DEPARTMENT OF GEOLOGY

ANNA UNIVERSITY, CHENNAI

VISION

- To lead in providing quality education and research programmes in Geology and to motivate our students to be responsible scientists and engineers in the society

MISSION

- To provide quality education and research in various fields of Geology
- To provide human resources to the state and country in the field Geology.
- To bring in technologies to understand and manage the Earth and its resources for the future.
- To improve innovative thinking and entrepreneurship skills in cutting-edge technology for Geological Engineering.

PROGRESS THROUGH KNOWLEDGE

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

M. Sc. APPLIED GEOLOGY (2 YEARS)

REGULATIONS 2023

CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1	Imparting geological knowledge and skills to gain employment in Industry, Science and research organizations and service sectors.
PEO2	Produce quality manpower in geology that can elevate and lead the organization effectively
PEO3	Enable the students to understand and bring solutions to societal problems related to Geology.
PEO4	Motivate students to pursue higher studies and research in Geology
PEO5	Create an environment to auger entrepreneurial skills that will innovate and market geology related products.

2. PROGRAMME OUTCOMES (POs):

After going through the two years of study, our Master of Science in Applied Geology graduates will exhibit the ability to:

PO #	Graduate Attribute	Programme Outcome
PO1	Conceptualize/develop solutions	Conceive and develop solutions to societal problems related to geological processes and to understand their origin and nature.
PO2	Modern tool usage	Apply various mapping tools and techniques, usage of geological, geophysical and geochemical equipment to improve the understanding of the earth system science.
PO3	Problem analysis	Identify, formulate and solve Geological and technical problems.
PO4	Environment and sustainability	Develop policies with environment consciousness that can provide sustainable development.
PO5	Ethics	Interact in industry, business and society in a professional and ethical manner.
PO6	Life-long learning	Continue professional development and learning as a life-long activity.

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3. **PEO / PO Mapping:**

PROGRAMME EDUCATIONAL OBJECTIVES	PO1	PO2	PO3	PO4	PO5	PO6
I	3	-	3	2	-	-
II	2	3	-	-	3	-
III	3	3	3	3	-	-
IV	1	2	-	1	-	3
V	3	-	2	3	1	1
Avg.	**2.4**	**2.7**	**2.7**	**2.3**	**2.0**	**2.0**

4. Mapping of Course Outcome and Programme Outcome

		COURSES	PO1	PO 2	PO3	PO4	PO5	PO6
YEAR 1	SEM 1	Physical Geology and Geomorphology	2.7	2.8	2.8	2.8	1.5	1.6
		Advanced Mineralogy and Crystallography	3	2.8	2.8	2	1.4	1.6
		Stratigraphy and Palaeontology	2.3	2.6	2.8	2.4	1.0	1.0
		Structural Geology and Geotectonics	2.8	2.8	3.0	2.6	1.5	1.5
		Applied Geochemistry	2.6	3	3	2	1.4	1.4
		Applied Mathematics For Geologists	2.5	2.5	2.8	2.4	1.5	1.7
		Mineralogy Lab	2.3	2.6	2.8	2.4	1.0	1.0
		Structural Geology and Geological Mapping Techniques	2.3	2.6	2.8	2.4	1.0	1.0
		Plane and Geodetic Surveying Lab	2.3	2.6	2.8	2.4	1.0	1.0
	SEM 2	Igneous and Metamorphic Petrology	2.8	2.6	1.6	2.4	1.0	1.0
		Sedimentology and Sedimentary Petrology	2.8	2.6	1.6	2.4	1.0	1.0
		Exploration Geophysics and Field Techniques	2.3	2.6	2.8	2.4	1.0	1.0
		Fuel Geology	2.8	2.6	1.6	2.4	1.0	1.0
		Professional Elective I (One From List Of Electives)	3	2	2	3	1	1
		Applied Geochemistry Lab	2.3	2.6	2.8	2.4	1.0	1.0
		Petrology Lab	3	2	2	3	1	1
		Fieldwork Report and Seminar	2.5	2.2	3.0	1.6	1.3	1.2
YEAR 2	SEM 3	Economic Geology	2.3	2.6	2.8	2.4	1.0	1.0
		Engineering Geology	2.8	2.8	3.0	2.6	1.5	1.5
		Hydrogeology	2.3	2.6	2.8	2.4	1.0	1.0
		Geospatial Technology and its Applications	2.3	2.6	2.8	2.4	1.0	1.0
		Professional Elective II (One From List Of Electives)	3	2	2	3	1	1
		Professional Elective III (One From List Of Electives)	3	2	2	3	1	1
		Hydrogeology Lab	2.3	2.6	2.8	2.4	1.0	1.0
		Geological Field Training/ Institutional/Internship Training	2.5	2.2	3.0	1.6	1.3	1.2
	SEM 4	Mining Geology	2.8	2.8	3.0	2.6	1.5	1.5
		Professional Elective IV (One From List Of Electives)	3	2	2	3	1	1
		Project Work	2.5	2.2	3.0	1.6	1.3	1.2

ELECTIVES	Applied Hydrogeochemistry	3	2	2	3	1	1
	Natural Disaster and Mitigations	3	2	2	3	1	1
	Environmental Geology	3	2	2	3	1	1
	Geoprospecting	3	2	2	3	1	1
	Geosciences in Natural Hazards Management	3	2	2	3	1	1
	Groundwater Contamination	3	2	2	3	1	1
	Industrial Geology	3	2	2	3	1	1
	Applied Micropaleontology	3	2	2	3	1	1
	Medical Geology	3	2	2	3	1	1
	Mineral Evaluation and Management	3	2	2	3	1	1
	Nuclear Isotope Geology	3	2	2	3	1	1
	Oil Exploration and Production	3	2	2	3	1	1
	Ore Geology and Mineral Technology	3	2	2	3	1	1
	Planetary Geology	3	2	2	3	1	1
	Quaternary Geology	3	2	2	3	1	1
	Sequence Stratigraphy	3	2	2	3	1	1
	Soil Mechanics	3	2	2	3	1	1
	Data Science and Analytics	3	2	2	3	1	1
	Geostatistics	3	2	2	3	1	1

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

M.Sc. APPLIED GEOLOGY (TWO YEARS)

REGULATIONS 2023

CHOISE-BASED CREDIT SYSTEM

CURRICULA AND SYLLABI

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AG3101	Physical Geology and Geomorphology	PCC	3	0	0	3	3
2.	AG3102	Advanced Mineralogy and Crystallography	PCC	3	0	0	3	3
3.	AG3103	Stratigraphy and Palaeontology	PCC	3	0	2	5	4
4.	AG3104	Structural Geology and Geotectonics	PCC	3	0	0	3	3
5.	AG3105	Applied Geochemistry	PCC	3	0	0	3	3
6.	MA3101	Applied Mathematics for Geologists	FC	4	0	0	4	4
PRACTICAL								
7.	AG3111	Mineralogy Lab	PCC	0	0	2	2	1
8.	AG3112	Structural Geology and Geological Mapping Techniques	PCC	0	0	2	2	1
9.	RG3111	Plane and Geodetic Surveying Lab	PCC	0	0	4	4	2
			TOTAL	**19**	**0**	**10**	**29**	**24**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AG3201	Igneous and Metamorphic Petrology	PCC	3	0	0	3	3
2.	AG3202	Sedimentology and Sedimentary Petrology	PCC	3	0	0	3	3
3.	AG3203	Exploration Geophysics and Field Techniques	PCC	3	0	2	5	4
4.	AG3204	Fuel Geology	PCC	3	0	0	3	3
5.		Professional Elective-I	PEC	3	0	0	3	3
PRACTICAL								
6.	CY3211	Applied Geochemistry Lab	PCC	0	0	4	4	2
7.	AG3211	Petrology Lab	PCC	0	0	4	4	2
8.	AG3212	Fieldwork Report and Seminar	EEC	0	0	2	2	1
			TOTAL	**15**	**0**	**12**	**27**	**21**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AG3301	Economic Geology	PCC	3	0	0	3	3
2.	AG3302	Engineering Geology	PCC	3	0	0	3	3
3.	AG3303	Hydrogeology	PCC	3	0	0	3	3
4.	AG3304	Geospatial technology and its applications	PCC	3	0	2	5	4
5.		Professional Elective-II	PEC	3	0	0	3	3
6.		Professional Elective-III	PEC	3	0	0	3	3
PRACTICAL								
7.	AG3311	Hydrogeology Lab	PCC	0	0	4	4	2
8.	AG3312	Geological Field Training/ Institutional/Internship Training	EEC	0	0	2	2	1
			TOTAL	**18**	**0**	**8**	**26**	**22**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AG3401	Mining Geology	PCC	3	0	0	3	3
2.		Professional Elective-IV	PEC	3	0	0	3	3
PRACTICAL								
3.	AG3411	Project work	EEC	0	0	24	24	12
			TOTAL	**6**	**0**	**24**	**30**	**18**

TOTAL NO. OF CREDITS: 85

PROFESSIONAL CORE COURSES (PCC)

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	AG3101	Physical Geology and Geomorphology	3	0	0	3	I
2.	AG3102	Applied Mineralogy and Crystallography	3	0	0	3	I
3.	AG3103	Stratigraphy and Palaeontology	3	0	2	4	I
4.	AG3104	Structural Geology and Geotectonics	3	0	0	3	I
5.	AG3105	Applied Geochemistry	3	0	0	3	I
6.	AG3111	Mineralogy Laboratory	0	0	2	1	I
7.	AG3112	Structural Geology and Geological Mapping Techniques	0	0	2	1	I
8.	RG3111	Plane and Geodetic Surveying Lab	0	0	4	2	I
9.	AG3201	Igneous and Metamorphic Petrology	3	0	0	3	II
10.	AG3202	Sedimentology and Sedimentary Petrology	3	0	0	3	II
11.	AG3203	Exploration Geophysics and Field Techniques	3	0	2	4	II
12.	AG3204	Fuel Geology	3	0	0	3	II
13.	CY3211	Applied Geochemistry Laboratory	0	0	4	2	II
14.	AG3211	Petrology Laboratory	0	0	4	2	II

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15.	AG3301	Economic Geology	3	0	0	3	III
16.	AG3302	Engineering Geology	3	0	0	3	III
17.	AG3303	Hydrogeology	3	0	0	3	III
18.	AG3304	Geospatial Technology and its Applications	3	0	2	4	III
19.	AG3311	Hydrogeology Laboratory	0	0	4	2	III
20.	AG3401	Mining Geology	3	0	0	3	IV
					TOTAL CREDITS	**55**	

PROFESSIONAL ELECTIVE COURSES (PEC)

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			Lecture	Tutorial	Practical	
1.	AG3001	Applied Hydrogeochemistry	3	0	0	3
2.	AG3002	Natural Disaster and Mitigations	3	0	0	3
3.	AG3003	Environmental Geology	3	0	0	3
4.	AG3004	Geoprospecting	3	0	0	3
5.	AG3005	Groundwater Contamination	3	0	0	3
6.	AG3006	Industrial and Economic ores	3	0	0	3
7.	AG3007	Applied Micropaleontology	3	0	0	3
8.	AG3008	Medical Geology	3	0	0	3
9.	AG3009	Marine Geology	3	0	0	3
10.	AG3010	Mineral Evaluation and Management	3	0	0	3
11.	AG3011	Nuclear Isotope Geology	3	0	0	3
12.	AG3012	Oil Exploration and Production	3	0	0	3
13.	AG3013	Ore Geology and Mineral Technology	3	0	0	3
14.	AG3014	Planetary Geology	3	0	0	3
15.	AG3015	Quaternary Geology	3	0	0	3
16.	AG3016	Sequence Stratigraphy	3	0	0	3
17.	AG3017	Geostatistics	3	0	0	3
18.	SF3015	Soil Mechanics	3	0	0	3
19.	MA3001	Data Science and Analytics	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1	AG3212	Fieldwork Report and Seminar	0	0	2	1	II
2	AG3312	Geological Field Training/ Institutional/Internship Training	0	0	2	1	III
3	AG3411	Project Work	0	0	24	12	IV
					Total Credits:	**14**	

FOUNDATION COURSES (FC)

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1	MA3101	Applied Mathematics for Geologists	4	0	0	4	I
					Total Credits:	**4**	

SUMMARY

NAME OF THE PROGRAMME: M. SC. APPLIED GEOLOGY						
S.No	Subject Area	Credit per semesters				Credits Total
		I	II	III	IV	
1.	PCC	20	17	15	3	**55**
2.	PEC	0	3	6	3	**12**
3.	EEC	0	1	1	12	**14**
4.	FC	4	0	0	0	**4**
	Total	**24**	**21**	**22**	**18**	**85**

AG3101 PHYSICAL GEOLOGY AND GEOMORPHOLOGY L T P C
3 0 0 3

OBJECTIVES:

- Give better understanding on the applications of geomorphology in geological and engineering fields,
- Providing adequate knowledge on groundwater and natural hazards Management.
- To gain the knowledge about the planetary geomorphology.

UNIT I INTRODUCTION TO GEOMORPHOLOGY 9

Evolution of Earth, Earth's internal structure, principles of geodesy, isostasy, weathering- processes and products, Basic geomorphological concepts, endogenous and exogenous processes, Davisian/Geomorphic cycle, Planation surfaces, Processes of weathering, Weathering Indices and their significance.

UNIT II FLUVIAL AND COASTAL AND MARINE PROCESSES AND LAND FORMS 9

Classification of rivers and river valleys; Drainage basin - drainage morphometric parameters, work of river, river capture. Classification of coasts, coastal processes and landforms– coastal geomorphology of India, Coral reefs – types and significance. Development and evolution of landforms in oceanic settings, submarine canyons - Geosynclines - Island arcs.

UNIT III AEOLIAN AND GLACIAL PROCESSES AND LANDFORMS 9

Origin of deserts; causes of aridity and desertification; types and ages of deserts, Aeolian landforms. Process of glaciation, classification of glaciers; Glacial landforms; glacial erosion and deposition processes. Glaciation in the Himalayas. Concepts of landscape evolution; tectonic geomorphology.

UNIT IV APPLIED GEOMORPHOLOGY 9

Geomorphology in resources exploration; Hydro-geomorphology: Role of geomorphic processes and land forms in localization of ores and minerals - Coastal, alluvial and elluvial placers - Residual deposits; Engineering geomorphology – concept and applications.
Geomorphology in natural hazard management – floods, landslides, coastal erosion, Volcanoes and earthquakes, tsunami and other natural disaster.

UNIT V PLANETARY GEOMORPHOLOGY 9

Need for the study. Comparison of terrestrial and planetary landforms. Description and origin of Lunar, Martian and other planetary landforms and processes, methods of mapping planetary landforms.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1: Understand the endogenetic and exogenetic processes of the Earth.
CO2: Have better understanding of geological actions of wind, river,sea and glaciers and their related landforms .
CO3: Appreciate and comprehend the advanced concepts of geomorphology and its applications in Geology and engineering.
CO4: Gain knowledge on role of geomorphology in geological hazards and its mitigation
CO5: Understand the planetary geomorphology

REFERENCES

1. W.D. Thornbury (2004) Principles of Geomorphology (Second Edition). CBS publishers, New Delhi.
2. Pelletier J D. Quantitative Modelling of Earth Surface Processes, Cambridge University Press, Cambridge, 2008.
3. Schumm S A. River Variability and Complexity, Cambridge University Press, Cambridge, 2007.
4. Holmes A. Principles of physical geology, Thomas Nelson and Sons, USA, 1964.
5. Goudie A.S. Geomorphology, Springer, UK, 1998.

Mapping of CO with PO

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	-	3	2	-	1
2	-	2	3	3	1	2
3	2	3	3	3	2	2
4	3	3	3	3	2	2
5	-	3	2	3	1	1
Avg.	**2.7**	**2.8**	**2.8**	**2.8**	**1.5**	**1.6**

AG3102 ADVANCED MINERALOGY AND CRYSTALLOGRAPHY L T P C
3 0 0 3

OBJECTIVES:

- To impart fundamentals of crystals and crystallization processes.
- Teach students on formation of minerals and their physical, chemical and the optical characteristics of minerals
- To understand the advanced analytical techniques for crystallography

UNIT I CRYSTALLOGRAPHY 9

Classification of crystals-systems and classes of symmetry- International system of crystallographic notation- Use of projection diagrams to represent crystal symmetry-Unit Cells, Motifs and Lattices-Bravais Lattices-Miller Indices-Point groups and space groups.

UNIT II ELEMENTS AND MINERALS 9

Stoichiometry, atomic substitution-polymorphism, isomorphism and solid solution series – exsolution-Chemical bonding types and mineral properties-chemical classification of minerals-Rules governing atomic close-packing in crystalline solids and co-ordination number. Pauling's rules governing the ionic structures- coordination polyhedral-Crystal imperfections-defects, twinning and zoning Positioning of trace elements in minerals

UNIT III DESCRIPTIVE MINERALOGY 9

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

UNIT IV OPTICAL MINERALOGY 9

Polarizing microscope and accessory plate-Optical properties of common rock forming silicate minerals, uniaxial and biaxial minerals. Extinction angles, pleochroism, birefringence of minerals and their relation with mineral composition. Twinned crystals. Dispersion. U-stage and its applications.

UNIT V X- RAY CRYSTALLOGRAPHY 9

Principle of X-ray powder diffraction, Measurement of X-ray powder diffraction patterns, Powder diffractometers, Goniometer design in powder diffractometry, Monochromatic radiation, Bragg-Brentano geometry, Debye-Scherrer geometry. Application of Electron Micro Probe analyses and Scanning Electron Micrscopy in mineral sciences.

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TOTAL: 45 PERIODS

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OUTCOMES:

On completion of this course, the students expected to be able to:

CO1: Understand the crystallography and crystal symmetry
CO2: In-depth knowledge on the elementary properties of minerals.
CO3: Better understanding on the physical and chemical properties of various rock forming minerals and their identification.
CO4: Gain knowledge on identification of minerals through their optical properties.
CO5: Understand various x-ray techniques for and their applications in mineralogy.

REFERENCES

1. Ford, W.E., Dana's Text book of mineralogy (Fourth Edition), Wiley Eastern Limited., New Delhi, 1989.
2. Putnis, A Introduction to mineral sciences, Cambridge University Press, New Delhi, 1992.
3. Deer, Howie and Zusmann, Introduction to Rock forming minerals, IBH Publishers, New Delhi, 1998.
4. Rogers and Kerr Optical Mineralogy, McGraw Hill Book Company, New Delhi, 1986.
5. Ness, W.D. Optical Minerology. 348p, Oxford University Press, 2004
6. Klein, C. Mineral & Rock: Exercise in crystallography, mineralogy & hand specimen petrology (Rev.Ed.) 405p. John Wiley & Sons, 1989.
7. Dyar, M. D. and Gunter, M. E. Mineralogy and Optical Mineralogy. Mineralogy Society of America. 708p. 2008
8. Berry, L.G., Mason, B, and Dietrich, R.V. Mineralogy, CBS Publ. 1982
9. Winchel and Winchel, Elements of Optical Mineralogy, John Wiley & Sons, INC. USA.,1989.
10. Dexter Perkins, Mineralogy, Prentice Hall, USA, 2002
11. Hans Rudolf Wenk and Andrei Bulakh, Minerals their constitution and origin, Cambridge University Press, UK, 2004

Mapping of CO with PO

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	3	2	1	1	1
2	-	3	3	2	2	3
3	3	2	3	2	1	1
4	3	3	3	2	1	1
5	3	3	3	3	2	2
Avg.	**3**	**2.8**	**2.8**	**2**	**1.4**	**1.6**

AG3103 STRATIGRAPHY AND PALAEONTOLOGY L T P C
3 0 2 4

OBJECTIVES:

- To understand the geological setting of Indian continent to its mineral deposits
- To understand the events paleoclimate and paleoenvironment of the geological past
- To understand the evolution of invertebrate and vertebrate paleontology

UNIT I PRINCIPLES OF STRATIGRAPHY 9+6

Introduction and scope of stratigraphy, Principles of stratigraphy; Law of superposition; stratigraphic nomenclature- lithostratigraphy, biostratigraphy and chronostratigraphy and magnetostratigraphy. Walther's law. Geological time scale. Geological, physical and biological events through geological time.

Practical component: Geological events, evolution of life and mass extinctions in Indian stratigraphic scale, Order of superposition studies. Description of a litho profile.

UNIT II PRECAMBRIAN STRATIGRAPHY OF INDIA 9+6

Archaean cratonic nucleii of Peninsular India (Dharwar, Singhbhum, and Aravalli cratons); Proterozoic mobile belts (Central Indian Tectonic Zone, Aravalli-Delhi and Eastern Ghats); Southern Granulite terrain, Central Indian Tectonic zone, Aravalli-Delhi belt, North Singhbhum Mobile belt. Mineral deposits of Precambrian rocks.

Practical component: Locating the Archean cratons, mobile belts, CTZ, Precambrian terrain on India map. Spotting the Precambrian mineralized zones on the map.

UNIT III PHANEROZOIC STRATIGRAPHY OF INDIA 9+6

Geological setting and important stratigraphic features of Phanerozoic formations in India. Paleozoic; Spiti, Kashmir and Kumaon. Mesozoic; Spiti, Kutch, Narmada valley and Trichinopoly. Gondwana Super group. Cenozoic; Assam, Bengal basin, Garhwal-Shimla Himalayas. Siwaliks; Stratigraphic boundary problems in Indian stratigraphy.

Practical component: Locating the Phanerozoic formations in India, Demarcation of stratigraphic boundary based on fossil assemblages. Field study in Cretaceous Formations of India.

UNIT IV INVERTEBRATE AND VERTEBRATE PALEONTOLOGY 9+6

Fossil record through geological time scale. Mode of preservation of fossils and concepts of taphonomy. Body and ichnofossils, species concept, organic evolution. Ediacara fauna; morphology and time range of Graptolites, Trilobites, Brachiopods, and Molluscans. Vertebrate life through ages. Evolution in Proscidea, Equidae and Hominidae. Mass extinctions.

Practical component: Description and Identification of invertebrates. Age assessment, Index fossil and stratigraphic boundary, Paleogeography of Gondwana continents with fossil proxy. Tethyan fossils. Identification of Siwalik Vertebrates and paleoenvironment.

UNIT V MICROPALEONTOLOGY AND PALYNOLOGY 9+6

Organic and mineral walled microfossils. Methods of separation of microfossils from sedimentary matrix. Morphology of Foraminifera, Ostracod. Fossil spores, pollens and dinoflagellates. Gondwana plant fossils and their significance. Applications of paleontological data in stratigraphy, paleoecology and paleoclimatology.

Practical component: Foraminifera and palynofossil separation technique, Methods of Ident cation of microfossils; foraminifera and ostracod. M-T-R Trilinear diagram analysis for identification of environment of deposition. Biozones analysis- Bio facies diagrams, biostratigraphy problems. Factor and cluster analysis and interpretation of ecology of recent foraminifera. Deformed foraminifer's shells and its relation to pollution.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

On completion of this course, expected outcomes are:

CO1: A comprehensive knowledge of mineral wealth of India; a guide for exploration and Exploitation of mineral deposits.
CO2: Education to "past is key to the present" concept for correlation and enhancement the mineral and fossil fuel mineral exploration
CO3: Indexing the fossil system for paleoenvironment, paleotemperature, paleoecology, paleobathymetry in taking the stock of past sea level changes and global warming.
CO4: Bio-indicator clue in pollution and bio-mineralization.
CO5: A guide to the environment analysis by microfossil assemblages.

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2. Krishnan, M.S., Geology of India and Burma III Ed. IBH Publishers, New Delhi, 1984
3. Ravindra Kumar, Fundamentals of historical Geology and stratigraphy of India, Wiley Eastern Ltd. New Delhi, 1985
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Mapping of CO with PO

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	-	2	3	2	1	1
3	1	3	3	2	-	1
4	-	3	3	2	-	1
5	3	3	3	3	1	1
Avg.	**2.3**	**2.6**	**2.8**	**2.4**	**1.0**	**1.0**

AG3104 STRUCTURAL GEOLOGY AND GEOTECTONICS L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge their significance in geological setup and exploration of geological resources.
- To understanding of plate tectonics and its role in geological processes such as seismicity and volcanism.
- To gain the knowledge on geological and structural mapping and its application in geo resource exploration.

UNIT I INTRODUCTION 9

Concept, approach and scope of structural geology-primary and secondary Structures-Principles of geological mapping and map reading-V-rules and outcrop patterns-projection diagrams. Concepts of Stress, Strain and rheological properties of rocks-Behaviour of minerals, sediments and rocks under deformation conditions and their controlling factors

UNIT II DEFORMATION MECHANISMS & MICROSTRUCTURES 9

Planar and linear structures- cleavage, foliation, lineation and Unconformities-Structural behaviour of igneous Intrusions-Introduction to petro fabrics-Theories of rock failure-Kinematic analysis and Dynamic analysis – strain markers and method of strain measurements in naturally deformed rocks-deformation at microscale -controls of strain rate and development of microfabrics.

UNIT III JOINTS AND FAULTS 9

Joints and shear fractures - brittle and ductile shear zones - Mohr's circle and criteria for failure of rocks- Fault in rocks-recognition in field -classification of faults and fault surfaces on the basis of slip sense and surface effects- Dynamic analysis of faults- measurement of strain in deformed rocks- time relationship between crystallization and deformation - Normal faults, strike-slip faults and thrust faults terminology-role of fluid pressure- calculation of paleo-stress-Geometry and products of shear zones-Mylonites and Cataclastites.

UNIT IV FOLDS 9

Elements of fold geometry-classification of folds. Folding mechanisms- Regional fold styles-structural analysis of folds –Strain within buckled layer-Study of Superimposed folding-Type 1, 2 and 3 interference pattern. S and Z patterns-Stereoplot for different interference pattern-Distinction between F1 and F2 folds.

UNIT V GEOTECTONICS 9

Heterogeneity of the earth's Crust-Major tectonic features of the Oceanic and Continental Crust-Continental Drift-Seafloor spreading and Plate Tectonics-Rock magnetism, paleomagnetism and its origin; -polarity reversals-polar wandering-Island arcs, Oceanic islands and volcanic arcs-Isostasy-orogeny and epi-orogeny-Seismic belts of the earth-Seismicity and plate movements-present day global tectonics-Geodynamics of the Indian plate-Evolution of Himalaya.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1: Identify primary and secondary structures

CO2: Have knowledge on behaviour of minerals and rocks during stress

CO3: Acquire skills on field recognition of faults, folds and their types

CO4: Understanding of plate tectonics and its role in geological processes such as seismicity and volcanism.

CO5: Have knowledge on geological and structural mapping and its application in geo resource exploration.

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6. Billings, M.P. Structural Geology, Third Edition, Pearson Education Limited, 2016.
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8. Pollard DD and Fletcher RC (2005): Fundamentals of Structural Geology Cambridge University Press
9. Kearly, Klepies and Vine, Global Tectonics, Third Edition, Wiley, India, 2009.
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11. Ramsay, J.G. & Huber, M.I. The Techniques of modern structural geology. V.2. Folds and Fractures, 1987.

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Mapping of CO with PO

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	3	3	3	2	2
2	2	3	3	2	-	-
3	3	3	3	3	1	1
4	-	2	3	3	2	2
5	3	3	3	2	1	1
Avg.	**2.8**	**2.8**	**3.0**	**2.6**	**1.5**	**1.5**

AG3105 APPLIED GEOCHEMISTRY L T P C
3 0 0 3

OBJECTIVES:

- To understand chemistry of magma and evolution of various rock types through geochemical differentiation.
- To collect geochemical data for exploration of earth resources
- To analyze and interpret geochemical data for exploration for minerals, oil and groundwater.

UNIT I PRINCIPLES OF GEOCHEMISTRY 9

Introduction to geochemistry and cosmochemistry- origin of elements and their abundance in the universe – Periodic table - distribution of elements in rocks and soils. Chemical composition and characteristics of atmosphere – lithosphere - hydrosphere; geochemical cycles. Meteorites- types and composition.

UNIT II GEOCHEMISTRY OF MINERALS, ROCKS AND WATERS

Mineral stability, compositional changes in minerals. River water, Seawater, Seafloor hydrothermal systems; Groundwater and Lakes. Characteristics of Magma, Melting of rocks, Water in Magmas, eutectic and melting. Distribution of elements in igneous, sedimentary and metamorphic processes. Goldschmidt's classification of elements; fractionation of elements in minerals/rocks;

UNIT III ISIOTOPE GEOCHEMSIRTY 9

Isotope geochemistry and principles of Geochronology-Radioactive Decay, Determining Isotope Decay time, Potassium-Argon Systematics, Uranium-Thorium-Lead Systematics. Types of Isotope-Fractionation, isotope Exchange between minerals and water, Carbon, Oxygen and Sulphur isotopes, First-order decay and growth equations.

UNIT IV EXPLORATION GEOCHEMISTRY 9

Introduction – Primary dispersion pattern, Secondary dispersion pattern – background values. Geochemical anomaly – geochemical sampling-Principles and techniques used in the design and implementation of an exploration geochemical survey-Nernst's partition coefficient (compatible and incompatible elements)-Nernst-Berthelot partition coefficient and bulk partition coefficient-Fick's laws of diffusion and activity composition relation (Roult's and Henry's law).

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UNIT V ENVIRONMENTAL GEOCHEMISTRY 9

Introduction and the current relevance of biogeochemistry- biogeochemical cycles of carbon, nitrogen and phosphorus- Application of trace elements in petrogenesis-principles of equilibrium and Rayleigh fractionation-REE patterns, Eh and pH diagrams and mineral stability- Anthrosphere aquatic environment – Marine, fluvial, lacustral, aerosols-Perturbations caused by human activity.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students are expected to:

CO1: Familiarized with chemical properties of earth and its layers

CO2: Understand the geochemical characteristics of minerals and rocks

CO3: Have knowledge on isotopic methods and age determination

CO4: Collect geochemical data for exploration of earth resources

CO5: Analyze and Interpret geochemical data for exploration for minerals, oil and groundwater.

REFERENCES:

1. John V. Walther, Essentials of Geochemistry, Jones and Bartlett Publishers, 2005, Boston.
2. Girard, Principles of Environmental Chemistry, Jones and Bartlett Publishers, 2005, Boston.
3. Faure, G, Principles and applications of Geoche4msitry, Pearson Education, 1998, INC, Australia.
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5. Faure, G., Principles and applications of Geochemistry, Pearson Education, INC, Australia, 1998.
6. Nelson EBY, G., Principles of Environmental Geochemistry, Thomson Brooks/Cole, UK,2004.
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8. Lajtha, J. and Michener, R. Stables isotopes in ecology and environmental Science, Blackwell, U.K., 1994.
9. Goldchmidt, V.M Hand book of Geochemistry 1958

Mapping of CO with PO

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	2	3	3	2	1	1
2	3	3	3	2	1	1
3	3	3	3	1	1	2
4	2	3	3	2	1	1
5	3	3	3	3	3	2
Avg.	**2.6**	**3**	**3**	**2**	**1.4**	**1.4**

MA3101 APPLIED MATHEMATICS FOR GEOLOGISTS L T P C
4 0 0 4

OBJECTIVES:

- To enable the students, understand the numerical methods of solving systems of linear algebraic equations and the ideas of interpolation.
- To train the students to address the mathematical problems involved in geological science and understand various sampling, quantitative and statistical problems pertaining to geology.
- To make them understand the importance of estimation theory and introduce them to various tests of hypothesis.

UNIT I SYSTEM OF LINEAR EQUATIONS AND INTERPOLATION 12

Simultaneous linear equations – Direct method – Gauss elimination, Gauss Jordan methods – iterative method – Jacobi and Gauss Seidal methods - Difference table – Newtons forward and backward interpolation – Newtons divided differences – Lagrangian interpolation.

UNIT II NUMERICAL INTEGRATION AND ORDINARY DIFFERENTIAL EQUATIONS 12

Numerical integration – Trapezoidal and Simpson's 1/3 rules – Taylor series and Eulers methods – Runge-kutta method of fourth order – Adam-Bashforth and Milne Predictor – Corrector Method.

UNIT III EMPIRICAL STATISTICS 12

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

UNIT IV ESTIMATION THEORY 12

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation – Curve fitting by principle of least squares – Regression lines.

UNIT V TESTING OF HYPOTHESIS 12

Sampling distributions – Type I and Type II errors – Test based on Normal, t, $\chi^2$and F distributions for testing mean, variance and proportions – Tests for independence of attributes and Goodness of fit.

TOTAL :60 PERIODS

OUTCOMES:

At the end of the course, students will be able to

CO1: Develop the ideas of numerical and statistical methods of solving various applications involving resource evaluation and assessment.
CO2: Solve systems of equations numerically and also learn interpolation techniques.
CO3: Solve numerically the differential equations occurring in their field of study.
CO4: Apply estimation theory to various engineering problems.
CO5: Use various tests of hypothesis for their future work.

REFERENCES:

1. Devore. J. L, "Probability and statistics for Engineering and Sciences", Thomson and Duxbury, 9th Edition, Singapore, 2016.
2. Erwin Kreyszig. "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, New Jersey, 2010.
3. Grewal. B. S. and Grewal. J. S., "Numerical methods in Engineering and Science", Khanna Publishers, 6th Edition, New Delhi, 2002.
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1. Mann. P.S., "Introductory Statistics", John Wiley and sons. Inc, 9th edition, New York, 2015.
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Mapping of CO with PO

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	3	2	-	-
2	2	3	3	2	1	1
3	-	-	3	3	2	1
4	3	2	3	2	-	-
5	2	3	2	3	-	3
Avg.	**2.5**	**2.5**	**2.8**	**2.4**	**1.5**	**1.7**

AG3111 **MINERALOGY LAB** **L T P C**
0 0 2 1

OBJECTIVES:

- To give hands-on exercise on identification of crystals and minerals
- To impart practical training on optical mineralogical techniques
- To impart knowledge on minerals calculation practice

UNIT I CRYSTALLOGRAPHY **6**

Stereographic projections – axial ratios – Napier's theorem and problems

UNIT II PROPERTIES OF MINERALS IN HAND SPECIMENS **6**

Habit – cleavage – hardness – specific gravity – colour – luster – streak – fusibility – fluorescence – magnetic property of rock forming minerals.

UNIT III PROPERTIES OF ORE MINERALS IN HAND SPECIMENS **6**

Habit – cleavage – hardness – specific gravity – colour – luster – streak – fusibility – fluorescence – magnetic property of ore minerals.

UNIT IV PROPERTIES OF MINERALS IN THIN SECTION **6**

Systematic microscopic study of common rock forming minerals – RI – Birefringence – extinction angles – optic sign etc.

UNIT V MINERAL CALCULATION AND 4- AXES UNIVERSAL STAGE **6**

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

TOTAL: 30 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1: Familiar with uses of sterographic projection in crystal interface angle
CO2: Have knowledge on identification of minerals in hand specimens
CO3: Have knowledge on identification of ore minerals in hand specimens
CO4: Have knowledge on identification of minerals in thin section
CO5: Familiar with mineral cation calculations

REFERENCES

1. Dyar, M. D. and Gunter, M. E. Mineralogy and Optical Mineralogy. Mineralogy Society of America. 708p. 2008
2. Berry, L.G., Mason, B, and Dietrich, R.V. Mineralogy, CBS Publ. 1982
3. Winchel and Winchel, Elements of Optical Mineralogy, John Wiley & Sons,
4. INC. USA.,1989.
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6. Hans Rudolf Wenk and Andrei Bulakh, Minerals their constitution and origin,
7. Cambridge University Press, UK, 2004

Mapping of CO with PO

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	-	2	3	2	1	1
3	1	3	3	2	-	1
4	-	3	3	2	-	1
5	3	3	3	3	1	1
Avg.	**2.3**	**2.6**	**2.8**	**2.4**	**1.0**	**1.0**

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AG3112	STRUCTURAL GEOLOGY AND GEOLOGICAL MAPPING TECHNIQUES	L T P C 0 0 2 1

OBJECTIVES

- To teach field measurements of attitude of rocks
- To impart geological mapping techniques.
- Provide skills to determine bed thickness and depth

UNIT I STRIKE, DIP AND THICKNESS PROBLEMS 6

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

UNIT II STRUCTURAL MAPS 6

Completion of outcrops in geological maps - Three point problems - Drawing of profiles and studies of geological maps

UNIT III STEREOGRAPHIC PROJECTIONS 6

Determination of true and apparent dip, plunge and pitch of linear structures

UNIT IV GEOLOGICAL MAPPING TECHNIQUES 6

Map, toposheet, study of topographic features, map scale mapping instruments – Clinometer, brunton compass, odometer, altimeter, GPS, Map measurer, and Geologist's kit. Procedures for geological mapping at Igneous, Sedimentary and Metamorphic terrains. Outcrop study, method of traverses, Preparation of geological map and structural mapping.

UNIT V FIELD WORK and GEOLOGICAL INVESTIGATIONS 6

Identification of lithological units, structural identification, joints pattern measurements, faults identification, fold analysis, sample collection. Field studies in the important geological exposures of India and report writing.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

On completion of this course, the students expected to be able to:

CO1: Students familiar with find out the strike, dip and thickness of bed

CO2: Prepare structure geological mapping.

CO3: Familiar with find out the true and apparent dips by using sterographic projections

CO4: Gained knowledge on geological mapping techniques

CO5: Carryout geological field work individually and as a team

REFERENCES

1. Lahee, F.H., Field Geology, CBS publishers, N. Delhi, 2002.
2. John W. Barnes, Richard J. Lisle, Basic Geological Mapping, John Wiley & Sons Ltd, UK, 2004.
3. N. W. Gokhale, a Manual of Geological Maps, Reprinted by CBS Publishers & Distributiors Pvt. Ltd, India, 2008.
4. N. W. Gokhale, a Manual of Problems in Structural Geology, Reprinted by CBS Publishers & Distributiors Pvt. Ltd, India, 2009.

Mapping of CO with PO

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	-	2	3	2	1	1
3	1	3	3	2	-	1
4	-	3	3	2	-	1
5	3	3	3	3	1	1
Avg.	**2.3**	**2.6**	**2.8**	**2.4**	**1.0**	**1.0**

RG3111	PLANE AND GEODETIC SURVEYING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To familiarize students with the various surveying instruments.
- To impart practical skills on various surveying techniques.
- Provide skills to do individual and group surveys for geological explorations

EXCERCISES:

1. Chain traversing 8
2. Compass traversing 8
3. Plane table surveying – Method of intersection 4
4. Plane table surveying – Three point problem (any one method) 4
5. Plane table surveying – Two point problem 4
6. Plane table traversing 4
7. Fly levelling using dumpy/tilting level 4
8. Check levelling using dumpy/tilting level 4
9. Measurement of horizontal and vertical angles using theodolite. 8
10. Determination of tacheometric constants using horizontal and inclined line of sight. 4
11. To determine the elevation of an object using single plane method when base is accessible and inaccessible 4
12. GPS and Total Station – demonstration only. 4

TOTAL:60 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1: Use various surveying instruments individually
CO2: Have knowledge on different survey method with its merits and demerits
CO3: Do individual field surveys
CO4: Understand applications of Survey in geological explorations.
CO5: Have up-to-date knowledge on advanced surveying instruments and methods

REFERENCES:

1. T.P.Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008
2. Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, Surveying Vol.I & II, Lakshmi Publications Pvt Ltd, NewDelhi, 2005
3. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, Mc Graw Hill 2001
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8. K.R. Arora, Surveying Vol I & II, Standard Book house, Tenth Edition.

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Mapping of CO with PO

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	-	2	3	2	1	1
3	1	3	3	2	-	1
4	-	3	3	2	-	1
5	3	3	3	3	1	1
Avg.	**2.3**	**2.6**	**2.8**	**2.4**	**1.0**	**1.0**

AG3201 IGNEOUS AND METAMORPHIC PETROLOGY L T P C
3 0 0 3

OBJECTIVES:

- To familiarize the students on the igneous processes and chemical characteristics of magma its various rock types.
- Provide information on occurrence and geological setting of igneous rocks and metamorphic rocks.
- To understand the concept of metamorphic facies and metasomatic processes

UNIT I MAGMA GENERATION AND IGNEOUS ROCKS 9

Textures and structures of igneous rocks. General classification of igneous rocks. Interior of the earth and formation of magmas. Ascent and emplacement of magmas. Concept of primary and secondary magma, Crystallization of magma, Magma series, Dynamics Magmatic differentiation. Magma mixing, mingling and immiscibility.

UNIT II PHASE EQUILIBRIA IN IGNEOUS SYSTEMS 9

Phase Rule – Two component eutectic systems - diopside-anorthite system - incongruent melting – forsterite-silica system – Solid solution systems – albite-anorthite system – Exsolution – Albite-Orthoclase system. Crystallization in ternary systems: (Di-Ab-An, Di-Fo-Si, Di-Fo-An, Fo-An-Si) and their relation to magma genesis and crystallization.

UNIT III PLATE TECTONICS AND IGNEOUS PETROGENESIS 9

Igneous rocks of ocean basins: Ophiolites & Basalts - Igneous rocks of Continental Lithosphere: Granitic rocks; terrestrial anorthosites**,** carbonatites & Alkaline rocks; Mafic dyke swarms, boninites and layered complexes. Continental Rhyolites; Continental Flood Basalts - Igneous rocks of convergent margins, Variation diagrams- Distribution and tectono magmatic setting of important igneous complexes of India**.**

UNIT IV METAMORPHIC PETROLOGY 9

Texture and structure of metamorphic rocks. Nomenclature and description of metamorphic rocks. Basic concepts of metamorphic reactions. Isograds, Metamorphic Differentiation, Anataxis and Origin of Migmatites, Diagrammatic representations of mineral reactions and mineral paragenesis – ACF, AKF, AFM diagrams.

UNIT V METAMORPHIC FACIES & METASOMATISM 9

Concept and Classification of Metamorphic Facies and Facies Series, Introduction to Ultrahigh Temperature and Ultrahigh Pressure Metamorphism, Description of each Facies of Low – Medium

to High – Pressure and Very High - Pressure with special reference to characteristic Minerals, subdivision into Zones/Sub-facies, Mineral Assemblages-pelitic, basic-ultrabasic and impure calcareous rocks. Metasomatism, ultra-metasomatism and anataxis. Metamorphism and plate tectonics. Paired metamorphic belts – EPMA Studies – PT Estimates –ITD

TOTAL: 45 PERIODS

OUTCOMES

On completion of this course, the students are expected to

CO1. Have better understanding on magma and magmatic processes
CO2. Understand the crystallization processes of minerals and rocks
CO3. Differentiate various Igneous types and their tectonic settings
CO4. Understand clearly on metamorphic processes and formation of metamorphic rocks.
CO5. Interpret magmatic and geodynamic processes and their signatures worldwide.

REFERENCES

1. Frost, R and Frost C.D., "Essentials of Igneous and Metamorphic Petrology" Cambridge University Press, USA 2014
2. Philpotts, A.R. and Ague, J.J., "Principles of Igneous and Metamorphic Petrology" Cambridge University Press, USA 2010
3. Vernon, R.H. and Clarke, G.L. 2008: Principles of Metamorphic Petrology, Cambridge University Press Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, Sao Polo, Delhi
4. Best M.G., Igneous and Metamorphic Petrology, 2nd ed. Blackwell. UK, 2002.
5. Winter, J., "An Introduction to Igneous and Metamorphic Petrology", Prentice-Hall 2001
6. Hall, Anthony, Igneous Petrology. Longman, UK1996.
7. Barker A.J. Introduction to Metamorphic Textures and Microstructures. 1st ed., Blackie, Glasgow; 2nd ed., Stanley Thornes, Cheltenham, 1998.
8. Mason R., Petrology of the Metamorphic Rocks, 2nd ed. Unwin Hyman, London, 1990.

MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	3	2	1	2	1	1
3	2	3	1	2	-	1
4	2	3	2	2	-	1
5	3	3	2	3	1	1
Avg.	**2.8**	**2.6**	**1.6**	**2.4**	**1.0**	**1.0**

AG3202 SEDIMENTOLOGY AND SEDMENTARY PETROLOGY L T P C
3 0 0 3

OBJECTIVES:

- To familiarize the students on Sedimentary processes
- To provide knowledge on sedimentary structure and tectonic settings
- Describe on occurrence and geological setting of igneous rocks and metamorphic rocks.

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UNIT I ORIGIN AND CLASSIFICATION OF SEDIMENTS 9

Weathering and erosion process, products, principles of sedimentation process, scope, applications, classification of sedimentary rocks, sedimentary textures-grain size, roundness, sphericity, shape and fabric, quantitative grain size analysis.

UNIT II SEDIMENTARY PROCESS AND STRUCTURES 9

Sediment transport and deposition- fluid and sediment gravity flows, lamellar and turbulent flows, Reynold number, Froude number, grain entrainment, Hjulstrom diagram, bed and suspension load transport. Primary, penecontemporaneous deformation structures and biogenic structures. Paleocurrent analysis.

UNIT III SEDIMENTARY BASINS AND TECTONICS 9

Evolution of sedimentary basins. Sedimentation in major tectonic setting; principles of sequence stratigraphy- concepts and factors controlling base level changes, parasequence, clinoform, system tract, unconformity and sequence boundary. Sedimentary basins of India.

UNIT IV SEDIMENTARY ENVIRONMENT AND FACIES 9

Facies models for marine, fluvial, glacial, and deltaic. Siliciclastic shallow and deep marine environments; carbonate platforms- types and facies models. Sedimentary provenance and diagenesis of sediments.

UNIT V SEDIMENTARY PETROLOGY 9

Origin of sedmentary rocks. Types of sandstones and their petrogenesis; Grawacke and Grawacke problem, plate tectonics and sandstones composition. Argillaceous rocks, their classification and genesis. Volcaniclastic sediments and their characteristics. Limestone and dolomites: classification and petrography, Models of dolomitization. Banded iron formation, evaporates, cherts, and Phosphorites; classification, texture, structure, origin, diagenesis and depositional environment.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students are expected to

CO1. Have better understanding on sediments and classification
CO2. Understand the processes of sedimentation and sedimentary structures
CO3. Differentiate various tectonic settings and sedimentary processes
CO4. Understand clearly on sedimentary environment and provenance
CO5. Identify and distinguish sedimentary rocks on the basis of their mode of formation.

REFERENCES

1. Tucker, M.E., Sedimentary Petrology, Blackwell Science U.K., 2001.
2. F.J. Pettijohn., Sedimentary Rocks, third edition, CBS Publishers & Distributors, Reprint 2002.
3. Sam Boggs, Principles of Sedimentology and Stratigraphy. Pearson, USA, 2000.
4. Sam Boggs, Jr., Principles of Sedimentology and Stratigraphy 4th Edition, Pearson, USA, 2006.
5. Donald R. Prothero, Frederic Schwab., Sedimentary Geology: An Introduction to Sedimentary Rocks and Stratigraphy W H Freeman, USA, 2003.
6. Bhattacharyya, C. Chakraborty., Analysis of sedimentary Successions.,Oxford and IBH Publishing Co. Pvt Ltd, New Delhi,2000
7. Mike D Blum,Susan B. Marriot, Suzanne F.Leclair, Fluvial Sedimentology ,2005., Blackwell Publishing., London
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11. Nicholls, G. Sedimentology and Stratigraphy. Wiley-Blackwell, 1999

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MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	3	2	1	2	1	1
3	2	3	1	2	-	1
4	2	3	2	2	-	1
5	3	3	2	3	1	1
Avg.	**2.8**	**2.6**	**1.6**	**2.4**	**1.0**	**1.0**

AG3203 EXPLORATION GEOPHYSICS AND FIELD TECHNIQUES L T P C
3 0 2 4

OBJECTIVES:

- To study the physical properties of earth and application of physics in geology,
- To understand subsurface features and structures for better understanding of subsurface geology.
- To Familiarize the students on geophysical techniques and their field setup, data processing and interpretation.

UNIT I INTRODUCTION & ELECTRICAL METHODS 9+6

Scope of exploration geophysics – physical properties of the earth – Electrical methods – SP, IP, and resistivity methods - methods of electrode arrangement – field methods – interpretation – application electromagnetic methods – case studies

FIELD TECHNIQUES: - Resistivity surveys – Wenner and Schlumberger methods – electrical sounding and profiling –- problems on these methods

UNIT II GRAVITY METHODS 9+6

Principle – field methods – gravimeters –calibration - corrections – interpretation of gravity data – determination of shape and depth of ore bodies — corrections & applications – GRACE mission – case studies

Field Techniques: Field investigation on resistivity – sounding and profiling – SP methods - Interpretation of data – standard computer packages in interpretation – Problems on gravity methods

UNIT III MAGNETIC METHODS 9+6

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

Field Techniques: Problems on magnetic methods – preparation of anomaly maps – methods of corrections

UNIT IV SEISMIC METHODS 9+6

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

determination of attitude and depth of formations – applications- various types of shooting – case studies

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

UNIT V RADIOACTIVITY METHODS AND WELL LOGGING 9+6

Fundamentals of radioactivity – principle of radioactivity methods –instruments – field methods, interpretation and Applications – Well logging - Self potential – resistivity – radioactivity logging methods – caliper and other miscellaneous logging methods – field procedure and interpretation of data – case studies

Field Techniques:- Radioactive methods - problems on well logging – interpretation of data.

TOTA: 75 PERIODS

OUTCOMES:

On completion of this course, the students are expected to be able to:

CO1. Have better understanding on the physical properties of earth and its layers
CO2. Understand the geophysical anomalies and their significance in subsurface exploration
CO3. Acquire skills on various geophysical methods and their field surveys
CO4. Collect data using various geophysical techniques and do analysis
CO5. Interpretation of data for exploration for minerals, oil and groundwater

REFERENCES:

1. Burger, H.R., Exploration Geophysics of the Shallow Subsurface, Prentice Hall, 1992.
2. Dobrin, M.B An introduction to geophysical prospecting, McGraw Hill, New Delhi,1984
3. Mamdouh R. Gadallah Ray Fisher. Exploration Geophysics , Springer 2009
4. John M. Reynolds , An Introduction to Applied and Environmental Geophysics Reynolds Geo-Sciences Ltd, UK, 1997
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6. Rama Rao, B.S and Murthy I.B.R Gravity and magnetic methods of prospecting. Arnold Heinmann Pub. New Delhi, 1978.
7. Robinson, Edwin S., Cahit Coruh, Basic exploration geophysics. New York : Wiley, 1988.
8. Surface Geophysical Methods Volume 1, Fall 2004
9. Darling and Toby Well Logging and Formation Evaluation.Oxford UK, Elsevier. p 5p.2005 ISBN 0-7506-7883-6

MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	-	2	3	2	1	1
3	1	3	3	2	-	1
4	-	3	3	2	-	1
5	3	3	3	3	1	1
Avg.	**2.3**	**2.6**	**2.8**	**2.4**	**1.0**	**1.0**

AG3204 **FUEL GEOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- To study the origin of Coal, petroleum and Nuclear minerals
- To teach Indian occurrences of hydrocarbons.
- To teach students geological and geophysical exploration techniques

UNIT I ORIGIN OF COAL AND ITS PROPERTIES 9

Origin of coal and its type. Coalification. Coal and its properties; proximate and ultimate analysis. Different varieties and rank of coal. Concept of coal maturity, peat, lignite, bituminous and anthracite coal. Lithotypes, microlithotypes and maceral groups of coal, mineral and organic matter in coal.

UNIT II INDIAN COAL FIELDS 9

Lithology, stratigraphy and structures of Gondwana coal fields and Tertiary coal fields of India and its properties. Coal utilization, Combustion, carbonization, gasification and hydrogenation.

UNIT III ORIGIN AND PROCESS OF HYDROCARBON FORMATION 9

Fundamental concepts of organic and inorganic theories of hydrocarbon. Sedimentary processes and accumulation of organic matter-diagenesis, catagenesis and metagenesis of organic matter. Generation, migration and accumulation of oil – short and long migration - primary and secondary migration – various traps - crude oil types, Oil fields of India.

UNIT IV GEOLOGICAL, GEOPHYSICAL AND GEOCHEMICAL METHODS 9

Sedimentary basin analysis to its Petrophysical properties, depositional environment and time line and bathymetry analysis. Seismic method of hydrocarbon reservoir exploration. Seismic reflection patterns and to decipher the depositional and structural features. Well logging techniques, interpretation of logs, geochemical parameters; determination of TOM, TOC, VRO, TTI, and TAMR

UNIT V NUCLEAR MINERALS 9

Geological characteristics of and genesis of major types of Uranium deposits. Distribution of Uranium deposits in India and its stratigraphy and structure and properties. Placer minerals properties, distribution. Origin, physical and chemical properties of Monazite, Thorium deposits.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Understand the processes of formation of coal, petroleum and nuclear minerals.
CO2. Have knowledge on different rank of coals and Indian occurrence
CO3. Do independent geological mapping for hydrocarbon exploration
CO4. Gain skills on geophysical and geochemical exploration methods.
CO5. Understand the scope of geology in strategic mineral exploration

REFERENCES

1. Chandra, D., Singh, R. M. and Singh, M. P. Text book of coal (Indian context). Tara book agency, Varanasi. 2000.
2. Stach, E. Mackowsky, M. Th., Teichmuller, M., Taylor, G.H., Chandra, D. and Teichmuller, R. Stach's Text book of coal petrology, Gebnudar Borntraeger, Stuttgart, 1982.
3. Wilfrid Francis. Coal its formation and composition. Edward Arnold (Publishers) Ltd. London 1961.
4. Van Kreuelen. Coal – Typology – Chemistry – Physics Constitution. Elsievier publishing company, London 1961.
5. T. Levorsen Geology of Petroleum CBS publishers and distributors, Delhi, II Edition 1999.
6. Tissor and D. H. Welte Petroleum formation and occurrence Springer Velag, Tokyo, 1984.
7. G. Henery Geophysics of sedimentary basins, Technip, Rue Ginoux, Paris 1994.
8. Bhagwan Shtay, Petroleum Exploration and Exploration practices, Allied Publishers Ltd., 2001.
9. Fraure, G, Principles of isotope geology, John Wiley, Second edition. 1986.

MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	3	2	1	2	1	1
3	2	3	1	2	-	1
4	2	3	2	2	-	1
5	3	3	2	3	1	1
Avg.	**2.8**	**2.6**	**1.6**	**2.4**	**1.0**	**1.0**

CY3211 APPLIED GEOCHEMISTRY LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To develop analytical skill and practical exposure on geochemistry
- To understand the chemical properties of water, sediments and minerals in geology
- To train the students on sophisticated analytical instrument handling in geochemistry and their application

UNIT I ANALYSIS OF ORES 12

a) Analysis of Dolomite ore by Titrimetry method
b) Analysis of Haematite ore by Titrimetry method

UNIT II ANALYSIS OF METALS IN SOLUTIONS 16

a) Estimation of Iron and Copper in the given sample by Spectroscopy method
b) Estimation of Sodium and Potassium in the given sample by Flame Spectrophotometer
c) Estimation of Zinc and Nickel in the given sample Gravimetric method

UNIT III ANALYSIS OF WATER 12

a) Estimation of Acidity, Alkalinity and Hardness of the water sample by Titrimetry method
b) Determination of Total Dissolved Solids (TDS) of the water sample by Gravimetry method
c) Determination of Dissolved Oxygen (DO) of the water sample by Winkler's method

UNIT IV ELECTROANALYTICAL METHODS 12

a) Determination of strength of a acid by pH meter
b) Determination of strength of mixture of acids by Conductometry method
c) Estimation of amount of Iron in the given sample using Potentiometer

UNIT V DEMONSTRATION EXPERIMENTS 8

a) Identification of functional groups in a compound by IR Spectroscopy
b) Determination of thermal stability of the given sample by TGA and DSC techniques
c) Study the surface morphology of a material by SEM analysis
d) Determination of surface area, pore size and pore volume of a material by BET analysis
e) Separation and identification of individual components present in a mixture by Chromatographic technique

TOTAL: 60 PERIODS

OUTCOMES

After completion of the laboratory course, the student will be able to –

CO1. Analyze different type of ores
CO2. Estimate the percent of metals in solution using chemical methods
CO3. Determine the quality of water
CO4. Calculate the strength of acid using analytical techniques
CO5. Study the surface morphology and surface of a material by analytical instruments

Attested

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REFERENCES

1. Laboratory Manual - Department of Chemistry, CEGC, Anna University, 2023.
2. Mendham J., Denney, R.C., Barnes J.D., Thomas M. and Sivasakar B. "Vogel's Textbook of Quantitative Chemical Analysis", 6th Edition, Pearson Education, 2009.

MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	-	2	3	2	1	1
3	1	3	3	2	-	1
4	-	3	3	2	-	1
5	3	3	3	3	1	1
Avg.	2.3	2.6	2.8	2.4	1.0	1.0

AG3211 PETROLOGY LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To develop practical exposure and skills on Petrography of rocks
- To understand the index chemical and physical properties for mineral and rock identification
- Training on sophisticated microscopes and analytical instrument handling in Petrology

UNIT I IGNEOUS PETROGRAPHY 9

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

UNIT II SEDIMENTARY PETROGRAPHY 9

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

UNIT III METAMORPHIC PETRGRAPHY 9

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

UNIT IV PETROCHEMICAL CALCULATIONS 9

Norm calculation and interpretation of chemical analysis of representative rocks using variation diagrams – Niggli – Maniar Picolli – Harker's – Niggli basis – CIPW Norms-Plotting on ACF, AKF and AFM diagrams- interpretation.

UNIT V SEDIMENTARY TECHNIQUES 24

Sieving analysis practices- River, lake and marine sediment grain size analysis, interpretation- CM plotting, histogram, calculation of statistical parameters and interpretation of sediment depositional environment. Clay mineral separation from sedimentary mixture. Determination of sand-silt-clay ratio. Identification of clay minerals using XRD. Description of sedimentary rocks. Identification of

sedimentary structures and its interpretations. Interpretation of SEM – recognisition of physical and chemical etch marks- determination of transportation and porosity. Identification of heavy minerals and interpretation of provenance history. Sediment core logging, staining technique and identification of carbonate minerals.

TOTAL:60 PERIODS

OUTCOMES:

On completion of this course, the students are expected to be able to:

CO1. Identify different types of megascopic rock samples.
CO2. Distinguish rock types under microscope and identify constituent minerals
CO3. Determine the chemical composition of rocks and classify them.
CO4. Have skills on sedimentary analysis of rocks
CO5. Have up-to-date knowledge on modern and advanced equipment

REFERENCES

1. Frost, R and Frost C.D., "Essentials of Igneous and Metamorphic Petrology" Cambridge University Press, USA 2014
2. Philpotts, A.R. and Ague, J.J., "Principles of Igneous and Metamorphic Petrology" Cambridge University Press, USA 2010
3. Best M.G., Igneous and Metamorphic Petrology, 2nd ed. Blackwell. UK, 2002.
4. Sam Boggs, Jr., Principles of Sedimentology and Stratigraphy 4th Edition, Pearson, USA, 2006.

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	**3**	**2**	**2**	**3**	**1**	**1**

AG3212 FIELDWORK REPORT AND SEMINAR L T P C
0 0 2 1

OBJECTIVES:

- To gain the fieldwork knowledge in various geological sites
- To acquire the skills of writing and oral presentation of specific technical topic in Geology
- To develop the skills for geological field report and presentation

Syllabus

Students will undergo Geological fieldwork during first/second semester and submit the fieldwork reports.

The student will work for two hours per week guided by a group of staff members. They will be asked to give a presentation on any topic of their choice related to Geology and to engage in

discussion with the audience. A brief copy of their presentation also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on a technical topic. They will defend their presentation. Evaluation will be based on the technical presentation and the report and also on the interaction shown during the seminar.

TOTAL: 30 PERIODS

OUTCOMES:

CO1. The students will be traine to carryout geological fieldwork.
CO2. The students will be able to measure geological section and structures
CO3. The students will be prepare fieldwork reports.
CO4. The students will be trained to face an audience.
CO5. The students will be able to handle the situation during the group discussion and interviews.

MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	3	-	-	-
2	3	1	3	2	1	1
3	1	3	3	3	2	2
4	3	3	3	2	1	1
5	-	2	3	1	1	2
Avg.	**2.5**	**2.2**	**3.0**	**1.6**	**1.3**	**1.2**

AG3301 ECONOMIC GEOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To familiarize the students with the ore forming processes and mode of occurrences of ores and minerals
- To understand geological setting of Indian and global ore deposits
- To familiarize the students with National mineral policy and industrial uses of minerals

UNIT I PRINCIPLES OF ECONOMIC GEOLOGY 9

Introduction to ore and industrial minerals- Physical and optical properties of ore minerals-The nature and morphology of the principal types of ore deposit- Textures and structures of ore and gangue minerals- Classification of ore deposits Fluid inclusion studies-Wall rock alteration-Geothermometry, Geobarometry, Paragenitic Sequence, Zoning and dating of ore deposits.

UNIT II SURFACE AND INTERNAL PROCESSES 9

Surface processes: Principles of chemical weathering – lateritic deposits- clay deposits – calcrete-hosted deposits – supergene enrichment of Cu and other metals (Al, Ni and Fe) in near surface deposits – clastic sedimentation and heavy mineral concentration – placer deposits – chemical sedimentation – banded iron formations – phosphorites and evaporates.

Internal processes: Porphyry, skarn and hydrothermal mineralization-Mineralisation associated with (i) Ultramafic, mafic and acidic rocks, (ii) greenstone belts, (iii) komatiites, anorthosites and kimberlites and (iv) submarine volcanism

UNIT III GLOBAL TECTONICS AND METALOGENY 9

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

UNIT IV MINERAL DEPOSITS OF INDIA 9

Occurrence and distribution of various minerals used in industries- metalliferous deposits in India — base metals, iron, manganese, aluminums, chromium, nickel, gold, silver, molybdenum. Indian deposits of non-metals — mica, asbestos, barytes, gypsum, graphite, apatite and beryl-Gemstones, refractory minerals, abrasives and minerals used in glass, fertilizer, paint, ceramic and cement industries and building stones-Phosphorite deposits,Placer deposits, rare earth minerals- Strategic, critical and essential minerals-

UNIT V MINERAL ECONOMICS 9

India's status in mineral production-Changing patterns of mineral consumption, co-products and by-products-consumption, substitution and conservation of minerals-National Mineral Policy. Mineral Concession Rules. Marine mineral resources and Law of Sea.

TOTAL: 45 PERIODS

OUTCOMES

On completion of this course, the students are expected to be able to:

CO1: Distinguish various ore minerals and gangue.
CO2: Understand internal processes of economic ore formation
CO3: Comprehend surface processes and related ore deposits.
CO4: Understand global occurrence of economic minerals through geologic time
CO5: Have up-to-date knowledge on Indian ore deposits and National mineral policy

REFERENCES

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

MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	-	2	3	2	1	1
3	1	3	3	2	-	1
4	-	3	3	2	-	1
5	3	3	3	3	1	1
Avg.	**2.3**	**2.6**	**2.8**	**2.4**	**1.0**	**1.0**

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AG3302 **ENGINEERING GEOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- To provide the knowledge of geological investigation for site selection for engineering projects.
- To provide the knowledge to understand the recent trends in geotechnical engineering.
- To provide the knowledge on various engineering properties of rocks and their suitability for site selections for dam, tunnel, coastal structure constructions.

UNIT I SURFACE AND SUBSURFACE GEOLOGICAL INVESTIGATIONS 9

Field investigations-electrical and seismic geophysical methods in subsurface geological investigations for foundation engineering-Description of discontinuities-bed rock attitudes, thickness, calculation of True thickness and vertical thickness of bed rock-Geological information for slope stabilization.

UNIT II ENGINEERING PROPERTIES OF ROCKS AND SOILS 9

Elementary concepts of rock mechanics and soil mechanics. Concepts of stress, strain, Mohr circle and failure theories. Rock description and engineering classification of rocks, Geological studies and evaluation in planning, design and construction of major civil structures. weathering and its significance in engineering site- Engineering properties of rocks and soils, RMR, RQD methods-determination of engineering properties in field and laboratory.

UNIT III GEOLOGICAL INVESTIGATIONS FOR DAMS&TUNNELS 9

Dams -geological investigations- suitability of site, geological profile from catchment area to Dam site- lithology, structures, topography, slope, drainage system- groundwater studies in reservoir sites-reservoir site investigations, siltation analysis-Geological investigations for soft rock and hard rock tunnels construction.

UNIT IV GEOLOGICAL INVESTIGATIONS FOR COASTAL DEVELOPMENT 9

Geotechnical problems related to foundation for bridge and building site investigations. Recent trends in geotechnical engineering. Geotechnical case studies of major projects in India. Coastal erosion and accretion process and its impact-Geological investigations for harbor construction-Coastal protection structures-Sea walls, bulk heads, groins, jetties.

UNIT V GEOTECHNICAL STUDIES OF MASS MOVEMENTS 9

Mass Movements with special emphasis on landslide and causes of hill slope instability. Geological considerations for monitoring of landslides. Seismic designs of buildings influence of geological condition on foundation and design of buildings.

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Students will understand the field investigation techniques
CO2: Students will able to understand the rock mechanics and soil mechanics and engineering properties of rocks and soils
CO3: Students will understand the importance of geological considerations in dams and tunnel site investigations
CO4: Students will understand the coastal processes and coastal protection structures
CO5: Students will able to understand the recent trends in geotechnical engineering

REFERENCES

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

6. Waltham, A.C. Foundations of Engineering Geology, Blackie Academic Professional Pub., IEd.,UK,1994.

MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	3	3	3	2	2
2	2	3	3	2		
3	3	3	3	3	1	1
4		2	3	3	2	2
5	3	3	3	2	1	1
Avg.	**2.8**	**2.8**	**3.0**	**2.6**	**1.5**	**1.5**

AG3303 HYDROGEOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To teach the occurrence and distribution of groundwater in various geological formations
- To educate on estimation of various aquifer parameters in the field
- To give knowledge on groundwater quality assessment and sources of contamination.

UNIT I GROUNDWATER OCCURRENCE AND DISTRIBUTION 9

Introduction and scope; hydrologic/water cycle; hydrographs; origin and source; distribution of groundwater; porosity and types; hydraulic conductivity and transmissivity; specific yield and specific retention; storage coefficient; aquifers – types of aquifers; groundwater occurrence in various geological formations.

UNIT II GROUNDWATER FLOW AND RESOURCES ESTIMATION 9

Darcy's law – validity of Darcy's law – hydraulic gradient; Field and laboratory tests to find out hydraulic conductivity; flow nets; homogeneity and heterogeneity; isotropic and anisotropic formations; Water budgeting - groundwater resources estimation – static and dynamic reserve.

UNIT III ESTIMATION OF AQUIFER PARAMETERS 9

General groundwater flow equations – steady and unsteady radial flow towards wells – confined and unconfined aquifers; effect of aquifer boundaries; estimation of aquifer parameters by recovery tests; slug tests; introduction to groundwater modelling techniques.

UNIT IV GROUNDWATER QUALITY EVALUATION 9

Physicochemical parameters of groundwater – major ions and trace elements; water quality standards; groundwater quality representation charts and diagrams; suitability of groundwater for various uses; calculation of ion balance error; sources of contaminants – geogenic and anthropogenic; radiation in groundwater; groundwater pollution vulnerability mapping; seawater intrusion – causes and remediation; Groundwater quality case studies.

UNIT V GROUNDWATER RESOUCES DEVELOPMENT 9

Well construction and completion - shallow and deep well design; horizontal wells; infiltration galleries and collector wells; rainwater harvesting and artificial recharge of groundwater; hydrogeology of India; land subsidence. Groundwater development case studies.

Attested

TOTAL: 45 PERIODS

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OUTCOMES:

On completion of this course, students are expected to:

1. Understand various types of aquifers and groundwater occurrence.
2. Compute groundwater flow and fluctuation and also groundwater resources.
3. Estimate aquifer parameters using various field methods.
4. Evaluate the suitability of groundwater for various needs.
5. Plan for groundwater resources development and management.

REFERENCES

1. Domenico P.A. and F.W. Schwartz, Physical and chemical hydrogeology. John Wiley 1997.
2. Fetter,C. W., Applied Hydrogeology, New York, Macmillan, 2001.
3. Freeze, R.A and Cherry, J.A, Groundwater, Prentice Hall, 1979
4. D. K. Todd and L. W. Mays, “Groundwater Hydrology,” 3rd Edition, John Wiley & Sons, Inc., New York, 2005.
5. Hiscock, K, Hydrogeology: Principles and Practice, Wiley-Blackwell, 2005
6. Goyal Manish Kumar, Engineering Hydrology, PHI Learning Pvt Ltd.2016

MAPPING OF CO’S WITH PO’S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	-	2	3	2	1	1
3	1	3	3	2	-	1
4	-	3	3	2	-	1
5	3	3	3	3	1	1
Avg.	**2.3**	**2.6**	**2.8**	**2.4**	**1.0**	**1.0**

AG3304 GEOSPATIAL TECHNOLOGY AND ITS PPLICATIONS L T P C
3 0 2 4

OBJECTIVES:

- To teach principles and concepts of Photogrammetry, Remote Sensing and visual interpretation of satellite images.
- To teach various GIS techniques, GPS measurements and digital image processing.
- To learn the applications of geospatial techniques in geological and geomorphological mapping and provide knowledge on role of geospatial techniques in geo-hazards and geo-environmental projects.

UNIT I PHOTOGRAMMETRY AND REMOTE SENSING 9 + 6

Introduction to aerial photography, Aerial and space borne platforms; Photogrammetry – principles and concepts, Scale of vertical aerial photography, Parallax and vertical exaggeration, Flight / Drone mission; Introduction to remote sensing; Types of remote sensing and types of satellites; Global and Indian space missions; Types of resolution; Multispectral and hyperspectral remote sensing; Scanning mechanism; Spectral signatures of natural and geologic features. Visual interpretation of satellite images – importance of image interpretation keys.

Hands on exercise: Study of Survey of India (SOI) toposheets available in different scales; Identification of various features in aerial photos and satellite images. Setting up of stereoscope, orientation of aerial photographs under a stereoscope.

UNIT II GEOGRAPHICAL INFORMATION SYSTEM 9 + 6

Types of maps, Map scale, Various georeferencing and map projection systems; Introduction to GIS. Various Components of GIS; Types of data – spatial and non-spatial data; Vector and raster data; Digitization and scanning; Geo database – data input – retrieval – data presentation; Buffering and overlay analysis; Edge matching and rubber sheeting; DEM / DTM and TIN models; Assigning ranks and weights for geologic studies.

Hands on exercise: Familiarization with GIS software packages**;** Georeferencing, Digitization and generation of thematic maps using GIS. Preparation of DEM and TIN Models.

UNIT III DGPS AND DIGITAL IMAGE PROCESSING 9 + 6

Introduction to GPS and DGPS, Global and Indian GPS programmes; Applications of GPS. Digital image processing - Pre-processing / image rectification and restoration, Image Enhancement techniques; Image classification – unsupervised and supervised.

Hands on exercise: Measurements using GPS and DGPS in the field, Familiarization with Image Processing softwares; Unsuprvised and Suprvised classification of satellite images;

UNIT IV GEOLOGICAL AND GEOMORPHICAL APPLICATIONS 9 + 6

Geospatial technology for lithological and structural mapping; Geomorphological mapping; Land use/land cover change detection; Mineral targeting, Groundwater prospecting and artificial recharge; Hydrocarbon exploration. Case studies for the above.

Hands on exercise: Preparation of geomorphological, geological and land use / land cover maps; Analysis of aerial photos and satellite images for mineral, groundwater and hydrocarbon explorations.

UNIT V GEOHAZARDS & GEO-ENVIRONMENTAL APPLICATIONS 9 + 6

Geospatial technology for Route alignment; Site selection for various geological engineering projects. Landslides and earthquake studies, Coastal erosion and Coastal Zone Management; Marine exploration; Surface water and groundwater pollution; Case studies for the above.

Hands on exercise: Landslide vulnerability mapping using geospatial technology; Interpretation of satellite data for various geo-hazards and geo-environmental projects. Ground truth / Field verification of maps features.

TOTAL: 75 PERIODS

OUTCOMES:

On completion of this course, the student can

CO1: Understand the techniques of acquisition of data using airborne and space borne platforms.
CO2: Prepare various thematic maps using GIS techniques.
CO3: Enhance the quality of satellite images to extract more details
CO4: Interpret satellite images for geological and geomorphological studies
CO5: Apply remote sensing, GIS and GPS for various geo-hazards and geo-environmental studies.

REFERENCES:

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

8. Bai Tian GIS Technology Application in Environmental and Earth Sciences, CRC press, Taylor and Francis group LLC. ISBN 13: 978-1-4987-7604-2. 2017.

MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	-	2	3	2	1	1
3	1	3	3	2	-	1
4	-	3	3	2	-	1
5	3	3	3	3	1	1
Avg.	**2.3**	**2.6**	**2.8**	**2.4**	**1.0**	**1.0**

AG3311 HYDROGEOLOGY LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To compute water budgeting and determine hydraulic conductivity in the lab.
- To predict groundwater flow, quality and fluctuation using software packages.
- To find out aquifer parameters from the pump test results.

UNIT I WATER BUDGETING AND GROUNDWATER RESOURCES ESTIMATION 12

Determination of porosity and hydraulic conductivity in lab – constant and falling head permeameters. Water budgeting; Groundwater resources and reserve estimation.

UNIT II GROUNDWATER FLOW PREDICTION 12

Groundwater flow prediction based on groundwater head – radial vectors to indicate groundwater flow – contours to represent groundwater head; Preparation of groundwater table elevation model using software packages.

UNIT III AQUIFER PARAMETERS ESTIMATION 12

Problems on groundwater flow to wells - steady and unsteady flow – confined and unconfined aquifers – recovery tests - estimation of transmissivity and storage coefficient of wells. Field visit for conducting pump tests.

UNIT IV GROUNDWATER MODELING 12

Exposure to groundwater modeling software packages – Boundary conditions, Calibration, Validation and Prediction

UNIT V GROUNDWATER QUALITY 12

Measurement of physicochemical parameters of groundwater using water quality kits; determination of ion balance error; preparation of various water quality representation diagrams and charts using different software packages; plotting spatial variation of groundwater quality parameters using software packages.

TOTAL: 60 PERIODS

OUTCOMES:

On completion of this course, students are expected to:

1. Estimate groundwater resources and reserve.
2. Prepare water table elevation model and groundwater flow patterns.
3. Estimate hydraulic conductivity, transmissivity and storativity.
4. Assess the level of groundwater pollution
5. Determine the applicability of groundwater for various needs.

Attested

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REFERENCES

1. Fetter,C. W.,Applied Hydrogeology, New York,Macmillan, 2001.
2. D. K. Todd and L. W. Mays, "Groundwater Hydrology," 3rd Edition, John Wiley & Sons, Inc., New York, 2005.
3. Hiscock, K, Hydrogeology: Principles and Practice, Wiley-Blackwell, 2005

MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	2	3	1	1
2	-	2	3	2	1	1
3	1	3	3	2	-	1
4	-	3	3	2	-	1
5	3	3	3	3	1	1
Avg.	**2.3**	**2.6**	**2.8**	**2.4**	**1.0**	**1.0**

AG3312 **GEOLOGICAL FIELD TRAINING/ INSTITUTIONAL / INTERNSHIP TRAINING** **L T P C 0 0 2 1**

OBJECTIVES:

- To train the students in the field work so as to have a firsthand knowledge
- To understand the preactical problems related to geology in carrying out field and industrial geological tasks.
- To develop skills in facing and solving field problems

SYLLABUS

The students individually undertake training in reputed industries during the summer vacation for a specified period of three to four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

TOTAL: 30 PERIODS

OUTCOMES

CO1. Student will be able to choose the field of training
CO2. Student will be able to develop their skills work in any types of geological field
CO3. Student will be able to work on various laboratories.
CO4. Gain knowledge on analytical instrumentation
CO5. Student will be able to prepare the geological training/internship reports individually.

MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	3	0		0
2	3	1	3	2	1	1
3	1	3	3	3	2	2
4	3	3	3	2	1	1
5		2	3	1	1	2
Avg.	2.5	2.2	3.0	1.6	1.3	1.2

AG3401 **MINING GEOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- To teach students on surface and underground mining methods
- To teach ore reserve estimation and ore body modeling.
- To teach them mineral prospecting, sampling and drilling techniques.

UNIT I MINERAL MAPPING **9**

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

UNIT II SAMPLING AND ASSAYING **9**

Macro/Micro Economic Considerations - Sampling – Types - Sampling Quantity-Spacing, Sampling error of Mean-Sample Data Processing-Interpretation- Drilling – surface drilling and underground drilling, definition drilling – Core, Diamond Drilling arrangement - Core logging, Preparation of Slice Plan-Maximising Drill Data Vis-à-vis Cost of Drilling-Preparation of Assay Plans/Sections - Cutoff Grade- ROM Grade, Determination of Mineable Limits, Breakeven Stripping Ratio-Ultimate depth-Pit Limit for Different cut-off.

UNIT II ORE RESERVE ESTIMATION **9**

Mineral Classification, Mineral Resources and Reserves – Types and Classification - Geological / Techno-economic Considerations in Reserve Classifications – Feasibility Report preparation - Reserve Estimation Methods – Triple Axial System – UNSC, Simple problems

UNIT IV OREBODY MODELLING **9**

Integrating Surface/ Underground mapping - Drilling Sampling to evolve a 3D Model – Level plan and slice plan, Fold/Fault Interpretation from Maps and Bore hole Data – Software Applications in 3D orebody modelling including GIS

UNIT V SURFACE AND UNDERGROUND MINING METHODS **9**

Surface Mining – Development of Bench Mining-Concept-Height/Width/Slope of Benches- Manual and Mechanised Strip/Terrace/Open pit Mining - Initial Mine Cut-Production per Blast, Typical Opencast Layout - Placer and Alluvial Mining – Underground Mining - Various Coal and Metal Mining Methods - Stoping/Development activities – Cut and fill, Block caving – Solution mining and its importance.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Carryout individual mine survey using surveying methods
CO2. Do sampling and prepare slice plan.
CO3. Carryout ore reserve estimation for surface and underground deposits.
CO4. Gain knowledge on surface mining methods
CO5. Understand underground mining methods

REFERENCES

1. Beth Thorpe, Mining Geology-Exploration and Management, Syrawood Publishing House, 2016.
2. Robert Stevens, Mineral Exploration and Mining Essentials, Pakawau GeoManagement Inc, Reprinted, 2012.
3. R.N.P.Arogyswamy, Courses in mining geology. Oxford-IBH, New Delhi, 1994.
4. McKinstry, H.E. Mining Geology, Newyork: Prentice-Hall, Inc. 1970.
5. Deshmukh, D.J.. Elements of Mining Technology, Dhanbad: Vidyaprakshan, 1998.

6. Bruce, A.K.. Surface Mining, Colarodo: Society for Mining, Metallurgy and Exploration Inc. 1990.
7. Hustrulid, H.V and Mark Kuchta, Open Pit Mine Planning and Design Fundamentals, Brookfield USA: A.A Balkema, 1995.
8. Hartman. Howard L, Introduction to Mining Engineering, New York: John Wiley and Sons, 1987.
9. W.C.Peters, Exploration and mining geology. John Wiley & Sons, New York, 1987.

MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	3	3	3	2	2
2	2	3	3	2	-	-
3	3	3	3	3	1	1
4	-	2	3	3	2	2
5	3	3	3	2	1	1
Avg.	**2.8**	**2.8**	**3.0**	**2.6**	**1.5**	**1.5**

AG3411 **PROJECT WORK** **L T P C**
0 0 24 12

OBJECTIVES:

- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature
- To develop the methodology to solve the identified problem
- To train the students in preparing project reports and to face reviews and viva-voce examination.

SYLLABUS

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the Head of the department. The students will be evaluated through a viva-voce examination by a panel of the examiners including one external examiner.

TOTAL: 360 PERIODS

OUTCOMES:

CO1. Students will be able to conceptual and identify a scientific problem
CO2. Able to find a suitable methodology
CO3. Can do individual fieldwork and sampling related to the project work
CO4. Students can develop the skills for data analysis and interpretation
CO5. Students will be able to write a compile their findings and produce a report.

Attested

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MAPPING OF CO'S WITH PO'S

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	3	2	3	0		0
2	3	1	3	2	1	1
3	1	3	3	3	2	2
4	3	3	3	2	1	1
5		2	3	1	1	2
Avg.	**2.5**	**2.2**	**3.0**	**1.6**	**1.3**	**1.2**

AG3001 APPLIED HYDROGEOCHEMISTRY L T P C
3 0 0 3

OBJECTIVES:

- To study the chemical properties of Groundwater.
- To understand various reactions and ion exchange processes that affect quality of water.
- Also to understand interactions between water and minerals in surface and subsurface formations

UNIT I GROUNDWATER SAMPLING AND EQUILIBRIUM 9

Chemical parameters – sampling and influence of well conditions- sampling for environmental isotopes – pore water sampling – Chemical processes in relation to hydrogeology - calculation of parameters – representation of results – thermodynamics – law of mass action - activity coefficients - saturation indices with respect to common minerals

UNIT II CARBONATE REACTIONS 9

Carbonate system - solution – precipitation – role of pH and alkalinity – carbonic acid and carbonate equilibrium constants – case studies

UNIT III REDOX REACTIONS 9

Oxidation and reduction – half reactions – balancing of reactions – examples in groundwater – Eh and pe – pH and Eh – stability of water – mineral stability diagrams

UNIT IV ION EXCHANGE PROCESSES 9

Adsoption – absorption – surface complex – reasons for surface charge – isotherms – distribution coefficient – ion exchange – cation exchange capacity – case studeis.

UNIT V SILICATE WEATHERING 9

Hydrochemical sequences – major – ion evolution – groundwater in crystalline rocks – hydrochemical processes during flow – clay minerals and changes in water chemistry due weahtering

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1: Groundwater sampling and calculation of chemical parameters.

CO2: Have better understanding on role of carbonate and Redox reactions on mineral stability

CO3: Comprehend the ion exchange processes and distribution of coefficients
CO4: Gain knowledge on role of hydrogeochemical sequences
CO5: Understand the relationship between clay minerals and water chemistry during weathering

REFERENCES

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

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	**3**	**2**	**2**	**3**	**1**	**1**

AG3002 NATURAL DISASTER AND MITIGATIONS L T P C 3 0 0 3

OBJECTIVES:

- To teach characteristics of natural hazards.
- To teach mitigation methods for natural hazards.
- To provide knowledge on assessment and management of natural hazards.

UNIT I DISASTER PHENOMENON 9

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

UNIT II MITIGATION 9

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

UNIT III ASSESSMENT 9

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

UNIT IV MANAGEMENT 9

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

UNIT V CASE STUDIES AND ADVANCED TOOLS 9

Post disaster review – role of remote sensing and GIS –National and state level case studies on various disasters.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Gain knowledge on natural hazards and their characteristics
CO2. Have better understanding on geological and hydrological hazards
CO3. Appreciate various mitigation techniques.
CO4. Carryout risk assessment and vulnerability mapping
CO5. Understand the role of remote sensing and GIS in natural hazard risk reduction.

REFERENCES:

1. Nick Carter, W. Disaster management, A Disaster manager's Handbook, Publisher: Asian development bank, Manila, 1992.
2. Mitigating natural disasters: Phenomena, effects and options, a Manual for policy makers and planners. Publisher: United Nations, Hew York, 1991.
3. Edward A. Keller, DeVecchio. Natural Disasters: Earth's Processes as Hazards, Disasters and Catastophes, Routledge, 3rd Edition, 2011.
4. Harsh K. Gupta, Disaster Management, Indian National Science Academy, ISBN 8173714568, 788173714566, 2006 second Edition, 152 Pages.
5. Ghanshyam Singh and Sandip Bhandari, Disaster Management, Gullybaba Publishing House (P) Ltd; 1st edition (2012), ISBN-13: 978-9381066492.

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	**3**	**2**	**2**	**3**	**1**	**1**

AG3003 ENVIRONMENTAL GEOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To provide the knowledge on Geology and environment, impacts due to mineral, soil and land degradation.
- To expose the students to assess various geological environments like terrestrial, aquatic, etc.
- To provide knowledge and guidelines to assess and plan various environmental issues.

UNIT I GEOLOGIC ENVIRONMENTS 10

Man-land relationship, Concept and scope of environmental geology –Geological characteristics of various environmental regimes – fluvial, coastal, marine, Aeolian, desert, and glacial. - Landforms as ecosystem units – Geomorphic controls on biodiversity and its conservation.

UNIT II TERRESTRIAL ENVIRONMENT 10

Environmental degradation due to mining and ore beneficiation – Air Pollution - sources of pollution - pollution due to dust and waste disposal-Mining – opencast – underground - disposal of industrial

and radio-active waste - dumping stacking – rehandling – management - mineral processing - tailing ponds - acid mine drainage – siltation - soil and mineral resources and their conservation-National and International standards- impact and management – Indian case studies

UNIT III AQUATIC ENVIRONMENT 8

Carbonate system and pH control. Water-rock interaction and solubility of minerals; incongruent dissolution of primary silicates; mass balance approach to weathering. Geological factors influencing the formation of surface, groundwater and marine Waters – geological basis of groundwater, surface and marine water pollution and management with Indian case studies

UNIT IV GEOLOGY IN ENVIRONMENTAL PLANNING AND MANAGEMENT 8

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

UNIT V GEOLOGICAL HAZARDS AND GLOBAL ENVIRONMENTAL CHANGE 9

Resources – renewable and non-renewable. Natural and man-made hazards; Causes, types, Mitigation and Management of earthquakes, landslides, tsunami and volcanoes**;** Causes and Indicators of global environmental change

TOTAL: 45 PERIODS

OUTCOMES:

CO1. Students will understand the earth processes and landforms
CO2. Students will able to understand the terrestrial environment issues
CO3. Students will learn about geological factors influencing the aquatic environment
CO4. Students will understand the roll of geology in environmental planning and management
CO5. Students will able to understand the mitigation and management on geological hazards

REFERENCES

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

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	3	2	2	3	1	1

AG3004 GEOPROSPECTING L T P C
3 0 0 3

OBJECTIVES:

- To familiarize the students with geological mapping techniques.
- To teach geophysical methods of prospecting for ores and minerals
- Also to provide knowledge on geochemical prospecting methods.

UNIT I GEOLOGICAL PROSPECTING 9

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

UNIT II ELECTRICAL METHODS 9

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

UNIT III SEISMIC METHODS 9

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

UNIT IV MAGNETIC AND GRAVITY METHODS 9

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

UNIT V GEOCHEMICAL PROSPECTING 9

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

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Carryout individual field study using geological mapping techniques.
CO2. Collect, process and analyse data using various geophysical methods
CO3. Explore the subsurface using geophysical methods
CO4. Gain knowledge on geochemical methods
CO5. Do accurate interpretation of data and locate economical ore reserves.

REFERENCES

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

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	**3**	**2**	**2**	**3**	**1**	**1**

AG3005 GROUNDWATER CONTAMINATION L T P C
3 0 0 3

OBJECTIVES:

- To study about the sources of groundwater and its parameters
- To understand various contaminations and its sources.
- To gain knowledge on remediation methods.

Attested

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UNIT I INTRODUCTION **9**

Groundwater occurrence and flow – types of porosity – transmissivity and storage coefficient - significance in groundwater contamination - sources of contamination – landfills

UNIT II TYPES OF CONTAMINATION **9**

Types – point and non point sources – natural and anthropogenic - organic and poly aromatic compounds – biological – other sources –gasoline spills on the water table - chlorinated solvent spills which sink

UNIT III IDENTIFICATION OF CONTAMINATION **9**

Application of electrical conductivity measurement for soil and groundwater contamination - Application of Ground Penetration Radar and other methods

UNIT IV TRANSPORT PROCESS **9**

Advection, dispassion and diffusion-sorption, biodegradation, transformation, retardation and attenuation of solutes – radionuclide transport

UNIT V REMEDIATION **9**

Waste site characterization-Geochemical modelling-Modeling concepts -Thermodynamics - groundwater quality - Emerging remediation methods, including surfactant and co-solvent soil flushing

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Comprehend groundwater occurrence and its parameters.
CO2. Have better understanding various contaminants of groundwater and their sources
CO3. Use geophysics methods to delineate contaminated sites of soil and groundwater.
CO4. Gain knowledge contaminant transport due to groundwater
CO5. Evaluate and suggest remediation for contaminated sites.

REFERENCES:

1. Philip B. Bedient, Hanadi S.Rifai and Charles J. Newll Ground Water Contamination: Transport and Remediation (2nd Edition) , 1999.
2. Fetter, C.W., Contaminant hydrogeology (2nd Edition), 2008.
3. Geophysics study committee., Groundwater Contamination:National Academy Press., Washington D.C ,1984.
4. Michael J. Barcelona., Contamination of Groundwater: prevention, assessment, restoration., Noyes data corp., 1990.
5. Reza M. Khanbilvardi., John Fillos., Groundwater hydrology, contamination and remediation., Science publication, 1986

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	**3**	**2**	**2**	**3**	**1**	**1**

Attested

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AG3006 **INDUSTRIAL AND ECONOMIC ORES** **L T P C**
3 0 0 3

OBJECTIVES:

- To study the economic importance of minerals and resources
- To teach mining project evaluation and mineral conservation.
- To provide knowledge on mineral policies and environmental protection.

UNIT I ECONOMICS IN MINERAL EXPLORATION 9

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

UNIT II MINERAL/MINE ECONOMICS AND FINANCE 9

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

UNIT III MINERAL PROJECT EVALUATION 9

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

UNIT IV MINERAL CONSERVATION 9

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

UNIT V MINERAL POLICIES AND ENVIRONMENT 9

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

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Understand the economics involved in mineral exploration
CO2. Have better knowledge on finance and economics of mine operation and production .
CO3. Comprehend mineral project evaluation
CO4. Adopt methods to conserve minerals and resources
CO5. Understand the national mineral policy and environmental assessments.

REFERENCES

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

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	**3**	**2**	**2**	**3**	**1**	**1**

Attested

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AG3007 APPLIED MICROPALAEONTOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To study the microfossils and their various types
- To understand different calcarious microfossils belong to different environment.
- To understand siliceous microfossils their role in sequence and biostratigraphic studies

UNIT I INTRODUCTION 9

Introduction to Micropaleontology- scope. Relationship of micropaleontology with ocean sciences; Modern field and laboratory techniques in the study of microfossils (collection, sampling and processing techniques, scanning electron microscopy and mass spectrometry);

UNIT II CALCAREOUS MICROFOSSILS 9

(i) Foraminifera - Benthic foraminifera, Planktic foraminifera, their modern biogeography, outline of morphology, significance in Cenozoic oceanic biostratigraphy and paleoceanographic, paleoclimatic interpretations.
(ii) Ostracoda - outline of morphology and wall structure, their significance in environmental studies and oceanic biostratigraphy.
(iii) Pteropoda - a brief introduction, application of pteropods.

UNIT III SILICEOUS MICROFOSSILS 9

Siliceous Microfossils: Radiolaria, diatoms and silicoflagellate - outline of morphology, modern biogeography, their environmental significance and application in biostratigraphy. Phosphatic Microfossils: Conodonts - outline of morphology, paleoecology, geological significance and biological affinities. Introduction to Organic walled microfossils and their biostratigraphic and palaeoenvironmental significance.

UNIT IV NANNOFOSSILS AND PTEROPODS 9

Calcareous nannofossils - outline of morphology, modern biogeography and their application in oceanic biostratigraphy and paleoceanographic, paleoclimatic reconstructions; Pteropoda - a brief introduction, application of pteropods.

UNIT V MICROFOSSILS AND ITS APPLICATIONS 9

Study of microfossils from Precambrian- Quaternary; applications – age determination, paleofacies; Interpretation of tectonics from micro faunal evidence. A brief account of the concepts and methods for the development of micropaleontological indicators useful in reconstruction of history of past, environmental changes and biostratigraphic correlation. Uses in coal and oil exploration.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Understand scope of micro fossils in oil exploration.
CO2. Distinguish and identify various calcarious micro fossils
CO3. Identify nannofossils and peteropods.
CO4. Individually collect and identify microfossils, spores and pollens
CO5. Gain knowledge on role of microfossils in oil exploration

REFERENCES

1. P. K. Saraswati and M. S. Srinivasan (2016): Micropaleontology: Principles and Applications, Springer.
2. Arnold (2002): Quaternary Environmental Micropaleontology (Ed. Simon K. Haslett), Oxford
3. B. U. Haq and A. Boersma (1998). Introduction to Marine Micropaleontology, Elsvier.
4. Bignot, G., Grahm and Trottman (1985): Elements of Micropaleontoogy, London.
5. Jones, T.P. and Rowe, T.P. (1999): Fossil plants and spores, Modern Techniques, Geological Soc. of London.

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	**2**	**2**	**3**	**1**	**1**
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	**3**	**2**	**2**	**3**	**1**	**1**

AG3008 **MEDICAL GEOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- To study the chemical constituents of earth materials and their link to health
- To understand various natural toxicants and contaminants.
- To understand various techniques and tools to identify natural toxicity

UNIT I INTRODUCTION **9**

The Foundations of Medical Geology, Geochemical Classification of the Elements, Contributions to Medical Geology from Public Health and Environmental Medicine, Development of Medical Geology.

UNIT II PATHWAYS AND EXPOSURES **9**

Volcanic Emissions and Health, Radon in Air and Water, Arsenic in Groundwater and the Environment, Fluoride in Natural Waters, Water Hardness and Health Effects, Bioavailability of Elements in Soil, Selenium Deficiency and Toxicity in the Environment, Soils and Iodine Deficiency.

UNIT III GEOLOGY HUMAN HEALTH **9**

Natural Distribution and Abundance of Elements, Anthropogenic Sources, Uptake of Elements from a Chemical Point of View, Uptake of Elements from a Biological Point of View, Biological Functions of the Elements ,Geological Impacts on Nutrition, Biological Responses of Elements

UNIT IV GEOPATHOLOGY AND TOXICOLOGY **9**

Environmental Epidemiology, Environmental Medicine, Environmental Pathology, Toxicology, Speciation of Trace Elements. Geophagy and the Involuntary Ingestion of Soil, Natural Aerosolic Mineral Dusts and Human Health, The Ecology of Soil-borne Human Pathogens, Animals and Medical Geology

UNIT V TECHNIQUES AND TOOLS **9**

Mapping Geological factors for human health using RS and GIS - Investigating Vector-Borne and Zoonotic Diseases, Mineralogy of Bone, Inorganic and Organic Geochemistry Techniques, Histochemical and Microprobe Analysis in Medical Geology.

TOTAL: 45 PERIODS

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COURSE OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Understand the characteristics of natural materials and their link to public health
CO2. Have better understanding on pathways and exposures to natural toxicity
CO3. Appreciate geology and human health relationship.
CO4. Gain knowledge on natural toxicology and geopathology
CO5. Use different techniques to enable probing of diseases in medical geology

REFERENCES:

1. Miomir M. Komatina, Effects Of Geological Environments On Human Health, Burgess Publishers - 2004
2. Olle Selinus, B. J. Alloway, Essentials of medical geology: impacts of the natural environment on public health, Lewis Publishers, USA - 2005
3. C. B. Dissanayake, Rohana Chandrajith, Introduction to Medical Geology , Lewis Publishers, USA - 2009
4. Rolf O. Hallberg, Medical geology , Environmental geology – Burgess Publishers, 2007
5. Miomir Komatina, Base of medical geology , Lewis Publishers, 2007.

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	**3**	**2**	**2**	**3**	**1**	**1**

AG3009 MARINE GEOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To understand the Ocean features, geological resources, Ocean environment, and Ocean geology.
- To understand the exploration and exploiting methods
- To understand the various instrumentations and its techniques.

UNIT I PHYSICAL FEATURES OF THE OCEAN 9

Introduction to Geological Oceanography. Classification of coasts. Ocean floor morphology. Description of Continental shelf, slope, rise and abyssal plains. Mid-oceanic ridge, Subduction zone and description of trenches, Ocean basins, Island arcs, Hot spots, Transform faults and Triple junction. Plate tectonics and Neotectonic processes.

UNIT II OCEANIC CRUST, SEDIMENTS 9

Morphologic and tectonic domains of the ocean floor. Structure, composition and mechanism of the formation of oceanic crust. Ocean sediments, classification, digenesis, Ocean tectonics.
Factors controlling the deposition and distribution of oceanic/marine sediments - Biogenous, Cosmogenous, Hydrogenous, Terrigenous and Authigenic.

UNIT III OCEAN RESOURCES 9

Classification of marine mineral deposits. Origin and depositional system of marine resources; beach placers, shelf deposits, deep ocean Phosphatic, Polymetallic nodules, sulfate deposits, hydrocarbon deposits, Ocean-energy resources, Tidal energy-potential, Wave energy-potential, Ocean Thermal Energy Conversion (OTEC), Sea water as a resource.

UNIT IV OCEANOGRAPHIC INSTRUMENTATIONS 9

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

UNIT V OCEAN POLLUTION AND LAW OF THE SEA 9

Concept of sea level changes, physical and chemical properties of seawater. Marine pollution-pathways, residence time, pollutants in the marine environment. Law of the sea, Law of the Sea Treaty: EEZ. Fundamentals of Remote sensing applications to ocean science.

TOTAL: 45 PERIODS

OUTCOMES:

CO1. Students will understand the physical features of the ocean
CO2. Students will able to understand the morphologic and tectonic domains of the ocean floor
CO3. Students will learn about the various ocean resources
CO4. Students will understand the various oceanographic instrumentations used for marine exploration
CO5. Students will able to understand the law of the sea

REFERENCES

1. J.J. Bhatt. Oceanography – Exploring the Planet Ocean. D. Van. Nostrand Company, New York, 1994.
2. Shepard, F. P. Submarine Geology, Harper and Row Publ. New York, 1994.
3. Kerth. S, Ocean Science, John Wiley and Sons. Inc. New York. 1996.
4. James, K, Marine geology Prentice Hall, Inc. Englewood Clifs. N. J. 07632., 1981.
5. Eric. C. Bird Coasts: An Introduction to Coastal Geomorphology, III ed. Basil Black well Publ. 1984.
6. Suzy Bullock, Marine Geology,2017
7. Jon Erickson, Marine Geology: Exploring the New Frontiers of the Ocean, Facts On File Inc; Revised edition , 2002

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	3	2	2	3	1	1

AG3010 MINERAL EVALUATION AND MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To provide information on exploration of mineral and ore petroleum deposits,
- To teach methods of ore reserve estimations, mineral economics and feasibility studies,
- To describe mineral processing and beneficiation and national mineral policies.

UNIT I PRE FEASIBILITY STUDIES 9

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

UNIT II MINE MINERAL ECONOMICS 9

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

UNIT III MINERAL PROJECT FEASIBILITY 9

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

UNIT IV MINERAL PROCESSING/BENEFICIATION 9

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

UNIT V MINERAL POLICIES 9

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

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Carryout pre-feasibility studies on mineral prospecting.
CO2. Have better understanding of mine mineral economics
CO3. Evaluate and do feasibility studies for operating mines.
CO4. Gain employment in mineral mining and beneficiation industries
CO5. Carryout strategic studies for sick mineral based industries

REFERENCES:

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

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	3	2	2	3	1	1

AG3011 **NUCLEAR ISOTOPE GEOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- To study the radioactive elements and different dating methods
- To understand stable isotopes and their use in Geochronology
- To teach on isotopes and their significance in geological studies.

UNIT I INTRODUCTION AND THE PHYSICS OF THE NUCLEUS 9

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

UNIT II ISOTOPOES IN GEOCHRONOLOGY 9

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

UNIT III STABLE ISOTOPE GEOCHEMISTRY 9

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

UNIT IV STABLE ISOTOPES AND APPLICATIONS IN PALAEOCLIMATE STUDY 9

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

UNIT V CARBON ISOTOPE AND PETROLEUM GEOCHEMISTRY 9

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

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Understand the radiogenic isotope geochemistry.
CO2. Have better understanding of isotopes in geochronology
CO3. Appreciate role of stable isotopes in geological studies
CO4. Gain knowledge on stable isotopes and their application for paleoclimate studies
CO5. Understand the role of carbon isotopes in oil exploration

Attested

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REFERENCES

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

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	3	2	2	3	1	1

AG3012 OIL EXPLORATION AND PRODUCTION L T P C
3 0 0 3

OBJECTIVES:

- To teach prospecting methods for oil exploration.
- To teach reserve estimation for oil production
- To provide knowledge on logging and reservoir properties.

UNIT I SEISMIC PROSPECTING 9

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

UNIT II RESERVE ESTIMATION AND DRILLING OPERATION 9

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

UNIT III DRILLING MUD 9

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

UNIT IV CASING AND CEMENTATION 9

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

UNIT V WELL LOGGING RESERVOIR ENGINEERING AND PRODUCTION 9

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

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Understand the seismic method of prospecting for Oil.
CO2. Carryout reserve estimation and understand drilling operations.
CO3. Gain knowledge on drilling mud and its properties.
CO4. Understand procedure involved in casing and cementation
CO5. Comprehend well logging methods and reservoir engineering.

REFERENCES

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

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	3	2	2	3	1	1

AG3013 ORE GEOLOGY AND MINERAL TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To teach optical properties and identification ore minerals.
- To provide knowledge on geothermometry studies.
- To teach ore mineral beneficiation methods.

UNIT I ORE MICROSCOPY 9

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

UNIT II ORE FABRICS 9

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

UNIT III FLUID INCLUSION 9

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

UNIT IV MINERAL TECHNOLOGY 9

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

UNIT V MINERAL BENEFICATION 9

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

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Identify minerals under reflected light.
CO2. Classify minerals using ore textures and structures.
CO3. Carryout geothrmo-metry studies.
CO4. Gain knowledge on mineral dressing processes
CO5. Understand the mineral beneficiation methods.

REFERENCES

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

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	3	2	2	3	1	1

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AG3014 **PLANETARY GEOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the concepts of planetary science and Geology.
- To provide information on inner planets of the solar system
- To teach planetary remotesensing

UNIT I INTRODUCTION TO PLANETARY SCIENCE 9

The sun- vital statistics of the sun- -Solar system - origin - physics, chemistry, and the surface features of the solid bodies in the solar system; Solar system. -Celestial sphere- the growth of the geocentric system- physical properties of objects in the solar system.

UNIT II PLANETS 9

Physical properties- optical properties- rotation and magnetic field-surface temperature. Surface features of the terrestrial planets; Inner planets- Geological phenomena- tectonic, volcanic, impact cratering, eolian, fluvial, glacial and possibly lacustrine and marine processes; Outer planets – formation and evolution processes –satellite-characteristic features.

UNIT III EARTH AND MOON 9

The earth: Planetary evolution- gross properties – solar terrestrial relations- earth in space-interior-geologic process; Moon-origin- basic facts- telescopic studies - internal structure-surface features-environment- surface composition and mineralogy and atmospheric conditions

UNIT IV ASTEROIDS-METEORITES- COMETS 9

Classification-physical and chemical properties, difference between asteroids-comets- meteors-geochemistry- relationship between earth and meteorite geochemistry; satellites- medium, small and tiny their- geology, interior, surface properties, atmosphere and potential for life.

UNIT V PLANETARY REMOTE SENSING 9

Study of planetary images, and construction of geological maps from orbital images and Rover (insitu); planetary data formats-Missions to - Moon- Mars-Venus- for geological exploration; Lunar return samples – Apollo-Luna.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Understand the Planetary science.
CO2. Have better understanding of planets and their geomorphologic features
CO3. Comprehend the knowledge on earth and moon and their properties
CO4. Gain knowledge on asteroids, meteorites and comets
CO5. Understand planetary remote sensing and its applications.

REFERENCES:

1. Gunter Faure & Teresa M. Mensing. 2007. Introduction to planetary science: the Geological perspective, Publisher Springer-Verlag New York.
2. Imke de Pater and Jack J. Lissauer. 2001. Planetary Sciences, Published by Cambridge University press.
3. A.M. Davis 2003. Meteorites, Comets, And Planets, Published by University of Chicago, IL, USA.
4. Grant H. Hieken, David T. Vaniman, Bevan M. Frech. 1991**.** Lunar Sourcebook: A User's Guide to the Moon, ***Cambridge University Press.***
5. Nadine Barlow. 2008. Mars: An Introduction to its Interior, Surface and Atmosphere. Cambridge Planetary Science (No. 8)
6. Mary Chapman. 2007. The Geology of Mars .Cambridge Planetary Science (No. 5)
7. K D Abhyankar. 1999. Astrophysics of the Solar system, Universities Press, Hyderabad, India.
8. A.N. Rencz, 1999. Manual of Remote Sensing, Third Edition, Volume 3, John Wiley & Sons, USA.
9. Encrenaz, T.; Kallenbach, R.; Owen, T.; Sotin, C. 2005. The Outer Planets and their Moons. Springer Space Science Reviews.

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	3	2	2	3	1	1

AG3015 **QUATERNARY GEOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the Quaternary period and types of Quaternary deposits.
- To understand the Quaternary Study Techniques
- And to understand the Causes of Quaternary climate change.

UNIT I QUATERNARY IN INDIA **9**

Definition of Quaternary- Introduction to Quaternary deposits in India-Quaternary Stratigraphy – Oxygen Isotope stratigraphy, biostratigraphy and magnetostratigraphy. Quarternary soil types.

UNIT II CHRONOLOGY OF QUTERNARY SEDIMENTS **9**

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

UNIT III QUATERNARY CLIMATE AND EMERGENCE OF HOMINIDS **9**

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

UNIT IV GLACIAL AND INTERGLACIAL CYCLES **9**

Glacial-interglacial cycles-eustatic changes-proxy indicators of paleoenvironmental/ paleoclimatic changes - land, ocean and cryosphere (ice core studies)-Responses of geomorphic systems to climate, sea level and tectonics on variable time.

UNIT V NEOTECTONICS **9**

Tectonic geomorphology, neotectonics, active tectonics and their applications to natural hazard assessment with case studies.

TOTAL: 45 PERIODS

OUTCOMES:

CO1. Students will understand the Quaternary period and types of Quaternary deposits.
CO2. Students will able to understand the dating methods and correlation studies.
CO3. Students will learn about the manifestation of Quaternary climate change and current issues in climate change.
CO4. Students will understand the proxy indicators of paleoenvironmental/ paleoclimatic changes.
CO5. Students will able to understand the Neotectonics and deformation during the Quaternary Period.

Attested

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REFERENCES

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

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	3	2	2	3	1	1

AG3016 SEQUENCE STRATIGRAPHY L T P C
3 0 0 3

OBJECTIVES:

- To teach the sequence stratigraphy techniques and its applications
- To understand depositional systems and models.
- To teach stratigraphic cycle and biostratigraphic records.

UNIT I INTRODUCTION 9

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

UNIT II SEQUENCE STRATIGRAPHY 9

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

UNIT III SEQUENCE DEPOSITIONAL MODEL 9

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

UNIT IV STRATIGRAPHIC CYCLES 9

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

UNIT V SEQUENCE BIOSTRATIGRAPHY 9

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

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students expected to be able to:

CO1. Understand the scope of sequence stratigraphy.
CO2. Construct sequence framework.
CO3. Carryout litho-log analysis and mark sequence boundaries.
CO4. Gain knowledge techno-stratigraphic models
CO5. Understand the sequence biostratigraphy and its applications.

REFERENCES

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

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
4	3	3	3	3	1	1
5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	3	2	2	3	1	1

AG3017 GEOSTATISTICS L T P C
3 0 0 3

OBJECTIVES:

- To know the fundamental concepts of probability and probability distributions.
- To understand Non-linear and Non-parametric Geostatistics.
- To learn the Geostatistical simulations and applications.

UNIT I INTRODUCTION 9

Introduction to probability: Random experiments, Events, Sample space, Definitions of probability. Mathematical expectation, Moment generating and Characteristic functions. Binomial, Poisson, Normal, Gamma, Exponential, Hypergeometric, Multinomial Distributions.

UNIT II PROBABILITY DISTRIBUTIONS 9

Random variables, Discrete and Continuous Probability Distributions, Joint Probability Distributions, Conditional Probability Distributions. Ordinary Kriging: Definition, Point/Block estimation procedures, Techniques of semi-variogram model fitting; Geostatistical evaluation scheme; Effect of Nugget variance on kriged weights.

UNIT III NON-LINEAR AND NON-PARAMETRIC GEOSTATISTICS 9

Brief capsule on Non-linear and Non-parametric Geostatistics: Lognormal, Disjunctive and Multi-Gaussian, Indicator and Probability Kriging. Linear models-ANOVA. Linear and Multiple Regression. Introduction to Multivariate Techniques-PCA, Factor analysis, Linear discriminant analysis, Classifications.

UNIT IV GEOSTATISTICAL SIMULATION 9

Geostatistical Conditional Simulation – Theory, Chi-square, t, and F distributions, Definitions, Methods of calculations and applications; Screen Effect. Techniques and Applications with special reference to Simulated Annealing Simulation. Anisotropy, Non-Stationarity, Regularisation, Presence of Nugget Effect and Presence of Trend. Extension, Estimation and Dispersion Variances: Advanced Geostatistics Practical difficulties associated with Semi-variography.

UNIT V GEOSTATISTICAL APPLICATIONS 9

Optimization of exploration drilling, Calculation of mineral inventory, Establishment of grade-tonnage relations, Calculation of planning cut-off grade; Misclassified tonnages; Geostatistical grade control plan. Introduction to Statistical Inference, Sampling Distributions, Point and Interval estimation, Hypothesis testing involving one and two univariate populations.

TOTAL: 45 PERIODS

REFERENCES:

1. Ross, S. M. Introduction to probability and statistics for engineers and scientists. Elsevier, 2004.
2. Spiegel, M. R. Probability and Statistics, Schaums Outline Series, McGraw-Hill Intl., Singapore, Asian Student edn., 1982.
3. Davis, J. C. Statistics and data analysis in geology, John Wiley, 1986.
4. Walpole, R. E. and Myers, R. H. Probability and statistics for engineers and scientists, Macmillan Publ. Co., 1989.
5. Johnson, R. A. and Wichern, D. W. Applied multivariate statistical analysis, Prentice Hall Inc., New Jersey, 1982.
6. Hardle W. Applied multivariate statistical analysis. Springer, 2003.
7. Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, 2020.
8. Fundamentals of Applied Statistics by S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, 2020.

OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 : Solve the problems related to the probability.
CO2 : Work with probability distributions and Kriging.
CO3 : Apply non-linear and non-parametric geostatistics, regression and factor analysis.
CO4 : Perform geostatistical Simulations
CO5 : Use geostatistics for geoscience applications.

MAPPING OF CO'S WITH PO'S

CO	PO					
	3	2	2	3	1	1
1	-	2	3	2	1	1
2	1	3	3	2	-	1
3	-	3	3	2	-	1
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5	2.3	2.6	2.8	2.4	1.0	1.0
Avg.	3	2	2	3	1	1

Attested

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SF3015 **SOIL MECHANICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To impart knowledge to classify the soil based on index properties
- To assess their engineering properties based on the classification.
- To familiarize the students about the fundamental concepts of strength of soils

UNIT I SOIL CLASSIFICATION AND COMPACTION 9

Formation of soil - Soil description – Particle – Size shape and colour – Composition of gravel, sand, silt, clay particles – Particle behaviour – Soil structure – Phase relationship – Index properties – Significance – BIS classification system – Unified classification system – Compaction of soils – Theory, Laboratory and field tests – Field Compaction methods – Factors influencing compaction of soils.

UNIT II EFFECTIVE STRESS AND PERMEABILITY 9

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– Permeability interaction – Hydraulic conductivity – Darcy's law – Determination of Hydraulic Conductivity – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace's equation – Introduction to flow nets – Simple problems. (Sheet pile and wier).

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9

Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point land, Line land and udl) Use of New marks influence chart –Components of settlement –– Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. - √t and log t methods– e-log p relationship.

UNIT IV SHEAR STRENGTH 9

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

UNIT V SLOPE STABILITY 9

Stability Analysis - Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Method of slices – Fellenious and Bishop's method - Slope protection measures.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student is expected to be able to

CO1. Demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems
CO2. Show the basic understanding of flow through soil medium and its impact of engineering solution
CO3. Understand about the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation
CO4. Show the understanding of shear strength of soils and its impact of engineering solutions to the loaded soil medium and also will be aware of contemporary issues on shear strength of soils.
CO5. Demonstrate an ability to design both finite and infinite slopes, component and process as per needs and specifications.

REFERENCES:

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt.Ltd. New Delhi, 2010.

3. Das, B.M., “Principles of Geotechnical Engineering”. Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013.
4. Punmia, B.C., “Soil Mechanics and Foundations”, Laxmi Publications Pvt. Ltd. New Delhi, 2005.
5. Murthy, V.N.S., “Soil Mechanics and Foundation Engineering”, CBS Publishers Distribution Ltd., New Delhi. 2015
6. Gopal Ranjan and Rao, A.S.R., “Basic and Applied Soil Mechanics”, New Age Ltd. International Publisher New Delhi (India) 2006.

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Avg.	3	2	2	3	1	1

MA3001 DATA SCIENCE AND ANALYTICS **L T P C**
3 0 0 3

OBJECTIVES:

- To know the fundamental concepts of data science and analytics and data analysis using R.
- To understand various data modeling techniques and stream data.
- To learn the basic and advanced features of open source big data tools and frameworks.

UNIT I INTRODUCTION TO DATASCIENCE AND BIG DATA 9

Introduction to Data Science – Data Science Process – Exploratory Data analysis –Collection of Data – Graphical Presentation of Data – Classification of Data – Storage and Retrieval of Data, Big data: Definition, Risks of Big Data, Structure of Big Data – Web Data: The Original Big Data – Evolution Of Analytic Scalability – Analytic Processes and Tools – Analysis versus Reporting – Core Analytics versus Advanced Analytics– Modern Data Analytic Tools – Statistical Concepts: Sampling Distributions – Re-Sampling – Statistical Inference – Introduction to Data Visualization.

UNIT II DATA ANALYSIS USING R 9

Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis – Bivariate Analysis: Correlation – Regression Modeling: Linear and Logistic Regression – Multivariate Analysis – Graphical representation of Univariate, Bivariate and Multivariate Analysis in R: Bar Plot, Histogram, Box Plot, Line Plot, Scatter Plot, Lattice Plot, Regression Line, Two-Way cross Tabulation.

UNIT III DATA MODELING 9

Bayesian Modeling – Support Vector and Kernel Methods – Neuro – Fuzzy Modeling – Principal Component Analysis – Introduction to NoSQL: CAP Theorem, MongoDB: RDBMS Vs MongoDB, Mongo DB Database Model, Data Types and Sharding – Data Modeling in HBase : Defining Schema– CRUD Operations.

UNIT IV DATA ANALYTICAL FRAMEWORKS 9

Introduction to Hadoop: Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Introduction to MapReduce – Running Algorithms Using MapReduce – Introduction to HBase: HBase Architecture, HLog and HFile, Data Replication – Introduction to Hive, Spark and Apache Sqoop.

UNIT V STREAM ANALYTICS 9

Introduction to Streams Concepts – Stream Data Model and Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window.

TOTAL : 45 PERIODS

OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 : Convert real world problems to hypothesis and perform statistical testing.
CO2 : Work with big data platform and its analysis techniques.
CO3 : Select and employ mechanisms for tracking the software projects and maintaining quality.
CO4 : Write efficient MapReduce programs for small problem-solving methods.
CO5 : Implement suitable data analysis for stream data.

REFERENCES:

1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
2. Umesh R Hodeghatta, Umesha Nayak, “Business Analytics Using R – A Practical Approach”, Apress, 2017.
3. Anand Rajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
4. Nishant Garg, “HBase Essentials”, Packt, 2014.
5. Rachel Schutt, Cathy O'Neil, “Doing Data Science”, O'Reilly, 2013.
6. Foster Provost, Tom Fawcet, “Data Science for Business”, O'Reilly, 2013.
7. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley, 2014.

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