

**SRI VENKATESWARA UNIVERSITY::TIRUPATI**  
**S.V.U.COLLEGE OF SCIENCES**  
**DEPARTMENT OF GEOLOGY**

(Syllabus common for SV University College and affiliated by SVU Area)  
( Revised Scheme of Instruction and Examination, Syllabus etc., with effect from the Academic  
Years 2016-17 for I and II Semesters and 2017-18 for III and IV Semesters )

**M.Sc. GEOLOGY**

SCHEME OF INSTRUCTION AND EXAMINATION

**I SEMESTER**

Sl. No	Components of study		Title of the paper	Instru ctio n hour s per week	Cre dits	Inter nal asses sme nt mar ks	End seme ter exam Mark s	Total
1	Core	GEO-101	Geomorphology	6	4	20	80	100
2		GEO-102	Crystallography & Mineralogy	6	4	20	80	100
3		GEO-103P	Crystallography & Mineralogy	6	4	---	---	100
		GEO-104P	Geomorphology & Paleontology	6	4	---	---	100
4	Compuls foundatio	GEO-105	Stratigraphy & Paleontology	6	4	20	80	100
5	Elective foundatio	GEO-106	Human Values & Professional Ethics-I	6	4	20	80	100
		<b>Total</b>		<b>36</b>	<b>24</b>			<b>600</b>

**II SEMESTER**

Sl. No	Components of study	Title of the paper	Hours	Credits	IA marks	End semester exam Marks	Total	
1	Core	GEO-201	Structural Geology and Geotectonics	6	4	20	80	100
2		GEO-202	Remote Sensing and GIS	6	4	20	80	100
3		GEO-203P	Structural Geology & Sedimentology	6	4	---	---	100
		GEO-204P	Remote Sensing and GIS	6	4	---	---	100
4	Compuls foundation	GEO-205	Sedimentology	6	4	20	80	100
5	Elective foundation	GEO-206	Human Values & Professional Ethics-I	6	4	20	80	100
	<b>Total</b>			<b>36</b>	<b>24</b>			<b>600</b>

**III SEMESTER**

Sl. No	Components of study	Title of the paper	Instruction hour per week	Credits	Internal assesmen mark	End semester exam Marks	Total	
1	Core	GEO-301	Igneous Petrology	6	4	20	80	100
2		GEO-302	Metamorphic Petrology	6	4	20	80	100
3		GEO-303P	Petrology	6	4	---	---	100
		GEO-304P	Geochemistry	6	4	---	---	100
4	*Generic Elective	GEO-305	Geochemistry and Thermodynamics	6	4	20	80	100
		GEO-306	Computer Applications and Geostatistics					
		GEO-307	Dimensional Stones and Building Materials					
5	Open Elective	GEO-308	Gemmology	6	4	20	80	100
		GEO-309	Surveying and Field Geology					
	<b>Total</b>			<b>36</b>	<b>24</b>			<b>600</b>

## IV SEMESTER

Sl. No	Components of study	of the paper	Instruction hours per week	Credits	Internal assessment marks	End semester exam Marks	Total	
1	Core	GEO-401	Economic Geology <b>Title gy</b>	6	4	20	80	100
2		GEO-402	Mineral Exploration, Mining & Engineering Geology	6	4	20	80	100
3		GEO-403P	Economic Geology	6	4	---	---	100
		GEO-404P	<b>Project Work</b>	---	4	---	---	100
4	*Generic Elective	GEO-405	Hydrogeology	6	4	20	80	100
		GEO-406	Environmental Geology & Natural Hazards					
		GEO-407	Water Shed Management					
5	Open Elective	GEO-408	Medical Geology	6	4	20	80	100
		GEO-409	Fuel Geology					
<b>Total</b>				<b>36</b>	<b>24</b>			<b>600</b>

## I SEMSTER

### CORE

### GEO 101: GEOMORPHOLOGY

#### **UNIT- I:**

Volcanoes & Volcanism – Nature and Origin of volcanoes – Products of volcanism eruptive styles and associated land form. Volcanic Hazards and mitigation. Earthquakes and Earth's Interior. Causes, occurrence and effects of Earthquakes. Earth's interior according to seismic theory.

#### **UNIT- II:**

Mass wasting – Factors influencing mass wasting, types of mass movements – Recognizing and minimizing the effects of mass wasting. Plate tectonics – theory of plate tectonics – nature and origin of ocean floor, origin and shaping of continents.

#### **UNI - III:**

Geological action and resulting forms of Glaciers, wind and groundwater

**UNIT- IV:**

Geological action resulting landforms of River. Drainage patterns – Morphometric analysis and interpretations.

**BOOKS RECOMMENDED:**

1. Essentials of Geology-Stanley chermicoff, Haydn A. Chip Fox, Ramesh Venkatakrishnan.
2. Holmes – Physical Geology.
3. William D. Thornbury – Principles of Geomorphology.
4. Carls W. Montgomery – Principles of Geomorphology.

**CORE****GEO 102: CRYSTALLOGRAPHY AND MINERALOGY****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 – Birefringence, 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.

**BOOKS RECOMMENDED:**

1. Optical Mineralogy by F.F. Kerr
2. Elements of Optical Mineralogy by A.N winchell vol. 1,2 and 3
3. Mineral optics by F.C. Phillips
4. An Introduction to the methods of Optical crystallography by F.D. Bloss
5. The Universal stage by R.C. Emmons.
6. Introduction of crystallography by E.E. Ford
7. Modern Mineralogy by K. Frye
8. Rock forming minerals volumes 1 to 5 by W.A. Deer et al.

**GEO103: CRYSTALLOGRAPHY & MINERALOGY (Practicals)**

1. Crystallography: Identification of crystal models of 32 crystal classes and their crystals.
2. Megascopic identification of rock forming minerals;
3. Microscopic Identification of rock forming minerals.
4. Determination of Optic axial angle ( $2V$ );
5. Determination of extinction angle ( $Z^{\wedge}C$ )
6. Determination of Anorthite content and Twin laws.

**GEO104: GEOMORPHOLOGY AND PALAEOGEOLOGY (Practicals)**

1. Study of contour-variations and elevations on toposheet6s.

2. Identification, classification and preparation of drainage basin map on toposheet.
3. Morphometry analysis of the drainage basin:
  - a. Linear aspects
  - b. Aerial aspects and
  - c. Relief aspects.
4. Morphology, classification, geological age and stratigraphic position of important fossils of Mollusca family.
5. Morphology, classification, geological age and stratigraphic position of important fossils of Brachiopoda.
6. Morphology, classification, geological age and stratigraphic position of important fossils of Echinodermita.
7. Morphology, classification, geological age and stratigraphic position of important fossils of Arthropoda.
8. Morphology, classification, geological age and stratigraphic position of important fossils of Plant fossils and
9. Morphology, classification, geological age and stratigraphic position of important fossils of Microfossils – foraminifera.

## **COMPULSORY FOUNDATION**

### **GEO 105: STRATIGRAPHY AND PALAEOLOGY**

#### **STRATIGRAPHY:**

##### **UNIT-I:**

Principles of Stratigraphy: Concept of Lithofacies and Biofacies; Stratigraphic Correlation (Litho, Bio- and Chronostratigraphic Correlation); Geological time-scale. Major stratigraphical divisions and their equivalents in India. Brief account of classification, lithology, structures and fossil content with economic importance of Archaean, Cuddapahs and Vindhya.

##### **UNIT- II:**

Major stratigraphical divisions and their equivalents in India. Brief account of classification, lithology, structures and fossil content with economic importance of Triassic, Jurassic, and Cretaceous. Short account of Siwaliks, Gondwanas and Deccan Traps.

Boundary problems with reference to India a) Precambrian - Cambrian, b) Permian – Triassic, and c) Cretaceous – Tertiary

#### **PALAEOLOGY:**

##### **UNIT- III:**

Fossil record in geological time scale. Classification of fossils. Modes of preservation of fossils. Morphology, classification and evolutionary history of Mollusks (Lamellibranchs, Gastropods and Cephalopods), Echinoderms. Morphology and Evolutionary history of Graptolites, Trilobites, Brachiopods and Corals.

##### **UNIT- IV:**

Micro-Palaeontology: Detailed study of micro-fossils such as Foraminifera, Radiolaria, Conodonts, Ostracoda and Diatoms. Application of micro-palaeontology in hydrocarbons exploration.

Plant fossils – Gondwana flora and their significance.

General characters, classification and evolution of Horse, Elephant and Man

#### **BOOKS RECOMMENDED:**

1. Krumbin & solss , L.L; Sedimentation and stratigraphy.
2. Dunbars & Rodgers: Principles of stratigraphy.
3. M.S. Krishnan : Geology of India & Burma

4. D.N. Wadia, Geology of India.
5. Ravindra Kumar : Fundamentals of Historical Geology and stratigraphy.
6. R.C. Mehadietta : 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. Geokarnataka , Centenary Volume, Published by Mysore geological department.
10. Krumbin & solss , L.L; Sedimentation and stratigraphy.
11. Dunbars & Rodgers: Principles of stratigraphy.
12. M.S. Krishnan : Geology of India & Burma
13. D.N. Wadia, Geology of India.
14. Ravindra Kumar : Fundamentals of Historical Geology and stratigraphy.
15. R.C. Mehadietta : Geology of India, Pakistan, Bangladesh & Burma.
16. Purana basins of peninsular India – published by geological society of India, Bangalore.
17. Gondwana of India Special volume Published by Gondwana society of India.
18. Geokarnataka , Centenary Volume, Published by Mysore geological department.

## **ELECTIVE FOUNDATION**

### **GEO-106: HUMAN VALUES AND PROFESSIONAL ETHICS-1**

- I. Definition and Nature of Ethics. Its relation to Religion. Politics. Bussiness. Law. Medicine and Environment. NBed and Importance of Professional Ethics – Goals – Ethical Values In various Professions
- II. Nature of Values- Good and Bad. Ends and Means, Actual and potential Values, Objective and Subjective Values, Analysis of basic moral concepts- rights, ought, duty, obligation, justice, responsibility and freedom, Good behaviors and respect for elders, Character and Conduct.
- III. Individual and Society:
  - a. Ahimnsa (Non-Violence), Satya (Trub), Brahmacharya (Celibacy), Asteya (Non Possession) and Aparigraha (Non- stealing). Purusharthas (Cardinal virtues)- Dharma (Righteousness), Artha (Wealth), Kama(Fulfillment Bodily Desire), Moksha (Liberation)
- IV. Bhagavad Gita- (a) ?Niskama karma. (b) Buddhism. The Four Noble Truths – Arya astanga marga, (c) Jainsim- mahavratas and anuvratas. Values Embedded in Various Religions, Relirious Tolerance, Gandhain Ethics.
- V. Crime and Theories of punishment-(a) Regformative, Retributive and Deterrent. (b) Views on manu and Yajnavalka.

### **BOOKS RECOMMENDED:**

1. Join S Mackenjie: A manual of ethics.
2. “The Ethics of Management” by Larue Tone Hosmer, Richard D Irwin Inc.
3. “Management Ethics – Integrity at work’ by joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
4. “Ethics in Management” by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H Titus: Ethics for Today
6. Maitra. S.K. Hindu Ethics

7. William. Lilly: Introduction of Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manava Dhjarama Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil(ed.) G.C. Haughton.
10. Susruta Samhita: Tr.Kaviraj Kunjanlal, Kunjalal Brishagratha, Chowkamba Sanskrit Series, Vol I, II & III, Varansi, Vol 100, 16-20, 21-32 and 74-77 only.
11. Caraka Samhita: Tr. Dr. Ram Karam Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I, II, III Vol I PP 183-191.
12. Ethics: Theory and Contemporary Issues, Barbara Mackinnon, Wadsworth/Thomson Learning 2001.
13. Analyzing Moral Issue, Judith, A Boss, Mayfield, Publishing Company, 1999.
14. An Introduction to Applied Ethics (Ed) John H Piet and Ayodha Prasad, Cosmo Publications.
15. Text Book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.
16. I.C Sharma Ethical Philosophy of India Nagin&Co Julundhar.

## **SEMSTER: II**

### **CORE**

## **GEO 201: STRUCTURAL GEOLOGY AND GEOTECTONICS**

### **UNIT- I:**

Concept of stress and strain. Analyses of stress, stress ellipsoid. Analyses of deformation, strain ellipsoid. The response of rock to stress. Behaviour of materials, Factors controlling the behaviour of rock materials.

### **UNIT -II:**

Mechanics of folding and buckling, geometry of superimposed folding, fold systems. Construction projects, underground mining mechanics of faulting. Classification and recognition of faults. Strike slip faults, normal faults. Unconformities and their recognition.

### **UNIT- III:**

Tectonic aspects of Igneous rocks. Geometric classification of plutonic igneous rocks, tectonic setting of plutons.

Structures in metamorphic rocks, Foliation, Axial plane foliation, transported foliation, other metamorphic foliation.

Lination – problem of lination indicating extension parallel to fold axis, small scale folds.

Structural association, saltdomes, diapers, nappe, tectonic mélanges.

### **UNIT- IV:**

Plate tectonics – Dynamic evolution of continental and oceanic crust. Sea – floor, Islands arcs, orogeny and epirogeny. Geo-dynamics of Indian plate, evolution of Himalayas, Isostasy and neotectonics.

### **BOOKS RECOMMENDED:**

1. Badgley, P.C. 1965: Structural and Tectonic principles, Harper & Raw, New York.
2. Bayly B. 1992, Mechanics in Structural geology, Springe Verlag.
3. Billings M.P. 1968: Structural geology, printice-Hall of India, Private Ltd., New Delhi.
4. Davis G.R. 1984: Structural geology of rocks and region. John Wiley & Sons,Inc., New York.
5. Gass I.B, Peter J-smith and smith PGL: understanding the Earth.

6. Hobbs, B.E, Meaus, W.D. and Williams P.F., 1976: An outline of Structural geology. John wiley & sons, Inc, New York.
7. Keary. P and vine F.J. 1990: Global Tectonics. Blackwall
8. Modres. E and Twiss. R.J. 1995: Tectorics. Blackwall
9. Ramsay, J.G., 1967: Folding and fracturing of racks. Mcgraw.Hill,Inc USA.

**CORE**  
**GEO 202: REMOTE SENSING AND GIS**

**UNIT- I:**

Basic concepts and fundamentals of aerial photography scale of photography, Aerial cameras, factors influencing image quality, procurement of aerial photographs, side lap and over lap, Information to be recorded on Aerial photographs and their numbering. Preparation of photo index, mosaicing of Aerial photographs, stereoscopy, distortions in stereo model, stereoscopic exaggeration, estimation of dip and slope. Aerial photo interpretation for Geology. Techniques of interpretation. Recognition elements, Geotechnical land forms, drainage, vegetation analysis and land use analysis, sensing. Convergence of evidence for interpretation of Geology.

**UNIT- II:**

Basic concepts and fundamentals of Remote sending. Electromagnetic energy and its sources, Interaction of EM radiation with atmosphere. Interaction of EM radiation with earth surface. Atmospheric windows, different sp[ectral regions useful for Remote sensing.

**UNIT- III:**

Sensors – platforms, multispectral Remote sensing in micro wave regions, Remote sensing in thermal infrared regions, Present remote sensing satellites and their pay load characteristics. Application of remote sensing for gold, diamond and ground water exploration.

**UNIT- IV:**

**GIS:** Development and definitions – Hardware and software in GIS trends – spatial and non spatial data, GISDATABASE: Data structure - Raster and vector data structures – Data conversions-comparision of raster and vector data bases – data compression of spatial objects. Elements of GIS – Data capture – Verification and processing – data storage. Data base management systems: Types, merits and demerits, data manipulation analysis and spatial modeling – output format and generation.

**BOOKS RECOMMENDED:**

1. Sabbins F.F., 1985 – Remote sensing – Principles and application.
2. Freeman Ray R.G., 1969 – Aerial photographs in Geologic interpretations.
3. USGS Prof.paper 373 Bandat H.F.V. 1962: Aerogeology.
4. Miller V.C. & Miller C.F. 1961 – Photogeology.
5. Siegal B.S & Gillespie A.R. 1980 – Remote sensing in Geology.
6. Arranaff S: Geographical Information System: A management perspective. DDL publication, Ottawa 1989.
7. Burrough, P.A.: Principles of Geographic Information System for Land resource assessment, Oxford University Press, New York 1986.

**GEO 203: STRUCTURAL GEOLOGY AND SEDIMENTOLOGY (Practicals)**

1. Preparation and interpretation of Geological maps and sections,
2. Structural Problems concering economic mineral deposits,
3. Recording, and plotting of field data,
4. Three point problems, contour diagrams.
5. Identification of sedimentary rocks in hand samples as well as in thin sections.
6. Size and shape analysis, statistical methods and graphical representations.



7. Identification of clastic grains.
8. Mass properties of sedimentary rocks.

### **GEO 204: REMOTE SENSING AND GIS (Practicals)**

1. Aerial photo interpretation: Scale, height and slope from the aerial photos; study of inclined and vertical photographs.
2. Interpretation of satellite images – False color 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.

### **COMPULSORY FOUNDATION**

#### **GEO.205: SEDIMENTOLOGY**

##### **UNIT- I:**

Introduction – Scope of Sedimentology. Processes of weathering – Surface processing and Rock weathering. Source of sediments.

##### **UNIT- II:**

Classification of Clastic and Non-clastic rocks, Clastic rocks – Rudaceous rocks, Arenaceous rocks, Argillaceous rocks Non-clastic rocks – Chemical deposits and Organic deposits. Dolomites and dolomitisation.

##### **UNIT- III:**

Sedimentary textures: Grain size, Grain shape and Grain fabric

Sedimentary structures: Ripples, Dunes and Cross bedding, Graded beds and Sole structures.

##### **UNIT- IV:**

Classification of sedimentary environments.

Non-marine environments-Glacial, Eolian, Lacustrine and Fluvial environments

Marine: Shelf and Deep sea sediments.

##### **BOOKS RECOMMENDED:**

1. Sedimentary Rocks – Pettijohn, F.J
2. Origin of Sedimentary Rocks – Blatt, H., Middleton, G, and Murray, R.
3. Procedures in Sedimentary Petrology – Carver, R.C
4. Introduction to Sedimentology – Sengupta, S.M
5. An Introduction to Sedimentology – Shelly, R.C.
6. Practical Manual of Sedimentary Rocks – Lindholm, R

### **ELECTIVE FOUNDATION**

#### **GEO-206: HUMAN VALUES AND PROFESSIONAL ETHICS-I**

- I. Value Education- Definition – relevance to present day – Concept of Human Values – self introspection – Self esteem. Family values-Components, Structure and responsibilities of family-Neutralization of anger – Adjustability – Threats of family life – Status of women in

family and society - Caring for needy and elderly – Time allotment for sharing ideas and concerns.

- II. Medical ethics – Views of Charaka, Sushruta and Hippocrates on moral responsibility of medical practitioners. Code of ethics for medical and healthcare professionals. Euthanasia. Ethical obligation to animals Ethical issues in relation to health care professionals and patients. Social justice in health care, human cloning, problems of abortion. Ethical issues in genetic engineering and Ethical issues raised by new biological technology or knowledge.
- III. Business ethics – Ethical stands of business – Immoral and illegal practices and their solutions. Characterizes of ethical problem in management, ethical theories, causes of unethical behavior, ethical abuses and work ethics.
- IV. Environmental ethics- Ethical theory, man and nature- Ecological crisis, Pest control, Pollution and waste. Climate change, Energy and population, Justice and environmental health.
- V. Social ethics – Organ trade, Human trafficking, Human rights violation and social disparities, Feminist ethics, Surrogacy/pregnancy, Ethics of media- Impact of Newspapers, Television, Movies and Internet.

**BOOKS RECOMENDED:**

1. Join S Mackenjie: A manual of ethics.
2. “The Ethics of Management” by Larue Tone Hosmer, Richard D Irwin Inc.
3. “Management Ethics – Integrity at work’ by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
4. “Ethics in Management” by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H Titus: Ethics for Today
6. Maitra. S.K. Hindu Ethics
7. William. Lilly: Introduction of Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manava Dhjarama Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil(ed.) G.C. Haughton.
10. Susruta Samhita: Tr.Kaviraj Kunjanlal, Kunjalal Brishagratha, Chowkamba Sanskrit Series, Vol I, II & III, Varansi, Vol 100, 16-20, 21-32 and 74-77 only.
11. Caraka Samhita: Tr. Dr. Ram Karam Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I, II, III Vol I PP 183-191.
12. Ethics: Theory and Contemporary Issues, Barbara Mackinnon, Wadsworth/Thomson Learning 2001.
13. Analyzing Moral Issue, Judith, A Boss, Mayfield, Publishing Company, 1999.
14. An Introduction to Applied Ethics (Ed) John H Piet and Ayodha Prasad, Cosmo Publications.
15. Text Book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.
16. I.C Sharma Ethical Philosophy of India Nagin&Co Julundhar.

**SEMESTER: III**  
**CORE**  
**GEO 301: IGNEOUS PETROLOGY**

**UNIT – I :**

Introduction to Igneous Petrology – Formation of igneous rocks - Form, structures and textures of igneous rocks. Classification of Igneous rocks – Mode, CIPW norm; IUGS; and Irvine Barger.

**UNIT – II:**

Origin, characteristics and types magma. Bowen's Reaction Principle – Reaction series and its application to petrogenesis. Differentiations assimilation and mixing of the magmas.

**Unit: III:**

Phase equilibrium in igneous systems – Phase Rule – Crystallization of unicomponent; Binary and Ternary systems. The behaviour of major and trace elements in magmatic crystallization

**UNIT: IV:**

Petrography and petrogenesis of the following rock types: granites, basalts, layered intrusions, anorthosites, alkaline rocks, carbonatites, lamprophyres, ultramafic related rocks, pegmatites and kimberlites.

**BOOKS RECOMMEND:**

1. Principles of igneous and metamorphic petrology by A.R. Philpotts.
2. Igneous petrology by Carmichael et. Al.,
3. Igneous and metamorphic petrology by Turner and Verhoogen.
4. Igneous and metamorphic petrology by M. Best
5. Igneous petrology by Hughes
6. Petrography of the igneous and metamorphic rocks of India by S.C. Chatterjee.
7. Igneous petrology Hyndman.

**CORE**  
**GEO 302: METAMORPHIC PETROLOGY**

**UNIT- I:**

Metamorphism, Introduction, metamorphic processes, kinds of metamorphism, Agents of metamorphism. Classification and nomenclature of metamorphic rocks, structures and textures of metamorphic rocks.

**UNIT- II:**

Grades and zones of metamorphism – concepts of metamorphic facies, classification and description, mineralogical phase rule, ACF – AFM – AKF phase diagrams.

**UNIT- III:**

Contact metamorphic facies – hornfels, sanidinite – regional metamorphic facies – zeolite, blue schist, amphibolite, granulite, eclogite, genesis of granulites, and charnockites.

**UNIT- IV:**

Metamorphic differentiations, Anatexis and origin of migmatites, Regional metamorphism and paired metamorphic belts, mineralization associated with metamorphic process.

**BOOKS RECOMMENDED:**

1. B. Bhaskara Rao – Metamorphic petrology
2. Hyndman – Petrology of igneous metamorphic rocks.

3. Turner and Verhoogen – Igneous and metamorphic rocks.
4. Linkler H.G.F. – Petrogenesis of metamorphic rocks.
5. Philpotts A.R. – Principles of igneous and metamorphic petrology.
6. Yardly B.W. – An introduction to metamorphic petrology.
7. Turner F.J. – Metamorphic petrology.
8. Congillan – Metamorphic Geology

### **GEO 303: PETROLOGY- PRACTICAL**

1. Megascopic and microscopic examination of igneous rocks.
  - a. Different types of gneisses, pegmatites, syenites, anorthosites, dunites, peridotites, pyroxenites, basalts, andesites, rhyolites, trachytes, phonolites, kimberlites, dolerites, lamprophyres.
2. Megascopic and microscopic examination of metamorphic rocks.
  - a. Different types of schists, gneisses, amphibolites, granulites, eclogites, slates, marbles and quartzites.
  - b. Arranging metamorphic rocks according to the facies of metamorphism.
3. Modal analysis of some important igneous rocks and their classification.
4. Calculation of CIPW Norm
5. Variation diagrams Harker and Niggli
6. Discriminant diagrams of Pearce and Cann.

### **GEO304: GEOCHEMISTRY – PRACTICAL**

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 soils and water.

## **GENERIC ELECTIVE**

### **GEO305: GEOCHEMISTRY AND THERMODYNAMICS**

#### **UNIT- I:**

Definition, scope and development of geochemistry, geochemical classification of elements, Goldschmidt's geochemical principles, geochemical cycle. Meteorites – classification, mineralogy, age and origin.

#### **UNIT- II:**

Atmosphere – structure, composition and evolution, Biosphere – composition – biogenic deposits – geochemical cycle of carbon. Hydrosphere – nature, physicochemical properties of water, structure and bonding. Composition of sea and terrestrial water. Evolution of the oceans.

#### **UNIT- III:**

Isotope geology – Isotopes and the periodic table. Stable Isotopes – oxygen Isotopes, sulfur Isotopes, carbon Isotopes – Radioactivity and geochronology brief outline of Rb-Sr, K-Ar and radiocarbon ( $C^{14}$ ) systems.

#### **UNIT- IV:**

Thermodynamics – historical development – basic concepts and terms, first law of thermodynamics, entropy and second law of thermodynamics, Gibbs phase rule. Activity and fugacity.

**BOOKS RECOMMENDED:**

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. Nordstrom, D.K., and Munoz, J.L. 1986: Geochemical thermodynamics, Blackwell.
5. Henderson, P., 1987: Inorganic Geochemistry, Pergamon Press.
6. Arthur H. Brownlow, 1979. Geochemistry. Prentice-Hall, Inc.Englewood Cliffs, N.J 07632.

**GENERIC ELECTIVE**

**GEO 306: COMPUTER APPLICATIONS AND GEOSTATISTICS**

**UNIT- I: COMPUTER FUNDAMENTALS**

Introduction to computers: Definition - Characteristics – History and Generations of computers – Classifications of computers – Block diagram – Peripheral devices – Merits and demerits of the computers – Hardware and Software – Data and Information.

**UNIT- II: OPERATION SYSTEM**

Introduction to operating system: Windows. MS Office: MS Word – MS Excel – MS Access – MS Power Point.

**Lab Exercises:** MS Word

**UNIT- III: DATA IN EARTH SCIENCES**

Classification – Tabulation – Representation of field and laboratory data. Statistical analysis of geological data.

**UNIT- IV: QUANTITATIVE TECHNIQUES**

Central tendency and dispersion, Correlation and regression, Theoretical distribution analysis of one way variance.

**BOOKS RECOMMENDED:**

1. Hunt and sheily, computer and commonsense, PHT
2. Fundamentals of Mathematical statistics-Gupta S.C and V.K Kappor
3. Statistical methods-Snedeca G.W and Loncron W.G
4. MS Office 2000 – Hand Book.

**GENERIC ELECTIVE**

**GEO 307: DIMENSIONAL STONES AND BUILDING MATERIALS.**

**UNIT - I:**

Dimensional Stones :- Introduction ; Historical background; Criteria for selection of dimensional stones; Importance of dimensional stones in archaeological monuments

**UNIT- II:**

Dimensional stone-Indian scenario; Granite industry in India; Dimensional stones through Geological time scale; Granite trade in south India .

**UNIT- III:**

Dimensional stone verities; Distribution of dimensional stones in Andhra Pradesh; Export and import qualities.

#### **UNIT- IV:**

Building Materials- Introduction ; Verities of building materials; Ornamental and Building stones in Indian History. Distribution of building materials in Andhra Pradesh. Conservation of commercial Rock deposits/ Monumental /Building Stones.

#### **BOOKS RECOMMENDED:**

1. f.g.h. Blyth and M.A.Defreites. A Geology for Engineers.
2. D.P. Krymine and W.R. Judd: Principles of Engineering Geology.
3. Bell F.G. 1999. Geological Hazards. Rontiege, London.
4. k. Vikram: Directory of Dimensional Stones (1986).
5. Mineral Resources of Andhra Pradesh by P.K. Ramam.
6. Information Dossier on Regional evaluation of Dimension stone granite in Andhra Pradesh, India 1999, by Geological Survey of India, OPAP.

### **OPEN ELECTIVE GEO 308: GEMMOLOGY**

#### **UNIT – I:**

Introduction to Gemmology – Relation to Mineralogy and Crystallography Lithological Association of Gemstones in India – What is a Gem – Precious and Semi-Precious Stones – Gem-bearing stratigraphic Units in India – Gemstone Resources of India.

#### **UNIT – II:**

Creteria for recognition of gemstones – Virtues of gemstones – Colours – Optical Properties – Hardness – Fractures – inclusions – zoning – Brittleness – Pleochroism – Clarity – Amenability for cutting and polishing – 4 C's – Processing of gemstones – Preforming – Styles of Cutting – Cabachon cut-Rose cut, Brilliant cut, zircon cut, step, trap or emerald cut and mixed cuts.

#### **UNIT – III:**

Determination of various physical properties in the laboratory – Hardness – Specific gravity – Reflectivity and Reflectance – Dispersion – Lustre – Streak – Measurement of Refractive index – Colour distinction.

#### **UNIT – IV:**

Uses of gemstones in jewellery, medicine, health and customs. Important Gem Species : Diamond, Corundum and Ruby, Beryl – Chrysoberyl - Cat's Eye – Alexandrite, Topaz, Spinel, Garnets, Tourmaline, Peridot, Zircon, Varieties of Quartz Group – Sphene, Feldspar, Lapis Lazuli. Synthetic Gems.

#### **BOOKS RECOMMENDED:**

1. Industrial minerals and rocks of India by S. Deb (1975)
2. Introductory Gemology by Robert Webster (1945)
3. Prospecting for gemstones and minerals by John Sinkankas (1970)
4. Gems and Gem Industry in India by R.V. Karanth (2000)
5. Gems and Gem materials by E.H. Kraus (1941)
6. Precious Stones by Max Bauer (2 Vols.) (1968)
7. Van Nostrand's Standard Catalog of Gems by John Sinkankas (1968)
8. Geology of India and Burma by M.S. Krishnan (1968)

### **OPEN ELECTIVE GEO 309: SURVEYING AND FIELD GEOLOGY**

#### **UNIT- I:**

Introduction : Definition, Scales, examples and Problems, Measurement of distances with the instruments.

Chair Survey : Principles, offsets, cross staff, obstacle in chaining cross staff survey: plathap.  
Compass Survey: Prismatic Compass, surveyors compass: Traverse with chair and compass: bo a lip of lives, .mapretis declaration sources of crow in compass , problems.

#### **UNIT- II:**

Plane – tables :, Methods of plane tabling, the two point problems, the three point problems.

Levelling : Definitions of terms used in leveling , Different type of level, Principles of leveling, classification of leveling, errors in levelling , Precision of leveling, centowes interpretation of centowes, centow drawing .

Theodolite, optics, qualities of telescope, Measurement of angles, Traverse survey with the theodolite, checks in traversing, sources of crocs, Traverse computation .

#### **UNIT- III:**

General basis of field geology, planning a field project, basic field equipment , taking geological notes in the field collection rock samples, fossils their numbering and making , use of the compass, clinometer and Hard level in the field .

#### **UNIT- IV:**

Plotting geological features on a base map, mapping geological features on aerial photography , Making a geological map from Aerial photographs, Detailed mapping and sampling, preparation of geological report.

#### **BOOKS RECOMMENDED:**

1. Surveying & Levelling (part 1<sup>st</sup> ) – Late T.P. Kanethan and Prof. S.V. Kulkarni
2. Surveying and Leveling \_\_\_ B.C. Punmiya
3. Manual of field geology \_\_\_ Robert R. Compton
4. Field geology \_\_\_ Lahee.

#### **SEMESTER: IV**

#### **CORE**

#### **GEO 401: ECONOMIC GEOLOGY**

#### **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 with case studies.

a. Iron ore deposits, b. Chromite deposits, c. Manganese deposits, d. Copper deposits, e. Pb-Zn deposits, f. Bauxite deposits.

#### **UNIT- IV:**

Geology, nature of occurrence, genesis and distribution of coal and petroleum deposits, (b) Magnesite deposits, (c) Bauxite deposits, (d) Mica deposits, (e) Baryte deposits, (f) asbestos deposits, (g) mineral resources of Andhra Pradesh.

#### **BOOKS RECOMMENDED:**

1. Bateman A.M. and Jenson M.C. – Economic Mineral deposits Walker W. \_\_\_Metallogeny and global tectonics.
2. Krishna Swamy \_\_\_ Indian Mineral resources
3. Gokhale and Rao \_\_\_ Ore deposits of India

4. R.K. Sinha & N.L. Sharma \_\_ Mineral Economics
5. Cameron E.C. \_\_ Ore minerals and their intergrowth
6. R.L. Stanton \_Ore petrology
7. Park Jr. C.F. and Mac Diamid \_ Ore deposits
8. Lindgre. W. \_ Ore deposits Strata bound Stratiform ore deposits \_ Mc Graw hill scientific company

### **CORE**

### **GEO 402: MINERAL EXPLORATION, MINING AND ENGINEERING GEOLOGY**

#### **UNIT- I:**

Conservation of minerals. Renewable and non-renewable resources. Guides to locate ore bodies: Physiographic, lithologic, mineralogical and structural guides.

#### **UNIT- II:**

Definitions of mining. Open cast mining and underground mining methods. National mineral policy - Mining lease and regulations in brief. Methods of sampling.

#### **UNIT- III:**

Mineral processing principles: crushing – grinding and sizing. Concentration techniques, Gravity methods of separation (viz: Jigging, tabling, heavy media separation, magnetic methods and floatation).

#### **UNIT- IV:**

Role of geologist in the engineering projects. Geological consideration for the selection of dam sites. Types of dams, case histories of some major dams Nagarjuna Sagar, Srisailam and Bhakrananagal. Geological considerations in the selection of tunnels and their alignment, methods of tunneling. Influence of geological conditions on foundations and design of buildings.

#### **BOOKS RECOMMENDED:**

1. Mineral Economics, 1970, Sinha R.K., and Sharma, N.D.
2. Mining Geology \_ McKNISTRY
3. Courses in mining geology – AROGYASWAMY
4. Principles and Field Mining \_ forester J.D.
5. Introduction to Mining, Hartman, U.L.
6. Mineral processing technology, Wills, B.A.
7. Engineering materials by S.C. Rangwala
8. Principles of Engineering Geology and Geotectonics by D.P.Krynine and Judd, W.R.
9. Engineering Geology by B.S.Sathya Narayanaswamy
10. Engineering Geology by D.Venkat Reddy

### **GEO 403: ECONOMIC GEOLOGY - PRACTICAL**

Megascopic study of structures and fabrics of different ore minerals and industrial minerals.

Mineralogical and textural studies of common ore minerals Under ore microscope and their paragenetic significance.

Microchemical techniques for identification of ores.

Excercises on mine sampling and determination of tenor and estimation of ore reserves.

### **GEO 404: PROJECT WORK**

1. Project work
2. Dissertation and
3. Viva- voce.

#### **GENERIC ELECTIVE**

### **GEO 405 : HYDROGEOLOGY**

#### **UNIT- I:**



Hydrological cycle – precipitation, runoff, infiltration, evaporation, transpiration. Hydrological properties of rocks – Porosity, permeability, strativity, specific yield and specific retention. Hydraulic conductivity. Hydrographs water table contour maps. Ground water:- Origin occurrence, vertical distribution of ground water.

**UNIT- II:**

Classification of aquifers: Confined, unconfined leaky and coastal aquifers: Geological formations as aquifers, springs. Ground water movement: Darcy's Law, determinators of hydraulic conductivity. Dispersion of ground water tracers.

**UNIT- III:**

Quality of ground water: Measures of water quality, physical analysis, biological analysis. Chemical analysis, graphic representations. Interpretation of chemical analysis. Classification of waters, pollution of ground water, pollution in relation to water use.

**UNIT- IV:**

Groundwater exploration: Surface and subsurface geological, and geophysical methods of groundwater exploration. Hydrogeomorphic mapping using various remote sensing techniques. Artificial recharge of groundwater, consumptive and conjunctive use of surface and ground water.

**BOOKS RECOMMENDED:**

1. Groundwater Hydrology – David Keith Todd.
2. Groundwater \_ H.M. Raghunath
3. Groundwater Assessment, Development and Management \_ K.R. Karanth.
4. Hydrogeology \_ Davies, S.N./ De wiest, R.J.M.

**GENERIC ELECTIVE**

**GEO 406: ENVIRONMENTAL GEOLOGY AND NATURAL HAZARDS**

**UNIT – I:**

Principles of environmental geology; spectrum of environment, ecological perspective of environment; Land and its use, land desertification and land degradation and land management.

**UNIT – II:**

Soil profile, origin of soil, classification of soils, soil types of India, and soil conservation; Soil degradation due to irrigation, use of fertilizers and pesticides; Water resources – hydrological considerations, problems and management.

**UNIT – III:**

Environmental management in mining, Impacts of mining activities on the environment, erosion, causes and control.

**UNIT – IV:**

Geoenvironmental hazards – volcanoes, earthquakes, floods, landslides, coastal hazards. Pollution and energy – Global warming, water contamination, waste disposal, alternate sources of energy.

**BOOKS RECOMMENDED:**

1. Environmental Geology – Indian context \_ K.S. Valdiya (1987)
2. Environmental Geology - Flawn, P.T. (1970)
3. Environmental Geology – Keller, E.A. (1976)
4. Landslide and their control \_ Zaruba, Q and Menel V (1969)
5. Focus on Environmental Geology \_ Tank, R.W. (1973)
6. Environmental Geology \_ C.W. Montgomeny (1989)

7. Environmental Geology \_ D.R. Coats (1981)
8. All you wanted to know about Disasters – (Brig) B.K. Khanna (2005)

**GENERIC ELECTIVE**  
**GEO 407: WATERSHED MANAGEMENT**

**UNIT- I:**

Introduction: Definition – Basic unit for development classification of watershed – The principles behind watershed management – Watershed delineation – Watershed characterization – Watershed prioritization.

**UNIT- II:**

**NATURAL RESOURCES:**

Land resources – Water resources – Soil resources – Artificial recharge – Analysis of rainfall data. Application of Remote Sensing technology over conventional methodology in Ground water exploration, Ground water balance studies, Management of groundwater and Land capability studies.

**UNIT- III:**

**AGRICULTURE AND DEMOGRAPHY:**

Crop pattern, water use efficiency crops, Social forestry and Afforestation, Sprinkler irrigation, Drip irrigation, Distribution of population, Population Density, Scheduled caste/ Tribe population, Literacy, Number of workers in different categories etc.

**UNIT- IV:**

**PLANNING FOR SUSTAINABLE DEVELOPMENT:**

Development planning: analysis and integration, Action Plans-local, regional and national level – Monitoring impact in watersheds – Conservation and watershed management.

**BOOKS RECOMMENDED:**

1. Hand book of Applied Geology – Ven Te chow(ed)
2. Groundwater resource evaluation – W.C Walton
3. Groundwater – H.M Raghunath
4. Hydrogeology – Devis & De wiest
5. Watershed management-JVS Murthy
6. Watershed development-VVJ Sharma C. Subba Rao and NVBSS Prasad.

**OPEN ELECTIVE**

**GEO 408: MEDICAL GEOLOGY**

**UNIT- I:**

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

**UNIT- II:**

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

**UNIT- III :**

Geology Human Health - Natural Distribution and Abundance of Elements, Anthropogenic Sources, Uptake of Elements from a Chemical Point of View, Uptake of Elements from a Biological Point of

View, Biological Functions of the Elements ,Geological Impacts on Nutrition, Biological Responses of Elements

**UNIT- IV :**

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

**BOOKS RECOMMENDED:**

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

**OPEN ELECTIVE**

**GEO 409: FUEL GEOLOGY**

**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 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 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.

**BOOKS RECOMMENDED:**

1. Petroleum formations and occurrences by Tissort B.P. and Welte D.H. 1984
2. Text book of coal by Chandra, D., et al., 2000
3. Uranium ore deposits by Dahlkamp F.J. 1993

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