SRI VENKATESWARA UNIVERSITY:: TIRUPATI

SVU COLLEGE OF SCIENCES

DEPARTMENT OF GEOLOGY

Syllabus for M.Sc. GEOLOGY

Revised NEP syllabus

(w.e.f. the Academic Year 2024-2025)

Vision of the Department

The Geology department of the University seeks to provide the highest levels of education through continuous revision and expansion of our educational, research, and outreach programs in order to produce well-trained, competent, academic and professional geoscientists capable of responding to societal needs.

Mission of the Department

The Geology Department will develop in each student, critical thinking, enthusiasm, initiative and the necessary skills to become lifelong students of Earth Sciences. Emphasis will be placed on learning basic concepts and techniques through research, in an environment that promotes the development of professionals with social, cultural and humanistic sensibility as well as profound ethical values. In this way, the department will contribute to the enrichment of science and society through the creation and dissemination of new knowledge through scientific research.

About the Program

Sri Venkateswara University offers M.Sc., Geology programme, under Choice Based Credit System (CBCS). The CBCS enables the

students to select choice of subjects as per her /his interest and requirement. Acquiring knowledge in the related discipline is advantageous to the students. The CBCS program is framed in such a way that to impart more Knowledge in the field of Geological sciences.

Geology is an inter-disciplinary subject which enables to understand the earth processes and its treasures. It incorporates inputs from almost all science disciplines. Geologists are mainly involved in the exploration and extraction of natural resources viz., minerals, rocks, fossil fuel and water. In the fast growing world geologists will have to play a vital role in building the nation. Geologists can also engage in geological research, which has immense potential in the current scenario.

PROGRAMME OBJECTIVES

1. Education and Training: Provide an excellent preparation for a career in professional practice in industrial or environmental Earth Sciences, research in Geosciences, and specialist areas of other physical and natural sciences.

2. Communication Skills: Skills to communicate in written, numerical, graphical and verbal forms, in ways that are appropriate to different audiences and indifferent situations, ranging from scientific and industry reports, to group and individual oral presentations, and from blogs and outreach articles, to news articles and essays.

3. Critical Thinking: Acquire an understanding of the concept in geology and related disciplines and an ability to understand, integrate, and extend it so that all fundamental geological concepts are accessible.

4. Problem Solving: Skills to recognise and articulate a problem and then apply appropriate conceptual frameworks and methods to solve it.

5. Analytical Reasoning: A broad knowledge base in geology and related disciplines such as chemistry, physics, biology and mathematics needed to provide insight into these Earth processes

6. Research – Related Skills: Develop a research design, which has an appropriate problem related to earth sciences but may incorporate some scientific methods, ability to plan and write a research paper.

7. Self and Time Management: Time management skills are developed through interaction with the assessment process for submission of continuous assessment material.

8. Leadership and Team Work: Ability to contribute effectively to team objectives and interact productively with others both in project-related settings and in meetings.

9. Scientific Reasoning: Develop a systematic understanding of both core areas and advanced topics in the study of the Earth and view the Earth from new and challenging perspectives of time, space, process and pattern.

10. Digital Literacy: Ability of advanced Word skills and advanced GIS, statistics, databases, spreadsheets, digital drawing through online workbooks and workshops

11. Moral and ethical values: The degree to which every student engages with these themes will vary but it is important that all think especially about ethical issues.

12. Life – long Learning: Ability to blend academic and practical skills and to transfer such skills to other domains of one's life and work.

Program Educational Objectives (PEOs)

1. Creative, innovative educators and learning facilitators, who master geological Science, have the ability to use information technology to keep up with developments in geological science.

2. Reviewers of geological problems, both experimentally and/or literature studies and publish the results in scientific forums and journals.

3. Examiner of problems related to the earth sector (extraction, mitigation, and conservation) factual and applicable, providing solutions to these earth problems conceptually.

4. Planning and implementing staff in the exploration- production/extraction industry, and mitigation and conservation of geological resources.

5. Entrepreneurs whose business fields are related to commodities or equipment in the extraction, mitigation, and conservation of geological resources.

6. Staff to heads of agencies related to regulation, supervision, and policy makers in the extraction, mitigation and conservation of geological resources.

Program Educational Outcomes

1. To develop an in-depth knowledge and skills in qualitative and quantitative research methods through laboratory, field and web modes of learning.

2. Recognize the need for sustainable use of earth resources, and value environmental, indigenous and other community perspective on geological activities.

3. Apply geological knowledge and critical thinking skills to identify a problem and to describe a strategy for handling.

4. Synthesize geological data on arrange of spatial and temporal scales to make interpretations that allow for scientific uncertainty.

5. Work effectively and professionally in multidisciplinary teams as a member and a leader and be able to manage and analyze complex ethical issues.

Program Specific Outcomes (PSOs)

1. Learn the essential properties of Earth's components, including its core, mantle, asthenosphere, lithosphere, atmosphere, hydrosphere, and biosphere and also demonstrate mastery of the conceptual framework for understanding earth system processes and the development of earth's features overtime.

2. Acquiring geologic data in the field, laboratory, satellites and big data from data banks, analyzing and interpreting the data through application of scientific method.

3. Capable of applying advanced and current concepts and methods of the geosciences to formulate and solve complex geological problems.

4. Students are capable of understanding the impact of a geo- engineering solution in global and societal context.

5. Apply knowledge and techniques from allied fields, including mathematics, chemistry, physics, biology, geoengineering, and computing, to solve geological constraints in societal context.

DEPARTMENT OF GEOLOGY

Master of Sciences:

(With effect from 2024 - 2025)

The course of study and the scheme of Examinations

SEMESTER-I

S. No	Course	Code	Title of the paper	Hours	Credits	IAS	SE	Total
1		101	Crystallography & Mineralogy	4	4	30	70	100
2	Core	102	Igneous & Metamorphic Petrology 2 (A) Precambrian and Quaternary Geology – 2 (B)	4	3	25	50	75
3		103	Structural Geology & Geotectonics 3 (A) Natural Hazards and Disaster Management 3 (B)	4	3	25	50	75
4	Practical - I	104	Igneous & Metamorphic Petrology 2 (A) and Structural Geology & Geotectonics 2(B)	6	2	15	35	50
5	SOC	105	Hydrogeology and Engineering Geology 1 (A) Computer Applications and Geostatistics 1 (B)	4	3	25	50	75
6		106	Field Geology and Surveying 2 (A) Geological Mapping Techniques 2 (B)	4	3	25	50	75
7	Practical – II	107	Hydrogeology and Engineering Geology 1 (A) and Field Geology and Surveying 2 (A)	6	2	15	35	50
			Total	**36**	**20**	**160**	**340**	**500**
8	Audit Course	109	Indian Knowledge Systems-1	4	0	100	0	0

SEMESTER-II

S. No	Course	Code	Title of the paper	H	Credits	IAS	SEM	Total
1		201	Stratigraphy and Indian Geology - 4	4	4	30	70	100
2	Core	202	Sedimentology and Sedimentary Petrology - 5 (A)	4	3	25	50	75
			Sedimentary Basins of India – 5 (B)					
3		203	Geochemistry and Isotope Geology – 6 (A)	4	3	25	50	75
			Geodynamics – 6 (B)					
4	Practical - III	204	Sedimentology and Sedimentary Petrology - 5 (A) and Geochemistry and Isotope Geology – 6 (A)	6	2	15	35	50
5	SOC	205	Paleontology – 3 (A)	4	3	25	50	75
			Fuel Geology – 3(B)					
6		206	Geomorphology – 4 (A)	4	3	25	50	75
			Watershed Management – 4 (B)					
7	Practical – IV	207	Paleontology – 3 (A) and Geomorphology – 4(A)	6	2	15	35	50
8	OOTC	208	Open Online Transdisciplinary Course-1	--	2	100	--	100
			Total	**36**	**22**	**260**	**340**	**600**
9	Audit Course	209	Indian Knowledge Systems-2	4	0	100	0	0

SEMESTER-III

S. No	Course	Code	Title of the paper	Instruction hours per week	Credits	Internal assessment marks	End semester exam Marks	Total
1		301	Mining Geology - 7	4	4	30	70	100
2	Core	302	Remote Sensing and GIS – 8 (A) / Digital Image Processing – 8 (B)	4	3	25	50	75
3		303	Economic Geology and Indian Mineral Deposits – 9 (A) / Meteorology and Climatology – 9 (B)	4	3	25	50	75
4	Practical - V	304	Remote Sensing and GIS – 8 (A) and Economic Geology and Indian Mineral Deposits – 9 (A)	6	2	15	35	50
5	SOC	305	Mineral Exploration and Ore Beneficiation – 5 (A) / Dimensional Stones and Building Materials – 5 (B)	4	3	25	50	75
6		306	Water Resource Management – 6 (A) / Environmental Geology -6 (B)	4	3	25	50	75
7	Practical – VI	307	Mineral Exploration and Ore Beneficiation – 5 (A) and Water Resource Management – 6 (A)	6	2	15	35	50
8	OOTC	308	Open Online Transdisciplinary Course – 2	--	2	100	--	100
*	Seminar/tutorials /Remedial Classes and Quiz as part of internal assessment.			4	--	--	--	--
			Total	**36**	**22**	**260**	**340**	**600**

SEMESTER - IV								
S. No	**Course**	**Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	OOSDC	401	Open Online Skill Development Courses	-	8	-	200	200
2	PW	402	Project Work – Orientation classes	24	12	300	0	300
*	Conducting classes for competitive exams, communication skills, UGC / CSIR and NET / SLET examinations			12	-	-	-	-
			Total	**36**	**20**	**300**	**200**	**500**
Total Semesters				**144**	**84**	**1320**	**880**	**2200**

GEO 101: CRYSTALLOGRALPHY AND MINERALOGY

Course Learning Objectives:

1. To give students the description of elements of crystallography, crystal structures, symmetry and symmetry functions of different crystal systems and respective minerals.
2. To identify the mineralogical composition of geological materials in order to help to reveal their origin and evolution.
3. To describe the concepts of optical phenomena in thin sections of minerals.
4. To provide knowledge on the structural, chemical identification of the common rock forming minerals and demonstrative how minerals make up Igneous and Metamorphic rocks.

SYLLABUS

UNIT – I

Elements of crystallography – Derivation of the 32 crystal classes, Hermann – Maugin symbols, Twinning in crystals, X – ray crystallography.

UNIT – II

General principles of optics; Refringence – Biregringence, pleochroism, Extinctions and measurements of extinction angles, optical ellipsoids (a) Fresnel's ellipsoid and (b) Fletchers indicatrix, optic axial angle and optic sign, Interference figures – Uniaxial and Biaxial figures, and optic anomalies.

UNIT – III

Structure of silicates, Isomorphism and polymorphism , Structure, Chemistry, physical and optical characters and paragenesis of the following mineral groups; Olivine, pyroxene, Amphibole, Mica.

UNIT – IV

Structure, chemistry, physical and optical characters and paragenesis of the following mineral groups; Quartz, Feldspars, Feldspathoids, Aluminium silicates, Granet. and Epidote. Study of the following minerals: Beryl, Apatite, Sphene, Tourmaline, Talk and Spinel, Iron, Copper, Manganese, Lead and Zinc

Textbooks /Reference Books:

1. Mineral & Rock: Exercise in crystallography, mineralogy & hand specimen petrology (Rev.Ed.), Klein, C. 405p. John Wiley & Sons, 1989
2. Elementary Crystallogaphy ,Buerger M.. The MIT Press (May 15, 1978)Optical Mineralogy by F.F. Kerr
3. Introduction of crystallography by E.E. Ford
4. Elements of Optical Mineralogy by A.N winchell vol. 1,2 and 3
5. Mineral optics by F.C. Phillips
6. An Introduction to the methods of Optical crystallography by F.D. Bloss
7. Modern Mineralogy by K. Frye
8. An introduction to Rock forming minerals ,Deer, Howie Zussman:, Vol. I – IV. Longman,London; 1969)
9. Rock forming minerals volumes 1 to 5 by W.A. Deer et al.
10. Rutley's Elements of Mineraology , Fracnk Rutley and Herbert Harold Read

Course Outcomes:

After completion of the course, Students will be able to:

1. Describe crystal structures, crystal symmetry and twinning
2. Use of X-ray crystallography to determine the arrangement Atoms in a crystal.
3. Identify the mineralogical composition of geological materials by studying some of the optical properties and techniques in order to reveal their origin and evolution.
4. Analyse physical chemical and optical Characteristics of minerals could lead to the discovery of new uses for Earth's mineral resources.

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	M	H	H	L	L	H	M	L	M
CO2	M	L	H	M	H	H	M	L	H	M	L	L
CO3	H	M	H	L	H	H	L	M	H	L	L	M
CO4	H	L	H	L	H	H	L	M	H	L	L	M

H: High; M: Medium; L: Low

Geo 102(A) IGNEOUS AND METAMORPHIC PETROLOGY

Course Learning Objectives:

1. To provide knowledge on origin, physical and chemical characteristics and types of magma.
2. To impart knowledge on igneous processes, formation, structures, textures and classification of Igneous rocks.
3. To understand the Bowen's reaction series and its application to petrogenesis of Igneous rocks by different magmatic processes.
4. To understand the phase equilibrium and crystallization of Uni, Binary and Tertiary systems.
5. To understand the physical and chemical processes that produce the different Igneous rocks types and their petrogenesis and distribution in the earth's crust and mantle
6. To impart knowledge on metamorphic processes, kinds of metamorphism, classification nomenclature, structures and textures of metamorphic rocks.
7. To understand Metamorphic grades, zones, facies and facies series. Mineralogical phase rule and phase diagram.
8. To impart knowledge on Contact and Regional metamorphic facies and their mineral assemblages and genesis of granulites and charnockites.
9. To understand Metamorphic differentiation processes and origin of migamtites and study the classic regional metamorphic regions of the world and paired metamorphic belts.
10. To impart knowledge on Mineralization associated with metamorphic processes.

SYLLABUS

UNIT - I:
Magma generation; Primary and Secondary magmas - Bowen's Reaction Principle - Magmatic differentiation: Partial melting; Fractional crystallization; Magma mixing and Anatexis - Criteria for classification of Igneous rocks: Textural, Mineralogical and Chemical; Norm (CIPW) and Niggli values - IUGS Classification.

UNIT - II:
Phase equilibria of single, binary and ternary silicate systems - Petrographic provinces and associations - Mineralogy, texture and Petrogenesis of Igneous rocks such as Granites, Basalts, Ultramafic rocks, Carbonatites, Lamprophyres, Pegmatites and Kimberlites.

UNIT - III:
Introduction to Metamorphism: Metamorphic processes; Kinds and Agents of Metamorphism - Classification of metamorphic rocks - Structures and Textures of metamorphic rocks - Grades and Zones of metamorphism - Concept, classification and description of metamorphic Facies - Compositional Plotting; ACF, AKF and AFM phase diagrams.

UNIT - IV:
Contact metamorphic facies - Regional metamorphic facies - Anatexis and Migmatites - Regional metamorphism and Paired metamorphic belts - Metamorphism of Carbonate rocks, Pelitic rocks and Mafic rocks.

Textbooks/Reference Books:

1. Carmichael, Ian S. E, Turner, Francis J and Verhoogen, John, 1974: Igneous petrology, McGraw-Hill, Newyork.
2. John, D. Winter, 2001: An Introduction to Igneous and Metamorphic Petrology, Prentice Hall Inc.
3. Ronald, D. Frost and Carol, D. Frost, 2014: Essentials of Igneous and Metamorphic Petrology, Cambridge University Press.
4. Myron, G. Best, 2003: Igneous and metamorphic petrology, 2nd edition, Blackwell Publishing Company.
5. Hughes, C.J., 1982: Igneous petrology, Elsevier Science Publishing Company.
6. Chatterjee, S.C., 1974: Petrograpy of the igneous and metamorphic rocks of India, McMillan Co. Of India, Madras.
7. B. BhaskaraRao, 1986– Metamorphic petrology, CRC Press
8. D.W. Hyndman, 1986 – Petrology of Igneous and Metamorphic rocks, 2nd Edition, McGraw-Hill Co., Newyork.
9. Francis, J. Turner and Verhoogen, 2004: Igneous and metamorphic Petrology, CBS Publishers.
10. Winkler H.G.F. 1976: Petrogenesis of metamorphic rocks, Springer-Verlog, Newyork, Inc.
11. Philpotts A.R. and J. Jay Ague, 2009: Principles of igneous and metamorphic petrology, 2nd edition, Cambridge University Press.
12. Bruce, W.D. Yardly, 1989 – An introduction to metamorphic petrology, Prentice Hall.
13. Turner F.J., 1981: Metamorphic petrology, McGraw-Hill
14. Congillen, 1982: Metamorphic Geology, London : Allen &Unwin,

Course Outcomes:

After completion of the course , Students will be able to:

1. Explain the evolution of magma by different processes takes place from origin to emplacement with respect to different tectonic settings.
2. Explain Igneous processes, formation, structures, classification and significance of texture in explaining rock history.
3. Obtain knowledge on the crystallizing phase equilibrium of multi component magma system.
4. Identify different Igneous rocks both in hand specimens and thin sections in terms of their petrogenesis by studying the petrographic characteristics.
5. Identify metamorphic minerals in thin section and interpret met textures and able to comment on met grade and types of metamorphism.
6. Describe identify and classify metamorphic rocks in hand samples based on mineral assemblages and textures.
7. Plotting quantitative and qualitative mineral and mineral to infer the metamorphic conditions and processes study of metamorphic rocks on chemical system.
8. Establish relation between metamorphism and plate tectonics.
9. Establish metamorphic reaction principles of economically important ores and minerals associated with metamorphic processes.

CO – PO Mapping:

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	M	M	H	M	M	L
CO2	H	H	H	H	H	H	M	M	H	M	M	L
CO3	H	H	H	H	H	H	M	M	H	M	M	L
CO4	H	H	H	H	H	H	M	M	H	M	M	L
CO5	H	H	H	H	H	H	M	M	H	M	M	L
CO6	H	H	H	H	H	H	M	M	H	M	M	L
CO7	H	H	H	H	H	H	M	M	H	M	M	L
CO8	H	H	H	H	H	H	M	M	H	M	M	L
CO9	H	H	H	H	H	H	M	M	H	M	M	L

H: High; M: Medium; L: Low

Geo: 102: PRECAMBRIAN AND QUATERNARY GEOLOGY – 2 (B)

Course Learning Objectives:

1. To understand the genesis and tectonic evolution of the Precambrian rocks exposed in different parts of India
2. To impart knowledge on Precambrian Stratigraphy
3. To aquire knowledge on Precambrian-Cambrian boundaries
4. To understand the genesis and tectonic evolution of the quaternary formations in different parts of India
5. To impart knowledge on quaternary Stratigraphy

SYLLABUS

UNIT – I

Evolution of lithosphere, hydrosphere, atmosphere, biosphere, and cryosphere;, lithological, geochemical and stratigraphic characteristics of granite – greenstone and granulite belts. Stratigraphy and geochronology of the cratonic nuclei, mobile belts and Proterozoic sedimentary basins of India. Life in Precambrian. Precambrian – Cambrian boundary with special reference to India.

UNIT – II

Precambrian formations of India : Dharwar Province, Eastern Ghats Province, Central Indian Province, Singhbhum-Orissa Province and Aravalli-Bundelkhand Province. Archaean Proterozoic boundary Precambrian-Cambrian boundary with special reference to Indian examples

UNIT – III

Quaternary Stratigraphy – Oxygen Isotope stratigraphy, biostratigraphy and magnetostratigraphy. Quaternary climates – 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 scales in the Quaternary, Quaternary dating methods, –radiocarbon, Uranium series, Luminescence, Aminoacid.

UNIT – IV

Quaternary stratigraphy of India– continental records (fluvial, glacial, aeolian, palaeosols and duricrust); marine records; continental-marine correlation of Quaternary record. Evolution of man and Stone Age cultures. Plant and animal life in relation to glacial and interglacial cycles during Quaternary. Tectonic geomorphology, neotectonics, active tectonics and their applications to natural hazard assessment.

Textbooks/Reference Books:

1. Naqvi, S.M. & Rogers, J.J.W. (1987): Precambrian Geology of India, Oxford Univ. Press.
2. Kumar, R. (1984): Fundamentals of Historical Geology & Stratigraphy of India
3. Williams, Durnkerley, Decker, Kershaw and Chhappell, 1998. Quaternary Environments. Wiley and Sons.
4. D.Q.Bowen.1978, Quaternary Geology, Pergoman
5. R.F.Flint, 1971, Glacial and quaternary geology
6. Griffith Taylo, 2008, History of Geormorphology and Quaternary Geology

Course Outcomes:

After completion of the course, Students will be able to:

1. Describe the characteristics of Precambrian rocks
2. Correlate Precambrian Stratigraphy
3. Differentiate Precambrian-Cambrian boundaries
4. Describe the genesis and tectonic evolution of the quaternary formations
5. Correlate quaternary Stratigraphy

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	M	H	M	M	H	M	M	L
CO2	H	M	H	H	H	H	H	M	H	M	M	L
CO3	H	M	H	H	H	H	H	M	H	M	M	L
CO4	H	M	H	H	H	H	H	M	H	M	M	L
CO5	H	M	H	H	H	H	H	M	H	M	M	L

H: High; M: Medium; L: Low

Geo-103(A) - STRUCTURAL GEOLOGY AND GEOTECTONICS

Course Learning Objectives:

1. To understand how earth's rocks deform at different levels of the lithosphere and develop basic appreciation of rock deformation at different conditions and scales to understand the difference between brittle and ductile deformation regimes.
2. To study the diverse and types of structures in the field to uncover information about the history of deformation (strain) in the rocks to understand the stress field, with emphasis on the regional geology.
3. To understand the tectonic aspects and characteristic features of plutons and to understand the origin of cleavage, schistosity, lineation and their relation to major structures.
4. To understand the Shear zones and their characteristics and textural features typical of Shear zones

SYLLABUS

UNIT - I

Concept of Stress and Strain: Analyses of Stress and Stress ellipsoid; Analyses of Strain and Strain ellipsoid - Types of Deformation - Mechanics of Plastic Deformation. – Factors controlling behaviour of Materials. – Failure by Rupture; Experimental data, Relation of Rupture to Stress, Relation of Rupture to Strain.

UNIT – II

Folds – Nomenclature, Mechanics, Causes and Recognition of Folding. – Faults: Classification, Mechanics, causes and criteria for recognition - Joints: Origin, Geometric and Genetic classification - Unconformities

UNIT – III

Cleavage and Schistosity: Terminology, Origin andrelation of Cleavage and Schistosity to Major Structures – Nature, Origin and types of Lineation - Shear zones: General characteristics, Types of shear zones, strain in shear zones - Mylonites and types of Mylonites - Sense of Shear: Concept, macroscopic, microscopic and other indicators.

UNIT – IV

Plate tectonics: Dynamic Evolution of Continental Crust and Oceanic Crust - Sea – floorSpreading - Islands Arcs, Anatomy of Mountain Belts - Geo-Dynamics of Indian Plate - Structural and Tectonic Evolution of Himalayas - Neotectonics.

Textbooks/Reference Books:

1. Badgley, P.C. 1965: Structural and Tectonic principles, Harper & Row; First Edition
2. Bayly B. 1992, Mechanics in Structural geology, Springer Verlag.
3. Billings M.P. 1968: Structural geology, printice-Hall of India, Private Ltd., New Delhi.
4. George, H. Davis and Stephen, J. Reynolds 1996: Structural geology of rocks and region, 2nd Edition, John Wiley & Sons, Inc. New York.
5. Blen, A Van Dar Pluijm and Stephen Marshak 1955: Earth Structure, 2nd Edition, W. W. Norton & Company.
6. Gass, I.G, Peter, J. Smith and Wilson. R.C.L., 1971: understanding the Earth, Artemis Press.
7. Hobbs, B.E, Means, W.D. and Williams P.F., 1976: An outline of Structural geology. John Wiley & Sons, Inc, New York.
8. Philip Kearey, Keith A. Klepeis, Frederick J. Vine, 2009: Global Tectonics, Wiley Blackwell
9. E. M. Moores and R. J. Twiss, 1995: Tectonics, W.H. Freeman.
10. Ramsay, J.G., 1967: Folding and fracturing of rocks. Mcgraw-Hill, Newyork, USA.

Course Outcomes:

After completion of the course, Students will be able to:

1. Demonstrate a basic understanding of stress, strain, rheology of earth's lithosphere and comprehends how to describe and classify brittle and ductile structures.
2. Describe, identify and analyze the folds, faults and joints and their effects on outcrop pattern.
3. Measure, plot and interpret structural field data and can relate these to geological Maps and knows how to read geological maps and geological cross-section.
4. Analyse shear zone characteristics and textures which are usually in highly Mineralized zones.

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	M	H	M	M	H	M	M	L
CO2	H	M	H	H	H	H	H	M	H	M	M	L
CO3	H	M	H	H	H	H	H	M	H	M	M	L
CO4	H	M	H	H	H	H	H	M	H	M	M	L

H: High; M: Medium; L: Low

GEO-103: NATURAL HAZARDS AND DISASTER MANAGEMENT-(B)

Course Learning Objectives:

1. To understand the origin and types of disasters
2. To Compare hazards, disasters and associated natural phenomena and their interrelationships, causes and their effects
3. To build skill to respond to disasters

SYLLABUS

UNIT - I

Types of hazards; Hazard map of India. Characteristics features of hazards -Types of disasters; - Components and dimension of disasters; Phases of disasters. Risk and vulnerability in disaster- vulnerability Atlas of India-History of major disaster in India and their consequences

UNIT - II

Earthquakes: Types of seismic waves, intensity scales and magnitude scale, seismicity in Indian region, mitigation measures and management **Volcanoes:** Types, mitigation measures and management,**Avalanche:** Types, mitigation measures - **Landslides:** Types, Causes, Vulnerable zones in India, mitigation measures and management **Drought:** Types, Mitigation Measures.

UNIT - III

Flood: Causes, vulnerable zones in India, Mitigation measures and management **Cyclone:** Causes, Vulnerable zones in India, mitigation measures and management **Tsunamis:** Causes, Predictability, effects, Possible Risk Reduction Measures. **Soil erosion:** Factors influencing Soil erosion, Mitigation Measures.

UNIT - IV

National policy on Disaster management- Disaster management principles and Elements - Disaster Management Act – Laws and regulations towards hazard management- Disaster Risk Management cycle - Roles and Responsibilities of Disaster Management Centres (DMC).- Role of Remote sensing and GIS in Disaster management

Textbooks/Reference Books:

1. K. S. Valdiya, 2013: Environmental Geology, McGraw Hill Education (India)
2. D. Collins Larry, R. and Schneid Thomas, D., 2000: Disaster Management and Preparedness, Taylor and Francis.
3. Goel, S.L. and Kumar Ram, 2000: Disaster Management, Deep and Deep Publications.
4. Living with Risk: A global review of disaster reduction initiatives, 2004 Vision, United Nations.
5. Parasuraman, S., 2004: India Disasters Report: Towards a Policy Initiatives, Oxford University Press.

Course Outcomes:

After completion of the course, Students will be able to:

1. Identify the natural and environmental disasters, its causes and apply preventive measures.
2. Analyze effectively the impacts due to natural, man-made, and planetary hazard
3. Adopt the laws and regulations towards hazard management
4. Prepare controls of mitigating toward natural disasters.

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L	M	M	M	H	H	H	H	H	M	M
CO2	L	L	M	M	H	H	H	H	H	H	M	M
CO3	L	L	H	M	H	H	H	H	H	H	M	M
CO4	L	L	H	M	H	H	H	H	H	H	M	M

H: High; M: Medium; L: Low

PRACTICAL – I

Geo:104: IGNEOUS & METAMORPHIC PETROLOGY 2 (A) AND STRUCTURAL GEOLOGY & GEOTECTONICS 3 (A)

Igneous & Metamorphic Petrology 2 (A)

Course Objectives:

1. To impart knowledge on the megascopic and microscopic identification and study of various physical as well as optical properties of different types of igneous rocks.
2. To do modal analyses of important igneous rocks to determine the quantitative mineralogy, classification and petrography.
3. To perform CIPW norm classification of igneous rocks and variation diagrams to understand the evolution of igneous rocks.
4. To draw Discriminate diagrams of Pearce and Cann.
5. To study physical and optical properties and determination of mineralogical compositon and textural characters.
6. To arrange metamorphic rocks according to the faices of metamorphism.
7. To construct and interpretation of ACF, AKF and AFM diagrams.

Syllabus:

1. Megascopic and microscopic examination of igneous rocks.
2. a) Different types of granites, pegmatites, syenites, anorthosites, dunites, peridotites, pyroxinites, basalts, andesites, rhyolites, trachytes, kimberlites, dolerites, lamprophyres.
3. Modal analysis of some important igneous rocks and their classification.
4. Calculation of CIPW Norm
5. Variation diagrams: Harker and Niggli
6. Discriminate diagrams of Pearce and Cann.
7. Megascopic and microscopic examination of metamorphic rocks.
8. Different types of schists, gneisses, amphibolites, granulites,
9. Arranging metamorphic rocks according to the facies of metamorphism.
10. Construction and interpretation of ACF diagrams.
11. Construction and interpretation of AKF and AFM diagrams.

Course Outcomes:

After completion of the course, Students will be able to:

1. Students will be able to identify and study the various igneous rocks megascopically and microscopically to determine the physical properties, mineralogical composition, textural characteristics to classify the igneous rocks.
2. Acquire knowledge of doing modal analyses of igneous rocks to determine the quantitative mineralogy, classification, and petrography.
3. Able to do CIPW norm calculations to classify the igneous rocks and also interprete the evolution of igneous rocks by drawing variation diagrams of Harker and Niggli.

4. Able to draw discriminate diagrams to understand the tectonic affinity of volcanic igneous rocks.
5. Able to determine the physical and optical properties, mineralogical compositon and textural characteristic of metamorphic rocks determining the conditions under which the rock has formed, which can give valuable insight into its geologic past.
6. Able to arrange metamorphic rocks according to their facies of metamorphism.
7. Able to construct and interpret ACF, AKF and AFM diagrams to know relative proportions of the oxides of alkalis (A), iron (F), and magnesium (M) in metamorphic rocks and to show how metamorphic mineral assemblages vary as a function of rock composition within one metamorphic facies

Structural Geology & Geotectonics 3 (A)

Course learning Objectives:

1. To determine the thickness of the ore body, and structural problems related to attitude of the rock formations.
2. To determine the simple problems related to structural features of the rocks.
3. To determine the structural field data and knows how to read geological maps and geological cross-sections.

Syllabus:

1. Structural Problems concerning Dip and strike
2. Estimation of thickness – Depth of ore body.
3. Determination of Throw/Heave/Stratigraphic separation etc., related to faults.
4. Preparation and interpretation of Geological maps and sections
5. Preparation of contour diagrams.
6. Recording and plotting of field data

Course Outcomes:

After completion of the course , Students will be able to:

1. Able to determine and solve the problems related to various structural features of the rock strata/ore body related to their thickness, strike and dip and enable the industry giving an idea how to extract the minerals economically.
2. Able to Measure, plot and interpret structural field data and can relate these to geological maps and knows how to read geological maps and geological cross-section.

Geo- 105: HYDROGEOLOGY AND ENGINEERING GEOLOGY- 1(A)

Course Learning Objectives:

1. To provide the basics of hydrological properties of rocks
2. To understand Water table and piezometric surface
3. To analyze the quality of water and source of groundwater pollution
4. To provide method for groundwater exploration and management techniques
5. To understand the role of geologist in engineering projects for the selection of sites

SYLLABUS

UNIT – I

Precipitation, Runoff, Infiltration, Evaporation, Transpiration- Hydrological properties of rocks- Origin, Occurrence and Vertical Distribution of Ground water – Classification of aquifers - Geological Formations as Aquifers – Springs - Darcy's Law, Cone of Depression – Hydrographs - Water Table Contour Maps - Dispersion of Groundwater Tracers - Water Quality Standards: Analysis and Interpretation.

UNIT - II

Groundwater Exploration: Surface and Subsurface Geological, and Geophysical Methods of Groundwater Exploration – Hydrogeomorphic units mapping using various Remote Sensing data- Artificial Recharge of Groundwater - Conjunctive use of Surface and Ground water.

UNIT – III

Role of geologist in the engineering projects - Engineering properties of rocks - physical characters of building stones, concrete and other aggregates –Rock as a Construction material – Geological consideration for the construction of dam and Reservoir sites -Types of dams, remedial measures for failure of dams and reservoirs - Case histories of some major dams: Nagarjuna Sagar, Srisailam and Bhakranangal.

UNIT – IV

Geological considerations in the selection of tunnels.–tunnelling — remedial measures for failure of tunnels - Influence of geological conditions on foundations and design of buildings - Geological considerations for the construction of roads/ highways and bridges - Problems of groundwater in engineering projects.

Textbooks/Reference Books:

1. Todd, D.K., 2004: Ground Water Hydrology, John Wiley & Sons, New York.
2. Raghunath, H.M., 1987: *Ground Water*, Wiley Eastern Ltd., Calcutta.
3. Karanth, K.R., 1987: *Groundwater: Assessment, Development and Management*, Tata McGraw - Hill Pub. Co. Ltd.
4. Schward and Zhang, 2003: Fundamentals of Groundwater, John Willey and Sons.
5. Davies, S.N. and De-West, R.J.N., 1966: *Hydrogeology*, John Wiley & Sons, New York.
6. Driscoll, F.G., 1988: *Ground Water and Wells*, UOP, Johnson, Div. St. Paul. Min. USA.
7. Fetter, C.W., 1984: *Applied Hydrogeology*, McGraw-Hill Book Co., New York.
8. Fitts, C.R., 2013: *Groundwater Science*, Academic Press.
9. Freeze, R.A. and Cherry, J.A., 1979: *Groundwater*, Englewood Cliffs, NewJersey: Prentice-Hall.
10. Krynine & Judd., Principles of Engineering Geology and Geotectonics (Mc Graw Hill)

Course Outcomes:

After completion of the course, Students will be able to:

1. Apply the knowledge of geological formations as aquifers
2. Analyze the suitability of water for various purposes and suggest remedial measures
3. Conduct geological and geophysical investigations to drill borewells.
4. Suggest various methods for surface water recharges methods
5. Evaluate geological conditions at the major engineering project sites.

CO – PO Mapping

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	M	H	H	H	H	H	H	H
CO2	H	H	H	H	M	H	H	H	H	H	H	H
CO3	H	H	H	H	M	H	H	H	H	H	H	H
CO4	H	H	H	H	M	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	M	M	H	M	M	L

H: High; M: Medium; L: Low

Geo-105: COMPUTER APPLICATIONS AND GEOSTATISTICS -1(B)

Course Learning Objectives

1. To introduce the basic knowledge of Computer applications and statistics related to Geology
2. To understand various methods to store and analyze the geological data using computer applications
3. To develop skills to interpret the geological data based on statistical methods
4. To estimate the quantity of geological resources to assess the economic importance.

SYLLABUS

UNIT – I

Documents creating – editing, formatting and printing in MS Word - Working with basic formulas and tables, Preparation of Charts in MS Excel - Preparation of presentation in MS Power Point – Database Management Systems – open source softwares in earth sciences

UNIT – II

Frequency Distribution, frequency curve and its characteristics – Mean, Median and Mode, Relationship between mean, median and mode - Cumulative frequency: Characteristics of cumulative frequency curve, Applications of cumulative Frequency curves.

UNIT – III

Variance, Standard Deviation, Covariance, Coefficient of variation, Skewness and kurtosis - Binomial distribution: Characteristics, Approximating, uses.

UNIT - IV

Sampling - Simple Random sampling, Restricted Random sampling – Grid sampling, Stratified sampling, Cluster sampling.

Textbooks/Reference Books:

1. D. D. Sharma, 2002: Geostatistics with applications in Earth Sciences, Capital Publishing Company, New Delhi.
2. Saroj, K. Pal, 1998: Statistics for Geoscientists, Concept Publishing Company.
3. Rajaraman, V. 2014: Introduction to Computers; PHI Learning.
4. Rons Mansfield, 2001: Working in MS Office, McGraw Hill.
5. Singh, M.P.: Computer Fundamentals, Foundation Publishing House.

Course Outcomes:

After completion of the course , Students will be able to:

1. Comprehend the database related to field geological data
2. Prepare and Interpret graphical and pictorial data
3. Exposure to some selected software's related to geology

CO – PO Mapping

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	M	H	H	H	H	H	H	H
CO2	H	H	H	H	M	H	H	H	H	H	H	H
CO3	H	H	H	H	M	H	H	H	H	H	H	H

H: High; M: Medium; L: Low

Geo-106: FIELD GEOLOGY AND SURVEYING -2 (A)

Course Educational Objectives:

1. To provide basic knowledge on chain, compass, plane table, theodolite, other field equipment and Aerial photographs
2. To analyze the Measurement techniques, aerial photographs and equipment used in land surveying
3. To design and problem solving skills in surveying using surveying equipments and techniques.
4. To demonstrate knowledge and understanding of the geological report

SYLLABUS

UNIT- I:

Basic concepts of field geology –Objectives of Field geology - Field equipment and Safety aspects – The Field Notebook –Field observations at different scales - Recording Palaeontological Information, Structural Information, Features of Sedimentary rocks, Igneous rocks and Metamorphic rocks.

UNIT- II

Recording Numerical data– Photography and Sampling – Mapping geological features on Aerial Photographs – Preparing Geological reports - Making a Geological Map – Plotting Geological features on a Base map –

UNIT- III

Scales - Measurement of distances with the survey instruments - Chain survey: Principles, offsets, obstacles in chaining, Traversing - Compass Survey: Principe, Types of Compass, bearing of compass, Included angles, Traversing–**P**lane table survey: Radiation method, intersection method, Method of Traversing.

UNIT- IV

Principles of leveling, Different type of levels, Classification of leveling – Theodolite survey: Measurement of angles, Heights and Distances, Traversing –Total station: Principle, Measurement of Distances, Area, Height, Angles, Traversing, Contouring using Total station

Textbooks/Reference Books:

1. T.P. Kanetkar and S.V. Kulkarni: Surveying & Levelling, Vol. I, R Agor Books.
2. B.C. Punmiya, 2017: Surveying and Levelling, McGraw-Hill Education.
3. Robert, R. Compton, 1962: Manual of field geology, John Wiley & Sons, New York.
4. Frederick, H. Lahee, 1961: Field geology, McGraw-Hill Company, New York.

Course Outcomes:

After completion of the course, Students will be able to:

1. Analyze surveying techniques, tools, survey data and geological reports
2. Prepare contour maps, geological maps and reports
3. Understand the use of different surveying instruments, field equipment, aerial photographs and their use.
4. Compute the area and earthwork for different works by using surveying instruments
5. Solve survey issues using proper survey and interpretation.
6. Use appropriate modern tools in surveying and mapping

CO –PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	M	M	H	M	M	L
CO2	H	H	H	H	H	H	M	M	H	M	M	L
CO3	H	H	H	H	H	H	M	M	H	M	M	L
CO4	H	H	H	H	H	H	M	M	H	M	M	L
CO5	H	H	H	H	H	H	M	M	H	M	M	L
CO6	H	H	H	H	H	H	M	M	H	M	M	L

H: High; M: Medium; L: Low

Geo-106: GEOLOGICAL MAPPING TECHNIQUES -2 (B)

Course learning objectives:

1. To measure attitude of formation with Compass
2. To visualise the geological setup of different formation in the field
3. To recognize different types of primary and secondary structures

SYLLABUS

UNIT – I

Survey of India Topographic sheets – Quadrangle maps – Resource maps - Clinometer compass - Brunton Compass - Geological field equipments- Geological Traverse

UNIT – II

Measurement of pitch and plunge - Determination of True dip, apparent dip, strike of beds, width of outcrops - Determination of Throw/Heave/Stratigraphic separation.

UNIT – III

Identification and analysis of geological structures: faults, folds, joints, unconformities – Mapping of the geological structures: faults, folds, joints, unconformities

UNIT - IV

Recoding of Petrological, paleontological and hydrological data - Preparation and Interpretation of Geological and contour maps. Preparation of cross sections - profile from a geological map.

Textbooks/Reference Books:

1. Robert, R. Compton, 1962: Manual of field geology, John Wiley & Sons, New York.
2. Frederick, H. Lahee, 1961: Field geology, McGraw-Hill Company, New York.
3. John W. Barnes, Richard J. Lisle,2004: Basic Geological Mapping, John Wiley & Sons, New York.
4. Barnes, J.W. ,2000: Geological maps and map-making, Oxford

Course outcomes

1. Able to record and present field observations on topographic maps
2. Comprehend and interpret the spatial dimension of geological field data
3. Apply mapping and interpretation skills in all fields of geology
4. Prepare geological map and cross sections from field data

CO –PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	M	M	H	M	M	L
CO2	H	H	H	H	H	H	M	M	H	M	M	L
CO3	H	H	H	H	H	H	M	M	H	M	M	L
CO4	H	H	H	H	H	H	M	M	H	M	M	L

H: High; M: Medium; L: Low

PRACTICAL – II

GEO: 107: HYDROGEOLOGY AND ENGINEERING GEOLOGY 1 (A) AND FIELD GEOLOGY AND SURVEYING 2 (A)

HYDROGEOLOGY AND ENGINEERING GEOLOGY 1 (A)

Course Objectives:

1. To provide the basics of hydrological properties of rock, aquifers, source of groundwater pollution and artificial recharge structures
2. To analyze the quality of water
3. To design the groundwater movement
4. To conduct groundwater investigations, to insist on the management of groundwater and methods of groundwater recharge
5. Role of geologist in engineering projects geological consideration for the selection of sites for major engineering projects.

Syllabus:

1. Simple numerical problems related to: hydrological properties
2. Preparation and interpretation of water level contour maps and depth to water level maps.
3. Study of Water potential zones of India maps
4. Graphical representation of chemical quality data and water classification (C-S and Trilinear diagrams).
5. Study on topographic environment for ideal site for Dams / Canals
6. Study on topographic environment for ideal site for Tunnels / Ghat roads
7. Preparation of geological cross sections of project sites
8. Suitability studies of building stones and road metal based physical and engineering properties

Course Outcomes:

After completion of the course , Students will be able to:

1. Apply the knowledge of geological formations and the hydrological properties of rocks
2. Analyze the suitability of water for domestic, irrigation and industrial purposes Conduct geological and geophysical investigations and give recommendations for drilling of borewells.
3. Explain causes of pollution of groundwater give remedial measures to the society.
4. Use modern methods and appropriate techniques to carrying out geophysical studies and artificial recharge methods
5. Students will get critical knowledge on evaluation of geological condition at the major engineering project sites.

FIELD GEOLOGY AND SURVEYING 2 (A)

Course Objective:

1. To provide basic knowledge on chain, compass, plane table , theodolite, other field equipment and Aerial photographs
2. To analyze the Measurement techniques, aerial photographs and equipment used in land surveying
3. To design and problem solving skills in surveying using surveying equipments and techniques.
4. To demonstrate knowledge and understanding of the geological report

Syllabus:

1. Identification of the rocks and their outcrop pattern in the field
2. Measurement of attitude of beds in and around engineering project site / mining area.
3. Identification of the landforms and geological information using toposheets of an engineering project site / mining area.
4. Plotting of area using Cross staff
5. Determination of area by radiation method using compass
6. Longitudinal and cross–sectioning of a road profile using levelling instrument
7. Measurement of heights and distances using theodolite
8. Determination of areas using theodolite
9. Contouring using total station

Course Outcomes:

After completion of the course , Students will be able to:

1. Understand the use of different surveying instruments, field equipment, aerial photographs and their use.
2. Compute the area and earthwork for different works by using surveying instruments
3. Analyze surveying techniques, tools, survey data and geological reports
4. Prepare contour maps, geological maps and reports
5. Solve survey issues using proper survey and interpretation.
6. Use appropriate modern tools in surveying and mapping

SEMESTER-II

S. No	Course	Code	Title of the paper	I	Credits	ISM	SEM	Total
1		201	Stratigraphy and Indian Geology - 4	4	4	30	70	100
2	Core	202	Sedimentology and Sedimentary Petrology - 5 (A)	4	3	25	50	75
			Sedimentary Basins of India – 5 (B)					
3		203	Geochemistry and Isotope Geology – 6 (A)	4	3	25	50	75
			Geodynamics – 6 (B)					
4	Practical - III	204	Sedimentology and Sedimentary Petrology - 5 (A) and Geochemistry and Isotope Geology – 6 (A)	6	2	15	35	50
5	SOC	205	Paleontology – 3 (A)	4	3	25	50	75
			Fuel Geology – 3(B)					
6		206	Geomorphology – 4 (A)	4	3	25	50	75
			Watershed Management – 4 (B)					
7	Practical – IV	207	Paleontology – 3 (A) and Geomorphology – 4(A)	6	2	15	35	50
8	OOTC	208	Open Online Transdisciplinary Course-1	--	2	100	--	100
			Total	**36**	**22**	**260**	**340**	**600**
9	Audit Course	209	Indian Knowledge Systems-2	4	0	100	0	0

Geo-201 STRATIGRAPHY AND INDIAN GEOLOGY -4

Course Learning Objectives:

1. To understand basic principles and nomenclature of Stratigraphy methods of Stratigraphy correlation and geological time scale.
2. To know the classification, lithology, structures of major stratigraphic units with economic importance.
3. To understand Major stratigraphic boundary problems with reference to India.

SYLLABUS

UNIT-I:

Lithostratigraphic, chronostratigraphic and biostratigraphic subdivisions -Recent developments in stratigraphic classification – code of stratigraphic nomenclature-– Concept of sequence stratigraphy- Facies concept in Stratigraphy - Phanerozoic stratigraphy of India – Major Boundry problems – Structure and tectonics of India

UNIT- II:

Archean Stratigraphy, Geological history, Origin of Archaeans, Clasification, Post-Dharwars, A.P. Dharwars, Eastern Ghat, Chotanagpur, Madhya Pradesh, Rajasthan, Assam, Correlation of peninsular Archaeans-Mineral Resources of Archaeans

UNIT- III:

Purana group of Stratigraphy, Geological history of Purana basins- Cuddapah super group, Pakala Basin – Bhima basin-Kaladgi Basin, Indravati basin-, Chattisgrah bain, Kolhan basin, Vindhyan Basin, Kurnool basin

UNIT- IV:

Study of Stratigraphic Units - Gondwanas, Deccan traps, Triassic rocks of Spiti, Jurassic of Kutch - Cretaceous of Trichinapalli - Siwalikhs

Textbooks/Reference Books:

1. Krumbein, W.C. & solss, L.L., 1951; stratigraphy and Sedimentation; W.H.Freeman and company.
2. Carl, O. Dunbar & John Rodgers., 1957: Principles of Stratigraphy; John Wiley.
3. M.S. Krishnan, 2012: Geology of India & Burma; CBS Publishers
4. Wadia, D.N., 1953: Geology of India, ST. Martin's Press Inc., New York.
5. Ravindra Kumar, 1985: Fundamentals of Historical Geology and stratigraphy; New Age Publishers
6. R.C. Mehdiratta: Geology of India, Pakistan, Bangladesh & Burma.
7. Purana basins of peninsular India – published by geological society of India, Bangalore.
8. Gondwana of India, Special volume Published by Gondwana society of India.
9. Dunbars & Roegers – Prinicles of Stratigraphy

Course Outcomes:

After completion of the course, Students will be able to:

1. Acquire comprehensive knowledge on principles of Stratigraphy, correlation methods classification of stratigraphic units, tectonic framework of India and Geological timescale.
2. Describe stratigraphic units and give stratigraphic column distribution in India, fossil content and economic importance of given geological formation.
3. Apply standard stratigraphic codes while preparing geological reports

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	H	M	H	M	H	H	M	M	L
CO2	H	M	M	H	M	H	L	H	H	M	M	L
CO3	H	M	M	H	M	H	H	H	H	M	H	L

H: High; M: Medium; L: Low

Geo- 202 : SEDIMENTOLOGY AND SEDIMENTARY PETROLOGY-5 (A)

Course learning objectives:

1. To understand Sediments to derive information on the depositional conditions
2. To establish the relation of the individual rock units in a basin to understand the evolution of the sedimentary sequences.
3. To learn different sedimentary environments.

SYLLABUS

UNIT- I:

History of Sedimentology – Formation of Sedimentary Rocks – Sedimentary Processes: Subaerial Weathering Processes and Products; Submarine Weathering Processes and Products – Fundamentals of Fluid Flow – Particle Transport by Fluids – Particle Transport by Sediment Gravity Flows - Classification of Sedimetnary rocks.

UNIT – II

Sedimentary Textures: Grain Size; Graphical representation of Grain size data; Grain size parameters; Particle Morphology – Internal organization and Sedimentary Structures: Primary structures and Secondary structures.

UNIT – III

Petrography and Petrogenesis of Sedimentary Rocks: Clastic, Volcaniclastic, and Non-Clastic Sedimetary rocks - Sedimentary facies: Concept; sedimentary facies association methods - Sedimentary depositional environments: Continetal (Fluvial, Desert, Glacial and Deltaic) and Marine (Neritic and Oceanic)

UNIT – IV

Basin Analysis: Mechanisms of Basin Formation, Plate tectonics and Basins: Kinds of sedimentary basins - Techniques of Basin Analysis - Applications of Basin Analysis – Sedimentary Basins of India.

Textbooks/Reference Books:

1. Leeder, M.,1999. Sedimentology and Sedimentary Basins From Turbulence to Tectonics. Blackwell, Oxford.
2. Lindholm, R., (1988) A practical approach to Sedimentology. Blackwell publication.
3. Gary Nicols, (2009): Sedimentology and Stratigraphy, 2nd Edn., Wiley-Blackwell.
4. Pettijohn, F.J .(1975) Sedimentary rocks. Harper and Row Publ., New Delhi
5. Selley, R.C.,(2000) Applied sedimentology, 2nd Edn., Academic Press,.
6. Sengupta, S.M, (2007), Introduction to Sedimentology, CBS Publishers & Distributors,

New Delhi.
7. Sam Boggs. Jr. (2009): Petrology of Sedimentary Rocks, 2nd Edn., Cambridge University Press.
8. Sam Boggs, Jr. (2006): Principles of Sedimentology and Stratigraphy, 4th Edn., Prentice Hall, New Jersey.
9. Donald. R. Prothero, and Fred Schwab (2014): Sedimentary Geology, 3rd Edn., W.H. Freeman & Company, New York.

Course Outcomes:

After completion of the course, Students will be able to:

1. Identify different sedimentary rocks in both hand specimens and thin sections
2. Analyze the depositional conditions and environments.
3. Suggest the sequence of sedimentary rock strata and describe the tectonic framework of sedimentation

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	H	M	H	M	H	H	M	M	L
CO2	H	M	M	H	M	H	L	H	H	M	M	L
CO3	H	M	M	H	M	H	H	H	H	M	H	L

H: High; M: Medium; L: Low

Geo- 202 SEDIMENTARY BASINS OF INDIA -5 (B)

Course learning objectives

1. To impart knowledge on Basin classification and depositional environments Basin evolution and sedinments and Remnant and fore land basins and young rift zones.
2. To understand basin mapping methods, depositional systems and sequence Stratigraphy
3. To impart knowledge on Stratigraphy, structure and tectonics of sedimentary basins ot East coast of India K G Basin, Bengal, Mahanadi and Cauvery Basins.
4. To understand Stratigraphy, Structure and tectonics of Sedimentary West Coast of India kuteh-Saurastra-Narmada, Cambay, Bombay high, KeralaKonkan off shOre basins.
5. To impart knowledge on Stratigraphy, structure and tectonics of some other sedimentary basins of India like Cuddapah, Rajasthan, Assam Shelf and limalayan Basins.

SYLLABUS

UNIT-I

Basins Classification and Depositional Environments: Tectonic Basin Classification, Tectonics and Basin Filling, Basin Morphology and Depositional Environments.

Basin Evolution and Sediments: Rift basins, Continental Margin and Slope Basins, Intracontinental Sag Basins. Deep-Sea Trenches, Foreland, Back arc and Retro arc Basins, Remnant and Foreland Basins, Collision – Related Basins, Pull-Apart Basins, Basin- Type Transitions

UNIT-II

Basin mapping methods: Structure and isopach contouring, Lithofacies maps, Geophysical techniques, Clastic petrographic data, Stratigraphic cross sections, Paleocurrent analysis, Depositional systems and sequence stratigraphy: Stratigraphic architecture, Nonmarine depositional systems, Coastal depositional system. Clastic shelves and associated depositional systems, Carbonate and evaporate depositional systems, Clastic depositional systems of the continental slope, rise and basin plain, Sequence stratigraphy

UNIT-III

Stratigraphy, Structure and Tectonics of Onshore and Offshore Sedimentary basins of East Coast of India with special reference to – Bengal Basin – Mahanadi - Krishna - Godavari and Cauvery Basins.

Stratigraphy, Structure and Tectonics of Onshore and Offshore Sedimentary basins of West Coast of India with special reference to Kutch – Saurastra – Narmada – Cambay Bombay high, Kerala – Konkan Offshore Basins.

UNIT-V

Stratigraphy, Structure and Tectonics of other Sedimentary basins of India with special reference to Cuddapah - Vindhyan – Rajasthan - Assam shelf – and Himalayan foot hill Basins.

Textbooks/Reference Books:

1. Einsele G 1992 Sedimentary Basins. Springer Verlag.
2. Miall A 2000 Principles of Sedimentary Basin analysis
3. Sengupta S 1997. Introduction to Sedimentology oxford – IBH
4. Petrol ferrous Basins of India, ONGC, Petroleum Asia Journal

Course outcomes:

After completion of the course, Students will be able to:

1. Explain Basin classification and depositional environments and evolution and sediments and some examples of rift zones.
2. Explain Basin mapping methods, depositional systems and sequence Stratigraphy.
3. Explain Stratigraphy, structure and tectonics of Bengal, Mahanadi, Krishna Godavari and Cauvery sedimentary basins.
4. Explain Stratigraphy, structure and tectonics of Kutuch, Saurastra, Narmada, Combay, Bombay High, Kerala and Kankan offshore basins of India
5. Explain Stratigraphy, structure and tectonics of Sedimentary Basins of India like cuddapah, Vindhyan, Rajasthan, Assam shelf and Himalayan basins

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	H	M	H	M	H	H	M	M	L
CO2	H	M	M	H	M	H	L	H	H	M	M	L
CO3	H	M	M	H	M	H	H	H	H	M	H	L
CO4	H	M	M	H	M	H	L	H	H	M	M	L
CO5	H	M	M	H	M	H	H	H	H	M	H	L

H: High; M: Medium; L: Low

GEO-203: GEOCHEMISTRY AND ISOTOPE GEOLOGY – 6(A)

Course learning objectives

1. This course first lays out the basic principles and techniques of modern geochemistry,.
2. Understanding processes in aqueous systems and the behaviour of trace elements in magmatic systems.
3. Introduces radiogenic and stable isotope geochemistry and illustrates their application to such diverse topics as determining geologic time, ancient climates. The focus then broadens to the formation of the solar system, the Earth, and the elements themselves.

SYLLABUS

UNIT- I:

Definition, scope and development of geochemistry - Geochemical classification of elements; Goldschmidt's classification of elements - Fractionation of elements in minerals/rocks - Geochemical principles - Geochemical cycle – Meteorites: classification, mineralogy, age and origin.

UNIT-II:

Chemical composition and characteristics of atmosphere, lithosphere, hydrosphere - Fick's laws of diffusion and activity composition relation (Roult's and Henry's law) - Application of trace elements in petrogenesis - Principles of equilibrium and Rayleigh fractionation - REE patterns, Eh and pH diagrams and mineral stability

UNIT- III:

Cosmic abundance of elements - Geochemical evolution of the earth - Distribution of major, minor and trace elements in crust and mantle - Mantle reservoirs - Geochemistry of water and water-rock interaction.

UNIT-IV:

Isotope geology: Isotopes and the periodic table - Stable Isotopes: Oxygen Isotopes, Sulfur Isotopes, Carbon Isotopes – Radioactivity and geochronology and brief outline of Rb-Sr, K-Ar and radiocarbon (C^{14}) systems.

Textbooks/Reference Books:

1. Manson, B. and Moore, C.B. 1991: Introduction to Geochemistry, Willey Eastern.
2. Krauskopf, K.B., 1967: Introduction to Geochemistry. McGraw Hill.
3. Faure. G., 1986: Principles of Isotope geology. John Wiley.
4. Henderson, P., 1987: Inorganic Geochemistry, Pergamon Press.
5. Arthur H. Brownlow, 1979. Geochemistry. Prentice-Hall, Inc. Englewood Cliffs, N.J

Course outcomes:

After completion of the course, Students will be able to:

1. Understand the behaviour of elements in a geochemical context and relate this knowledge to how elements redistribute within the Earth.
2. Learn to interpret and explain interactions between Earth reservoirs.
3. Understand and interpret the major processes that form and modify the Earth's crust and mantle.
4. Use isotopes to trace geological processes and age date specific events.

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	M	L	M	L								
CO2	M	L	M	L								
CO3	M	L	M	L								
CO4	H	L	H	M								

H: High; M: Medium; L: Low

PRACTICAL - III

GEO: 204: SEDIMENTOLOGY AND SEDIMENTARY PETROLOGY - 5 (A) AND GEOCHEMISTRY AND ISOTOPE GEOLOGY – 6 (A)

Sedimentology and Sedimentary Petrology - 5 (A)

Course learning objectives:

1. egascopic identification of sedimentary rocks by studying their physical and chemical properties.
2. To impart knowledge of granulometric analysis of sediments.
3. Understand the petrographic features of clastic and non-clastic rocks.
4. Study the facies characteristics for the construction of facies succession and depositional models.
5. To impart knowledge on separation, study and analysis of heavy minerals fron the unconsolidated sediments.

Syllabus

1. Megascopic study of sedimentary rocks and their identification through characteristic features.
2. Granulometric analysis of unconsolidated sediments and interpreting their modes of transport, and environments of deposition.
3. Petrographic study of clastic and non-clastic rocks and interpreting textural properties, depositional environments and diagenesis.
4. Separation and analysis of heavy minerals from unconsolidated sediments and understanding provenance.
5. Construction of facies succession and depositional models with facies characteristics

Course Outcomes:

1. Students will be able to identify the different sedimentary rocks megascopically and microscopically to understand the petrographic characteristics and interpret textural properties and determine the depositional environments and diagenetic processes.
2. Able to do granulometric analysis of unconsolidated sediments and interpret their modes of transport and environments of deposition.
3. Able to do separation and analysis of heavy minerals from the sediments and understand the Provenane.
4. By studying facies characteristics able to construct facies succession and depositional models of sedimentary formations.

Geochemistry and Isotope Geology – 6 (A)

Course learning objectives:

1. To impart knowedge of chemical analyses of rocks and minerals by various methods.

2. To perform chemical analyses of waters and representation of water analyses through graphical methods.

3. To impart knowledge of classification of groundwater for various purposes.

4. To estimate organic matter in soils and water.

Syllabus

1. Methods of the chemical analysis of rocks and minerals.
    a) Spectrophotometric methods
    b) Flame photometric methods
    c) Titrimetric methods.
2. Chemical analysis of water samples.
3. Graphical representation of water analyses data and classification of natural waters.
4. Classification of groundwater for use in drinking, irrigation and industrial purposes.
5. Estimation of organic matter of soils and water.

Course Outcomes:

1. Able to do chemical analyses of minerals and rocks by using various methods such as Spectrophotometric method, Flamephotometric method and Titrimetric method.
2. Able to do chemical analyses of waters and classify the groundwater for use in drinking, irrigation and industrial purposes through graphical methods.
3. Able to estimate the organic matter in soils and waters in the laboratory.

205- PALEONTOLOGY – 3 (A)

Course learning objectives:

1. To acquire skills on identification, classification and documentation of palaeobiota.
2. Acquire knowledge on morphology, classification and evolutionary trends of invertebrate fossils.
3. Describe evolutionary, separation and classification of different microfossils and application of micropalaeontological techniques in hydrocarbons exploration.

SYLLABUS

UNIT- I

Fossil record in geological time scale. Classification of fossils. Modes of preservation of fossils - Conditions necessary for fossilization- Geological significance of fossils .Micro-Palaeontology: Detailed study of micro-fossils and their distribution in India, Application of micro-paleontology in hydrocarbons exploration.

UNIT- II

Morphology, Classification, and Evolution and geological distribution of Corals, Brachiopods, Mollusca, Trilobites Echinoderms. Graptolites, and. Pelecypada,

UNIT- III

Origin and distribution of Plant fossils –Morphological study of different plant fossils – Application of Plaeobotony with particular reference to stratigraphic correlation and paleoclimates.

UNIT- IV

Origin of vertebrates and major steps in vertebrate evolution- General characters, classification and evolution of Horse, Elephant and Man

Textbooks/Reference Books:

1. Raup,D.M.,Stanley,S.M.,Freeman,W.H.(1971)
2. Principles of Paleontology 2. Benton, M. (2009). Vertebrate paleontology. John Wiley &Sons.
3. Shukla, A.C.& Misra,S.P.(1975).Essentials of paleobotany. Vikas Publisher
4. Armstrong, H. A., & Brasier, M.D. (2005) Microfossils. Blackwell Publishing
5. Clarkson,E.N.K.(2012)Invertebratepaleontologyandevolution4thEdition,

BlackwellPublishing.

Course Outcomes:

After completion of the course, Students will be able to:

1. Describe morphology, classification, evolutionary trends of Invertebrate fossils with geological and geographic distribution and paleoecological and paleo-enviromental relevance.
2. Ability to identify, classify and describe the morphology of the invertebrate fossils and plant fossils.
3. Application of fossils in establishing the age of the rock unit, correlation with other area, and Use of fossil in finding mineral deposits.
4. Ability to apply micropalaeotological techniques in hydrocarbon exploration.

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	H	M	H	M	H	H	M	M	L
CO2	H	M	M	H	M	H	L	H	H	M	M	L
CO3	H	M	M	H	M	H	H	H	H	M	H	L
CO4	H	M	M	M	M	H	M	H	H	M	M	L

H: High; M: Medium; L: Low

GEO: 205- FUEL GEOLOGY – 3 (B)

Course learning objectives:

1. To impart knowledge about the origin, composition and accumulation of petroleum; reservoir rock types and reservoir traps.
2. To know geology of oil bearing basins of India, position of oil and gas in India and future prosepects and economic scenario.
3. To educate about the coal characteristics, geographical distiribution of coal and detailed geolology of coal fields of India.
4. To enlighten about the occurrence and association of atomic minerals, methods of prospecting and uclear power stations country and future prospects.

SYLLABUS

UNIT- I:

Petroleum: Composition – nature - origin: inorganic and organic theories – migration (primary and secondary) and accumulation of oil and gas - Geographic locations - petroleum reservoir rocks - Reservoir rock types, Geological age of reservoir rocks - Reservoir traps - Classification of traps, anticlinal theory - Structural traps caused by folding, faulting and fracturing.

UNIT- II:

Primary stratigraphic traps - Fluid traps, Salt domes, Salt plugs, Cap rocks and association traps: Origin, reservoir conditions - Oil bearing basins of India - Geology of the productive oil fields of India - Position of oil and natural gas in India - Future prospects and economic scenario.

UNIT- III:

Coal: Definition, origin, sedimentology of coal bearing strata - Rank, grade and type of coal - Chemical characterization: Proximate and ultimate analysis - Coal forming epochs in the geologic past - Geological and geographical distribution of coal in India - Detailed geology for important coal fields in India.

UNIT- IV:

Atomic minerals: Mode of occurrence and association of atomic minerals in nature - Atomic

minerals as source of energy - Methods of prospecting and productive geological horizons in India - Nuclear power stations of country and future prospects - Atomic fuels and environment.

Textbooks/Reference Books:

1. Taylor, G.H., Teichmueller, M., Davis, A., Diesel, C.F.K. and others, 1998: Organic Petrology, Berlin – Stuttgart.
2. Selley, R.C., 1985: Elements of Petroleum Geology, Academic Press
3. Chandra, D., Singh, R.M and Singh, M.P: Textbook of Coal
4. Singh, M.P: Coal and Organic Petrology
5. Stach, E, Mackowsky, M.T.H, Taylor, H.H and others, 1982: Stach's Textbook of Coal Petrology
6. Holson, G.D. and Tiratso, E.N., (1985): Introduction to Petroleum Geology. Gulf Publishing, Houston, Texas.
7. North, F.K., (1985): Petroleum Geology. Allen Unwin.
8. VBoyle, R.W., (1982): Geochemical prospecting for Thorium and Uranium deposits, Elsevier

Course Outcomes:

After completion of the course, Students will be able to:

1. Understand about natural fuels like coal and petroleum their formation and distribution especially in sedimentary basins.
2. Analyze the formations, nomenclature in constitution of coal working detail of distribution of coals and coal industry in India, Sufficient idea offormation and entrapment of oil and gas.
3. Discuss the occurrence of atomic minerals in nature, methods of prospecting, atomic fuels and environment.

CO – PO Mapping:

POs → COs↓	PO 1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	M							
CO2	M	L	M	M	M							
CO3	M	L	M	M	M							
CO4	H	L	H	H	H							

H: High; M: Medium; L: Low

Geo 206- GEOMORPHOLOGY 4 (A)

Course learning objectives

1. To understand the processes that shape the landforms around us and how these depend on climate, tectonic regime outline.
2. To understand and apply geomorphological concepts to problems of slope instability and try to identify the factors responsible for landslide occurrences in various environments and techniques to minimize the mass wasting.

3. To know the evolution of landforms and depositional and erosional landforms of various geological agents.
4. Application of geomorphological concepts in economically important projects.

SYLLABUS

UNIT – I

Geomorphic significance of weathering; soils and its profile, formation of soils – Mass wasting and its geomorphic significance; creep, solifluction, patterned ground, earth flows, mud flows, debris flows, landslides, subsidence forms

UNIT - II

Evolution of landforms; endogenous and exogenous forces, role of lithology, peneplanation, rejuvenation of landforms – Fluvial geomorphic cycle; streams and valleys, valley development, classification of valleys – Drainage patterns and their significance; types of drainage patterns – Morphometric analysis of the drainage basin.

UNIT – III

Depositional and erosional landforms; Fluvial, Aeolian, Glacial, and Coastal – Karst topography - Topography of Ocean floors; geomorphic features on continental shelves and slopes, submarine canyons, classification of sea valleys – Topography of Deep sea floors –Barrier Reefs and Atolls.

UNIT – IV

Structural Geomrphology; Geomorphic expressions of uniclinal structure; topographic expressions of fault structure (fault geomorphology), topographic expressions of folded structure (fold geomorphology), inversion of relief, fluvial cycle of erosion on folded structure; topographic expressions of domed structure, fluvial cycle of erosion on domed structure.

Textbooks/Reference Books:

1. Holmes. A, (1972): Principles of Physical Geology, The English language Book society and Nelson
2. Thornbury. W.D, (2004): Principles of Geomorphology, 2 Edition, CBS Publishers and Distributors Pvt. Ltd., New Delhi
3. Huggett Richard John (2007): Fundamentals of Geomorphology. 2nd Edn, Taylor & Francis.
4. Savindra Singh, (1998): Geomorphology, CBS Publishers and Distributors Pvt. Ltd., New Delhi
5. Kale, V.S., and Gupta, A. (2005): Introduction to Geomorphology. Orient Blackswan Pvt. Ltd.

Course Outcomes:

After completion of the course, Students will be able to:

1. Able to describe land forms and land forming processes in different climate zones and tectonic regimes.
2. Able to explain different theories and models for landscape evolution.
3. Obtain knowledge in recognizing and minimizing the mass wasting.

4. Able to apply geomorphological concepts in economically important projects

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	L	M							
CO2	M	L	M	L	M							
CO3	M	L	M	L	M							
CO4	H	L	H	M	M							

H: High; M: Medium; L: Low

Geo: 206 : WATERSHED MANAGEMENT – 4 (B)

Course learning objectives

1. To provide basics of watershed management
2. To apply the mitigation techniques of land erosion
3. To develop water harvesting techniques based on the terrain conditions
4. To implement the approach of people's participation in watershed management

SYLLABUS

UNIT-I

Objectives of watershed development - Characteristics of watershed – Principles of watershed – Effects of watershed on community – Delineating the watershed – Basic data on watersheds – Need for watershed development – Watershed development programmes in India – Watershed Atlas

UNIT-II

Types and Factors affecting erosion - Effects and control methods of erosion - Estimation of soil loss due to erosion - Universal soil loss equation –Degradation agents – Impact of the degradation of watersheds– Land use and land capability studies - Management of Agricultural, Forest, Grassland and wild land - Reclamation of saline and alkaline soils.

UNIT-III

Concept of Rainwater harvesting - water harvesting structures - Guidelines for construction of harvesting structures – Success stories of water harvesting structures –Role of peoples participation in construction and management of harvesting structures– Rain water harvesting from roof top

UNIT-IV

Elements of watershed management – Planning and Implementation of watershed Management activities – Multidisciplinary approach for watershed management – Impact of watershed Management.

Textbooks/Reference Books:

1. Rajora, R., (1998),Integrated Watershed Management, Rewat Publications, New Delhi.
2. Tideman, E.M., (1996): Watershed Management: Guidelines for Indian Conditions, Omega Scientific Publishers, New Delhi.
3. Lal. S., (2004),Watershed Development, Management and Technology, Mangal

Deep Publications.
4. Paranjape, S. et. al., (1998), Watershed Based Development: A Source Book, Bharat Gyan Vigyan Samathi, New Delhi.
5. Suresh, R., (2002), Soil and Water Conservation Engineering, Standard Publishers and Distributers, Delhi.
6. Kakade, B.K., (2002), Soil and Water Conservation Structures in Watershed Development Programs, BAIF Development Research Foundation, Pune.

Course Outcomes

After completion of the course, Students will be able to:

1. Explain the importance of watershed management
2. Classify and explain the different water harvesting techniques
3. Use modern tools for land erosion control
4. Develop or improve the people's participatory approach for sustainable development and management of watersheds

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	M							
CO2	M	L	M	M	M							
CO3	M	L	M	M	M							
CO4	H	L	H	H	H							

H: High; M: Medium; L: Low

PRACTICAL – IV
Geo: 207: PALEONTOLOGY – 3 (A) AND GEOMORPHOLOGY – 4 (A)

Paleontology – 3 (A)

Course learning objectives:

1. To impart knowledge about Morphology, classification, geologival age and stratigraphic position of invertebrate
2. To impart knowledge about Morphology, classification, geologival age and stratigraphic position of plant fossils
3. To impart knowledge about Morphology, classification, geologival age and stratigraphic position of micro fossils

Syllabus:

1. Morphology, classification, geologival age and stratigraphic position of important fossils of Mollusca family
2. Morphology, classification, geologival age and stratigraphic position of important fossils of Brachiopoda.
3. Morphology, classification, geologival age and stratigraphic position of mportant fossils of Echinodermita.
4. Morphology, classification, geologival age and stratigraphic position of important fossils of Arthropoda.
5. Morphology, classification, geologival age and stratigraphic position of important fossils of Plant fossils
6. Morphology, classification, geologival age and stratigraphic position of important fossils of Microfossils – foraminifora.

Course Outcomes:

After completion of the course, Students will be able to:

1. Able to identify invertebrates
2. Analyze the importance of microfossils, invertebrate fossils and plant fossils
3. Explain the stratigraphic position of various fossils

<u>Geomorphology – 4(A)</u>

Course learning objectives:

4. To impart knowledge about the study of topographic sheets and understand the physiographic features of an area and also knows contour variations and elevations of the study area.
5. To impart knowledge about preparation of drainage basin maps and morphometric analysis of the drainage basin.
6. To impart knowledge about the calculation of slope of an area and preparation of slope map.

Syllabus:

1. Study of topographic sheets and preparation of physiographic description of an area
2. Study of soil profile of any specific area
3. Study of contour variations and elevations on toposheets.
4. Identification, classification and preparation of drainage basin map on toposheet.
5. Morphometry analysis of the drainage basin:
    a. Linear aspects
    b. Aerial aspects and
    c. Relief aspects.
6. Calculation of slope and preparation of slope map of a basin

Course Outcomes:

After completion of the course, Students will be able to:

1. Able to study and interprete the topographic sheets and physiographic features of an area.
2. Acquire knowledge about the preparation of drainage basin maps and able to do morphometric analysis of drainage basin to assess and manage both ground and surface water resourses.
3. Able to do calculation of slope and preparation of slope map for the detailed evaluation of particular site in terms of slope stability.

<u>SEMESTER-III</u>

S. No	Course	Code	Title of the paper	INS WEEK	Credits	IAM	SEE	Total
1		301	Mining Geology - 7	4	4	30	70	100
2	Core	302	Remote Sensing and GIS – 8 (A) Digital Image Processing – 8 (B)	4	3	25	50	75
3		303	Economic Geology and Indian Mineral Deposits – 9 (A) Meteorology and Climatology – 9 (B)	4	3	25	50	75
4	Practical - V	304	Remote Sensing and GIS – 8 (A) and Economic Geology and Indian Mineral Deposits – 9 (A)	6	2	15	35	50
5	SOC	305	Mineral Exploration and Ore Beneficiation – 5 (A) Dimensional Stones and Building Materials – 5 (B)	4	3	25	50	75
6		306	Water Resource Management – 6 (A) Environmental Geology -6 (B)	4	3	25	50	75
7	Practical – VI	307	Mineral Exploration and Ore Beneficiation – 5 (A) and Water Resource Management – 6 (A)	6	2	15	35	50
8	OOTC	308	Open Online Transdisciplinary Course – 2	--	2	100	--	100
*	Seminar/tutorials /Remedial Classes and Quiz as part of internal assessment.			4	--	--	--	--
			Total	**36**	**22**	**260**	**340**	**600**

Geo-301 MINING GEOLOGY- 7

Course learning objectives

1. To understand Mineral policies and acts
2. To understand different approaches of mineral exploration using different methods
3. To develop the capability to identify ore minerals and also design process flow charts in mineral processing.

SYLLABUS

UNIT- I

Mines and Minerals (Regulations and development) - Act ,1957 – National Mineral Policy - Mining Lease –Prospecting license – Renewal – Royalty and dead rent – Mineral concession rules (1960) – Certification of approval.

UNIT - II

Drilling: Percussion Drills, Rotary Drills, Miscellaneous Drilling methods, Drill Sampling, Accuracy of Sole Hole Sampling, Bore Hole Problems, Bore Hole Logging, Preservation and Sampling cares

UNIT – III

Mining methods: Classification of mining methods, Alluvial mining, Open cast mining or quarrying, Underground mining – Coal mining methods: Longwall advancing, Longwall retreating, Horizon mining, Strip mining and Miscellaneous mining.

UNIT - IV

Geochemical Prospecting: Metallic Mineral Deposits, Geochemical Field Techniques, Techniques used in Geobotanical Survey, Geochemical methods for Petroleum and Natural Gases Exploration – Ore Dressing: Crushing, Grinding, Sizing, Concentration; Washing and Scrubbing, Gigging, Tabling, Magnetic Separation, Electrostatic Separation – Flow Sheets: Chromite Gold, Copper and Lead and Zinc.

Textbooks/Reference Books:

1. Abbas & Abbasi - Reneawable Energy Resources & their Implication. (Prentice Hall India)
2. Arogyaswamy, R.N.P. (1994): Course in Mining Geology. Oxford IBH– New Delhi.
3. Gupta, H.K., and Rastogi, B.K. (1976). Elements of Mining Technology Dhanbad publishers, Dhanbad.
4. Mckinstry, H.E. (1980). Mining Geology, Prentice Hall, N.Y.
5. R.W. Marjoribanks (1997). Geological methods in Mineral Exploration and Mining, Chapman & Hall, London.

Course Outcomes

After completion of the course, Students will be able to:

1. Confirm mining rules and regulations
2. Able to determine suitable mining methods
3. Analyse different ores and ore beneficiation processes.

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	M							
CO2	M	L	M	M	M							
CO3	M	L	M	M	M							
CO4	H	L	H	H	H							

H: High; M: Medium; L: Low

Geo- 302: REMOTE SENSING AND GIS - 8 (A)

Course learning objectives

1. To learn basics of aerial remote sensing and its applications.
2. To understand the physics of electromagnetic spectrum and learn satellite remote sensing.
3. To learn characteristic features of Multi spectral remote sensing present satellites of world and application of Remote Sensing for important economically deposits.
4. To have training in GIS components models and applications.

SYLLABUS

UNIT- I:

Basic concepts and fundamentals of aerial photography - Scale of photography, Aerial cameras, factors influencing image quality, side lap and overlap, mosaicing of Aerial photographs, stereoscopy, estimation of dip and slope - Aerial photo interpretation for Geology; Techniques of interpretation; Recognition elements, Convergence of evidence for interpretation of Geology.

UNIT- II:

Basic concepts and fundamentals of Remote sensing - Electromagnetic energy and its sources - Interaction of EM radiation with atmosphere - Interaction of EM radiation with earth's surface - Atmospheric windows - different spectral regions useful for Remote sensing.

UNIT- III:

Sensors – platforms, Multispectral Remote sensing in Micro wave regions, Remote sensing in Thermal infrared regions, remote sensing satellites and their pay load characteristics - Application of remote sensing for gold, diamond and groundwater exploration.

UNIT- IV:

GIS: Hardware and software in GIS – spatial and non spatial data, Raster and vector data structures – Data conversions - Comparison of raster and vector data - Elements of GIS: Data capture, Verification and processing, data storage - Data base management systems: Types, merits and demerits - Data manipulation analysis and spatial modelling – Output format and generation.

Text books/Reference Books:

1. Sabbins, F. F., 2007: Remote sensing – Principles and application; Waveland Print, INC.
2. Richard, G. Ray, 1960: Aerial photographs in Geologic interpretations, Report, USGS, U.S. Govt. Print. Off.
3. Bandat, H.F.V. 1962: Aerogeology; Gulf Publ. Co., Houston, Texas.
4. Victor, C. Miller. 1961: Photogeology; McGraw – Hill, New York.
5. Siegal, B.S & Gillespie, A. R. (eds), 1980: Remote sensing in Geology; John Wiley.
6. Aronoff, S., 1989: Geographical Information System: A management perspective. DDL Publication, Ottawa, 1989.
7. Burrough, P.A., 1986: Principles of Geographic Information System for Land resource assessment, Oxford University Press, New York

Course Outcomes

After completion of the course, Students will be able to:

1. Develop knowledge in basics of Remote Sensing interpretation keys and applications.
2. Formulate the relationship between EMR and satellite Remote Sensing.
3. Application for Remote Sensing for important economic deposits.
4. Operate GIS data model and demonstrate GIS techniques for various applications.
5. Apply RS and GIS techniques to analyze the various geological materials.

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	M							
CO2	M	L	M	M	M							
CO3	M	L	M	M	M							
CO4	H	L	H	H	H							

H: High; M: Medium; L: Low

Geo- 302: DIGITAL IMAGE PROCESSING- 8 (B)

Course learning objectives

1. To introduce the concepts of image processing and basic analytical methods to be used in image processing
2. To familiarize students with image enhancement and restoration techniques
3. To develop the capability to use GPS and DGPS instruments and technology

Syllabus

UNIT I

Digital Number/pixel value - Image Rectification - Types of errors (Geometric, Radiometric and Atmospheric errors) – Corrections (Geometric, Radiometric and Atmospheric) – Image resampling – Resampling techniques - Computation of radiance and reflectance

UNIT II

Image Registration - Image Enhancements, Spatial Enhancement, Radiometric Enhancement, Spectral Enhancement, Principal Component Analysis – Image Classifications: Digital Supervised classification, Unsupervised classification - Reclassification Processing and Feature Extraction – Data merging.

UNIT – III

Basic concepts of Global Navigational Satellite Systems (GNSSs) – Principle of GPS – Components of GPS - Source of GPS Errors and biases, Advantages and disadvantages of GPS surveying – GPS positioning types – Absolute positioning- Applications of GPS

UNIT – IV

Differential positioning – DGPS Measuring Techniques (Static, Rapid Static, Kinematic, Real Time Kinematic), Application of DGPS.

Textbooks/Reference books:

1. Bernhardsen, T., 2002: Geographic Information Systems – An introduction. Wiley India.
2. Chandra, A.M. and Ghosh, S.K. 2007: Remote Sensing and Geographical Information Systems. Narosa Publishing House.
3. George Joseph: Fundamentals of Remote Sensing. Universities Press, Hyderabad.
4. Gupta, R. P. 2003: RemoteSensing Geology. Springer.
5. Heywood, I., Cornelius, S. and Carver, S. 2011: An Introduction to Geographical Information Systems, Pearson Prentice Hall, London.
6. Lillesand, T.M. and Keifer, R.W., 1979: Remotesensing and Image interpretation. John Wiley and Sons.
7. Lo C. P. and Yeung, A. K. W. 2002: Concepts and Techniques of Geographic Information Systems. Prentice Hall.
8. Panda, B. C. 2005: Remote Sensing – Principles and Applications. Viva Books Private Limited, New Delhi.
9. Pandey, S.N. 2001: Principles and Applications of Photogeology. New Age International
10. (P) Limited Publishers, New Delhi.
11. Reddy, A.M., 2006: Textbook of Remote Sensing and Geographical Information Systems. B S Publications.
12. Sabins, F.F., 1985: Remote Sensing–Principles and Applications. Freeman.
13. Seigal, B.S. and Gillespie, A.R., 1980: Remotesensing in Geology, John Wiley & Sons, 1980.

Course Outcomes:

After completion of the course, Students will be able to:

1. Analyze images in the frequency domain using various transforms.
2. Evaluate the techniques for image enhancement and image restoration.
3. Use GPS and DGPS techniques to various projects

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	M							
CO2	M	L	M	M	M							
CO3	M	L	M	M	M							
CO4	H	L	H	H	H							

H: High; M: Medium; L: Low

GEO: 303 ECONOMIC GEOLOGY AND INDIAN MINERAL DEPOSITS – 9 (A)

Course learning objectives

1. Various processes of formation of economic mineral deposits
2. To understand the genetic controls exerted by physical and chemical processes on ore formation in various geological settings through geological time scale.
3. Geology, mineralogy, occurrence genesis and distribution of metalliferous deposits with case studies.
4. Geology, occurrence genesis and distribution of coal petroleum and other industrial minerals.

Syllabus

UNIT- I:

Processes of formation of mineral deposits – magmatic concentration, metasomatism, hydrothermal process, sedimentation, residual and mechanical concentration, oxidation, supergene enrichment, sublimation, evaporation.

UNIT- II:

Ore deposition - physical and chemical controls of ore fluids and their migration - Metallogenic epochs and provinces with special reference to India - Classification of mineral deposits; UNFC Classifications - Mineralization through geological time scale.

UNIT- III:

Geology, nature of occurrence, mineralogy, genesis and distribution of the following ore deposits with case studies of Iron, Chromite, Copper, Pb-Zn and Bauxite - Geology, nature of occurrence, genesis and distribution of Coal and Petroleum deposits - Magnesite deposits - Mica deposits - Baryte deposits - Asbestos deposits - Mineral resources of Andhra Pradesh.

UNIT – IV

Mineral economics and its concepts - Tenor, grade and specification - Strategic, critical and essential minerals – National mineral policy.

Text books/Reference Books:

1. Mead L. Jenson, Bateman, A. M. 1981: Economic Mineral deposits – John Wiley, New York.
2. Krishna Swamy, S. and Sinha, R.K. 1988: India's Mineral resources – Oxford & IBH, New Delhi.
3. K.V.G.K. Gokhale, 1973: Ore deposits of India, Thompson Press (India) Publ.
4. R.K. Sinha & N.L. Sharma. 2019: Mineral Economics, 4th Edn, Oxford & IBH, New Delhi.
5. Paul Ramdohr, 1970: Ore minerals and their intergrowth, Elsvier
6. R.L. Stanton, 1972: Ore petrology, McGraw-Hill Book Company, New York.
7. Charles, F. Park, Jr., and Roy, A. Macdiarmid, 1964: Ore deposits, W.H. Freeman & Co.

Course Outcomes:

After completion of the course, Students will be able to:

1. This course has links directly with industry and share the knowledge about a wide range of ore deposits.
2. Offers a detailed study of origin of economic mineral deposits its identification properties
3. and distribution in India.
4. Comprehensive knowledge in reflection light optic and ore textures.
5. Acquire practical knowledge on microchemical techniques for identification ores and estimation of ore reserves.

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	M							
CO2	M	L	M	M	M							
CO3	M	L	M	M	M							
CO4	H	L	H	H	H							

H: High; M: Medium; L: Low

GEO-303: METEOROLOGY AND CLIMATOLOGY – 9 (B)

Course learning objectives

1. To produce graduates who possess quantitative, scientific reasoning skills that can be applied to atmospheric problems.
2. To understand the skills for interpreting and applying atmospheric observations and knowledge of the atmosphere and its evolution.
3. To learn explain short- and medium-term weather forecasts based on sound meteorological principles.
4. To understand the physical basis of the natural greenhouse effect and the way various human activities are increasing emissions of the natural greenhouse gases.
5. To understand and explain the causes of climate change

SYLLABUS

UNIT - I

Meteorology: branches and applications - Energy spectra of sun and earth, long wave radiation, Global radiation balance, Solar energy - Atmosphere: Composition and structure of atmosphere, Layered structure of atmosphere – influences of air temperature, Surface temperature, daily cycle of temperature, annual cycle of temperature - Precipitation processes.

UNIT - II

El Nino: Introduction, upwelling. El Nino, La Nina events and consequences: Detection and prediction of El Nino - Weather forecasting: Persistence, trends, climatology, analog and numerical weather prediction methods - Forecasting surface features: Anti cyclone, cyclone, cold front and warm.

UNIT - III

Climate Change: Introduction, definition - Classification of climate; - Climatic changes through geological time, Assessing climate change, Human intervention on climate change - Greenhouse effect, greenhouse gases, Climatic change and global warming, Kyoto protocol.

UNIT - IV

Causes of climate change: Ocean circulation pattern, Changes in compositions of atmosphere,

Changes in solar radiation - Impact of climate change: Rising of CO2, impact on atmospheric circulation & weather pattern – biosphere – hydrosphere – Sea level changes, Adaptation provinces.

Textbooks/Reference Books:

1. Alan, H. Strahler and Arthur, N.Strahler1992: Modern Physical Geography, Fourth Edition, John Wiley & Sons. Inc
2. Alan Strahler and Arthur Strahler (2002): Physical Geography, 2nd edition, John Wiley &Sons Inc.
3. Byers (2005), Meteorology, The Encyclopedia of Britannia, 15th Ed.
4. Dorothy J. Meeritts and Andrew De(1997): Wet & Kirsten Menking, Environmental Geology

W.H. Freeman and Company, New York

5. Horace General, (1994): Meteorology, McGraw Hill., New York
6. John, M. Das (1995): The Monsoons, National Book House Trust, New Delhi (Third Edition)
7. Rev.Fr.S. Ignacimuthu (2010): EnvironmentalStudies,MJP, Publishers
8. Travis Hudson (2012):Living with Earth-An Introduction to Environmental Geology, PHIL earning Private Ltd.

Course Outcomes:

After completion of the course, Students will be able to:

1. Possess scientific reasoning skills that can be applied to atmospheric problems and learn to explain short- and medium-term weather forecasts based on sound meteorological principles.
2. Explore El Nino impact and interpret weather forecasting.
3. Appraise climate change and predict it from geological records.
4. Explore impact of climate change.

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	L	M							
CO2	M	L	M	L	M							
CO3	M	L	M	L	M							
CO4	H	L	H	M	M							

H: High; M: Medium; L: Low

PRACTICAL - V

Geo - 304: REMOTE SENSING AND GIS – 8 (A) AND ECONOMIC GEOLOGY AND INDIAN MINERAL DEPOSITS – 9 (A)

Remote Sensing and GIS– 8 (A)

Course learning objectives:

1. Analyze satellite data using image processing techniques
2. Analyze aerial stereo pairs (aerial photos) using stereoscopes.
3. Perform image pre-processing and post-processing techniques
4. Classify satellite data for thematic mapping

SYLLABUS

1. Aerial photo interpretation: Scale, height and slope from the aerial photos; study of inclined and vertical photographs.
2. Interpretation of satellite images – False colour composites.
3. Visual image interpretation and extraction of thematic layers.
4. Identification of structures and lineaments.
5. Study of land use and land cover and demarcation of drainage basin.
6. Identification of Rock types and minerals.
7. GIS softwares – ARC INFO, ARC-GIS, ILWIS etc.,
8. Preparing data sets for input in GIS environment.
9. Analysis and manipulation of data in GIS.
10. Integration of spatial and temporal data.

Course Outcomes

1. Develop knowledge in basics of Remote Sensing interpretation keys and applications.
2. Formulate the relationship between EMR and satellite Remote Sensing.
3. Application for Remote Sensing for important economic deposits.
4. Operate GIS data model and demonstrate GIS techniques for various applications.
5. Apply RS and GIS techniques to analyze the various geological materials.

Economic Geology and Indian Mineral Deposits – 9 (A)

Course learning objectives:

1. To provide the basics of hydrological properties of rock, aquifers, source of groundwater pollution and artificial recharge structures
2. To analyze the quality of water
3. To design the groundwater movement 4.To conduct groundwater investigations
4. To insist on the management of groundwater and methods of groundwater recharge

Syllabus:

1. Megascopic study of structures and fabrics of different Ore minerals and Industrial minerals.
2. Mineralogical and textural studies of common Ore minerals Under Ore microscope and their paragenetic significance.
3. Microchemical techniques for identification of Ores.
4. Exercises on mine sampling and determination of tenor and estimation of Ore reserves.
5. Analyze data on mineral production, use and export

Course Outcomes

After completion of the course , Students will be able to:

1. This course has links directly with industry and share the knowledge about a wide range of ore deposits.
2. Offers a detailed study of origin of economic mineral deposits its identification properties and distribution in India.
3. Comprehensive knowledge in reflection light optic and ore textures.
4. Acquire practical knowledge on microchemical techniques for identification ores and estimation of ore reserves.

GEO-305: MINERAL EXPLORATION AND ORE BENEFICIATION – 5 (A)

Course learning objectives

1. Knowledge on energy resources and guides to locate ore bodies.
2. To enhance knowledge on various methods of exploration.
3. Knowledge on geophysical methods for ore reserve estimation
4. To impart knowledge on Ore beneficiation processes and techniques.

UNIT – I:

Conservation of minerals - Renewable and non-renewable resources - Guides to locate ore bodies: Physiographic, Lithologic, Mineralogical and Structural guides.

UNIT- II:

Stages of Exploration; Scope, Objectives and Methods of Prospecting - Regional Exploration: Geological, Geochemical and Geobotanical Methods - Geologic aspects of Drilling - Types of Drills - Drilling methods: Planning, Selection of Sites, Angle and Direction of Bore-holes.

UNIT – III

Methods of sampling - Weighting of samples and calculation of average grades - Mathematical and Statistical Methods - Ore Reserve Estimation - Geophysical Methods: Ground and Airborne Surveys; Gravity, Magnetic, Electrical and Seismic Methods of Mineral Exploration.

UNIT - IV

Ore Deposition - Physical and Chemical Controls of Ore fluids and their migration - Metallogenic Epochs and Provinces with Special reference to India – Ore beneficiation Processes - Physical Concentration Methods – Pre-treatment Processes: Drying, Calcination, Roasting, Agglomeration – Extraction via Flotation: Heap Leach Process, Smelting.

Textbooks/Reference Books:

1. Gokhale, K.V.G.K., and Rao, T.C., 1978: Ore deposits of India, Thompson Press, India.
2. Paul Ramdohr, 1970: Ore minerals and their intergrowth, Elsvier
3. R.L. Stanton, 1972: Ore petrology, McGraw-Hill Book Company, New York.
4. Lindgre, W: Ore deposits Stratabound Stratiform ore deposits, McGraw hill scientific company

Course Outcomes

After completion of the course, Students will be able to:

1. This course linked to industry and acquires knowledge on techniques to locate ore bodies, methods for mineral exploration and geologic aspects of drilling.
2. Acquire knowledge on geophysical methods for Ore reserve estimation.
3. Acquire knowledge on Ore beneficiation processes and techniques.

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	M							
CO2	M	L	M	M	M							
CO3	M	L	M	M	M							
CO4	H	L	H	H	H							

H: High; M: Medium; L: Low

GEO: 305 DIMENSIONAL STONES AND BUILDING MATERIALS – 5 (B)

Course learning objectives

1. To introduce the knowledge on dimensional stones and construction materials
2. To classify dimensional stones and construction materials
3. To inquire suitability of the dimensional stones of construction materials

Syllabus

UNIT- I

Criteria for selection of dimensional stones – Importance of dimensional stones in archaeological monuments - Dimensional Stone: Indian Scenario – Granite Industry in India – Dimensional Stones through Geological Time Scale – Granite Trade in South India.

UNIT – II

Dimensional Stone Varieties – Characteristics of Dimensional stone –Distribution of Dimensional Stones in India –Distribution of Dimensional Stones in Andhra Pradesh – Export and Import Qualities.

UNIT – III

Construction Materials: Varieties of Construction Materials – Ornamental and Construction Materials in Indian History – Distribution of Building Materials in Andhra Pradesh – Conservation of Commercial Rock Deposits/Monumental/Building Stones

UNIT – IV

Engineering properties of rocks, Behaviour of rock on application of stresses: Stress and its type; Strain and its type Application of Strain and stress curve; Mohr's Circle and Stress Transformation.

Textbooks/Reference Books:

1. Blyth, F.G.H. and Defreites, M.A., 1984: A Geology for Engineers
2. Krynine, D.P. and Judd, W.R., 1957: Principles of Engineering Geology.
3. Bell, F.G., 1999: Geological Hazards, Routledge, London.
4. Vikram, K., 1986: Directory of Dimensional Stones.
5. Raman, P.K., Mineral Resources of Andhra Pradesh.
6. Information Dossier on Regional Evaluation of Dimension Stone Granite in Andhra Pradesh, 1999: Geological Survey of India, OPAP.

Course Outcomes

After completion of the course, Students will be able to:

1. Explain the distribution of dimensional stones and occurrence of construction materials
2. Classify dimensional stones and construction materials
3. Assess the suitability of various dimensional stones and construction materials

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	M							
CO2	M	L	M	M	M							
CO3	M	L	M	M	M							
CO4	H	L	H	H	H							

H: High; M: Medium; L: Low

GEO: 306: WATER RESOURCE MANAGEMENT – 6 (A)

Course learning objectives

1. To introduce the fundamentals of groundwater flow
2. To learn the hydraulics of various types of wells
3. To develop the skills to conduct groundwater investigations
4. To understand the impacts of seawater intrusion

Syllabus

UNIT- I:

Rainfall Analysis - Hydrologic cycle; Hydrological properties of rocks - Types of Aquifers: Unconfined, Confined, Semi Confined & Perched-Groundwater movements: Sub surface movement, Base flow, Effluent flow and influent flow - Darcy's law, Reynold's number, Laminar flow and turbulence flow.

UNIT - II

Pumping test: Objectives, layout of the test and measurements - Pumping Tests Methods, Estimation of T & S by Theis, Jacob and Theis Recovery, Methods, Specific Capacity Method by Slither's Method

UNIT - III

Water level fluctuation: Water Table fluctuations and causative factors; Water table and Piezometric surface and its fluctuations - Water Table Contour maps - Well types, drilling methods

UNIT - IV

Surface investigation of groundwater - Subsurface investigation of groundwater - Artificial recharge of groundwater: Concept and methods - Saline water intrusion in aquifers: Saline water intrusion, Ghyben – Herzberg relation between fresh and saline water, Prevention and control of salt water intrusion in the coastal aquifers.

Textbooks/Reference Books:

1. Groundwater Hydrology by Todd, D.K. John Wiley & Sons. New York.
2. Hydrogeology by Karanth, K.R., Tata McGraw Hill Publ Co New Delhi.
3. Keller, E.A., 1978. Environmental Geology. Bell and Howell, USA.
4. Subramanian, V., 2001.Textbook in environmental Science, Narosa Publication, New Delhi.

5. Hydrogeology by Davis, S.N. and Dewiest, R.J.M. John wiley & Son New York.
6. Ground Water by Raghunath, H. M. Wiley Eastern Ltd. New Delhi.
7. Fetter, C.W., (1990), Applied Hydrogeology-McGraw Hill, Publisher, New Delhi.
8. Freeze, R.A. and John, A., (1979), Groundwater, Cherry, Prentice Hall, Inc, 604p.
9. Hiscock, K., (2005),Hydrogeology,Principles and Practice, Blackwell Publishing, 389p.
10. Reddy and Rami, J.P., (2008). A Textbook of Hydrology, University Science Press, Bangalore.
11. Schwartz, F.W and Zhang, H., (2003). Fundamentals of groundwater, John Wiley& sons, Inc, New York, 583p.
12. Shaw, E.M., (1994). Hydrology in Practice, 3rd edition, Chapman and Hall, London, 569p.
13. Tolman, C. (1972). Groundwater, McGraw Hill Book Company.
14. Walton, W.C. (1970). Groundwater Resource Evaluation, McGraw Hill Book Company.

Course Outcomes:

After completion of the course, Students will be able to:

1. Explain the distribution of groundwater
2. Estimate the yield of the wells
3. Assess the quantity and quality of groundwater

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	M							
CO2	M	L	M	M	M							
CO3	M	L	M	M	M							
CO4	H	L	H	H	H							

H: High; M: Medium; L: Low

Geo 306: ENVIRONMENTAL GEOLOGY - 6 (B)

Course learning objectives

1. To understand natural hazards and its impacts
2. To prepare students towards environmental concerns, issues, and impacts of climate change
3. To find the ways to deal with environmental problems associated mainly various types of pollutants
4. To apply the knowledge for efficient environmental decision-making, management and sustainable development.

Syllabus

UNIT – I

Ecology and Geology: Ecology for Geologists, Biodiversity, Ecological Restoration - Hazards, Disasters, Evaluating Hazards: Linkages, Disaster Prediction and Risk Assessment – The Human response to Hazards – Global Climate and Hazards – Population Increase, Land Use Change and Natural Hazards.

UNIT – II

Earthquakes: Magnitude and Intensity, Earthquake Processes, Earthquake Cycle, Earthquakes Caused by Human Activity, Earthquake Risk and Prediction – Tsunami: Effects of Tsunamis and Linkages to other Natural Hazards, Minimizing the Tsunami Hazard ,Volcanoes:, Volcanic Features, Volcanic Hazards – Forecasting Volcanic Activity.

UNIT – III

Sediments in Rivers –Discharge, Erosion, and Sediment Deposition, Effects of Land use Changes, Flood Plain Formation, River Flooding, Nature and Extent of Flood Hazards, Adjustments to Flood Hazards – Landslides: Slope Processes and Types of Landslides, Slope Stability, Cause and effects of Landslides, Minimizing the Landslide Hazard – Coastal Hazards: Coastal Processes, Coastal Erosion, Coastal Hazards and Engineering Structures, Human Activity and Coastal Erosion, Perception of adjustment to Coastal Hazards.

UNIT – IV

Water Pollutants, Surface water Pollution and Treatment, Groundwater Pollution and Treatment, Water Quality Standards, Wastewater Treatment – Air Pollution: Public Health Importance of Air Pollution, Sources and Types of Air Pollutants, Industrial Air Pollution, Risk Assessment, Air Pollution Prevention and Control - Mineral Resources and Environment: Minerals and Human use, Environmental Impact of Mineral Development, Recycling Mineral Resources.

Text Books/Reference Books*:*

1. Edward, A. Keller (2012): Introduction to Environmenal Geology, Pearson Printice Hall, New Jersey, USA.
2. Bennett, M.R. B., Doyle, P. (1997) Environmental Geology By. John Wiley & Sons, NewYork.
3. Rekha Ghosh and D.S., Chatterjee: Environmental Geology – Geoecosystems Protection in Mining Areas, Capital Publ. Co., New Delhi.
4. Carla W. Montgomery WCH Wm. C, (1989). Environmental Geology, Brown Publishers Dubuque, Iowa
5. Chiras, D.D, (1989) Environmental Science – A framework for decision making, Addison – Wesley Publishing Company. New York.,
6. Davis, N. et. al., (1976) Environmental Geosciences, John Wiley and sons, New York.,
7. Detwler, T.R, (1971) Man's Impact on Environment, McGraw Hill
8. Keith, L. H. (1996) Principles of Environmental Sampling. ACS Professional Reference book, Amer. Chem. Soc., Washington DC.
9. Khoshoo, T. L. (1988) Environmental Concerns and Strategies By. Ashish Publ. New Delhi.
10. Montgomery, C.W., (1989) Environmental Geology, Brown publications.,
11. Ray, P.K. and Prasad, A.K. (1995) Pollution and Health. Wiley Eastern Publ., New Delhi.
12. Strahler, A.N.,(1973) Environmental Geology, John Wiley and sons, New York.
13. Subramanian,V. (2002) A Textbook in Environmental Science, Narosa Publishing House, New Delhi
14. Valdiya, K.S. (1987) Environmental Geology – Indian Context. McGraw Hill Publ.

Course Outcomes:

After completion of the course, Students will be able to:

1. Explain different aspects of environment and local, regional and global environmental problems.
2. Classify and explain the environmental pollution and disaster control technologies
3. Prepare, interpret and implement environment projects

CO – PO Mapping:

POs → COs↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	H	M							
CO2	M	L	M	M	M							
CO3	M	L	M	M	M							
CO4	H	L	H	H	H							

H: High; M: Medium; L: Low

PRACTICAL - VI
GEO: 307: MINERAL EXPLORATION AND ORE BENEFICIATION – 5 (A) AND WATER RESOURCE MANAGEMENT – 6 (A)

Mineral Exploration and Ore Beneficiation 5 (A)

Course learning objectives:

1. Knowledge on energy resources and guides to locate ore bodies.
2. To enhance knowledge on methods of sampling and open cast mining and underground mining methods.
3. Awareness on National Mineral Policy
4. To impart knowledge on mineral processing principles and techniques.
5. Role of geologist in engineering projects geological consideration for the selection of sites for major engineering projects.

Syllabus:

1. Preparation of Geological cross section based on Borehole data;
2. Laying down of stripping boundary on geological cross sections;
3. Calculation of geological and mineable ore reserves, mineable waste, and grade.
4. Interpretation of remote sensing data for mineral exploration.
5. Preparation of mineral maps of India,
6. Graphical representation of production, export and import of important minerals.

Course Outcomes

After completion of the course , Students will be able to:

1. The purpose of mineral exploration is the discovery and acquisition of new mineral deposit amenable to economic extractive operations now or in future.
2. There is uncertainty on the supply side of the market because mineral exploration is risky and the results of investment in exploratory activity are difficult.
3. Exploration Results, Mineral Resources and Mineral Reserves for Oil Shales,. Oil Sands, and other energy minerals extracted by mining methods.
4. Mineral exploration is conducted to search for commercially viable concentrations of ores and minerals for mining purposes. A highly accurate

Water Resource Management – 6 (A)

Course learning objectives:

1. To understand different methods of analysis of Rainfall data.
2. To know the procedure of yield test
3. To prepare water level contour maps
4. To interpret geophysical data and to prepare profiles
5. To assess the site feasibility study of rain water harvesting structures

Syllabus:

1. Determination of mean rainfall of an area by any two methods.
2. Determination the yield of an open well by recuperation test.
3. Determination the yield of an open well by constant level pumping test.
4. Preparation of water level contour maps
5. Preparation of Geological profiles based on Vertical electrical sounding data
6. Determination of suitable water harvesting structures based on given data

Course Outcomes:

After completion of the course, Students will be able to:

1. Analyze the Rainfall data
2. Estimate yield of a bore well
3. Prepare water level contour maps
4. Prepare subsurface profiles
5. Suggest suitable sites for rain water harvesting structures

SEMESTER - IV								
S. No	**Course**	**Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	OOSDC	401	Open Online Skill Development Courses	-	8	-	200	200
2	PW	402	Project Work – Orientation classes	24	12	300	0	300
*	Conducting classes for competitive exams, communication skills, UGC / CSIR and NET / SLET examinations			12	-	-	-	-
			Total	**36**	**20**	**300**	**200**	**500**
Total Semesters				**144**	**84**	**1320**	**880**	**2200**

MODEL QUESTION PAPER
(Revised Syllabus w.e.f.2024-2025 for campus Students)
M.Sc., DEGREE EXAMINATION-2025
THIRD SEMESTER
SUBJECT: GEOLOGY
PAPER V – GEO.304b: ENVIRONMENTAL GEOLOGY

Time: 3 hrs **Max. Marks: 50**

SECTION – A

Answer any Five of the following questions. All questions carry equal marks 5 X2 =10 M

1. Concept of Environmental geology
2. Ecology for geologists
3. Earthquake magnitude
4. Types of volcanoes
5. Effects of landuse changes due to rivers
6. Types of landslides
7. Water pollutants
8. Sources of air pollutants

SECTION – B

Answer ALL questions. All questions Carry equal Marks 4 x 10 = 50 M

9. (a) Describe in detail the relationship of Geology and Biodiversity
   Or
   (b) Write an essay on global climatic changes and hazards.

10. (a) Explain the earthquake processes, risk and mitigation measures.
   Or
   (b) What is Tsunami? Explain its prediction and hazards

11. (a) Describe the river flooding and Geomorphological changes
   Or
   (b) Write in detail about the coastal hazards

12. (a) Explain the water pollution processes and waste water treatment
   Or
   (b) Explain industrial air pollution, risk assessment and measures of control