard zonation maps: preparation and utilization, Contribution of Remote Sensing and GIS.

Unit-II
Seismic Waves-earthquake and faults Measures of an earthquake, Magnitude and intensity earthquake occurrence in the World and India; causes of earthquake, plate tectonics, earthquake mechanism, seismic zoning map of India & its use, earthquake effects and mitigating measures.

Unit-III
Landslide occurrence in the world and India, causes and types of landslide and effects Mitigating measures, awareness and risk reduction

Unit-IV
Floods occurrence in the world and India; causes and types of landslide and effects. Mitigating measures, awareness and risk reduction.

Unit-V
Mitigation strategy : Preparedness community based disaster Management, emergency response, Relief measures, community health, casualty management; Role of Government, Non Governmental and media agencies; Reconstruction and Rehabilitation; Awareness through print and electronic media, involving youth in field observations.

PRACTICAL PAPER SCGL 004
BASED ON SCGL 002- Natural Hazards and Disaster Management

Worldwide distribution of disasters; Mapping of disaster-prone zones with the use of toposheets/ remote sensing tools; Preparing questionnaires, getting feedback, analyzing and interpreting the data about impact / socio-economic aspects etc

BOOKS RECOMMENDED

Enger Smith, Smith, W. M. C. Brown- Environmental Science
Turk & Turk- Introduction to Environmental Studies
G. S. Dahliwal, G. S. Sangha, P. K. Ralhan, Kalyani -Fundamentals of Environmental Science
Pardeep Sahni, Madhavi malalgoda and ariyabandu, -Disaster risk reduction in South Asia
Amita Sinvhal-Understanding Earthquake Disasters
Pardeep Sahni, Alka Dhameja and Uma Medury - Disaster Mitigation: Experiences and reflections