SRI VENKATESWARA UNIVERSITY: TIRUPATI

S.V.U COLLEGE OF SCIENCES

DEPARTMENT OF GEOLOGY

Course

M.Sc. GEOLOGY

Choice Based Credit System (CBCS)

Academic Year 2017 – 18

Vision

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

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.

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.**

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 Outcomes (POs)

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.**

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.

Semester-I

S. No	Components of study		Title of the paper	Instruction hours per week	Credits	Internal assess-ment marks	End semester exam Marks	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	Compulsory foundation	GEO-105	Stratigraphy & Paleontology	6	4	20	80	100
5	Elective foundation	GEO-106	Human Values & Professional Ethics-I	6	4	20	80	100
	Total			36	24			600

Semester-II

S. No	Components of study		Title of the paper	Instruction hours per week	Credits	Internal assessment marks	End semester exam Marks	Total
1		GEO-201	Structural Geology and Geotectonics	6	4	20	80	100

2	Core	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	Compulsory foundation	GEO-205	Sedimentology	6	4	20	80	100
5	Elective foundation	GEO-206	Human Values & Professional Ethics-II	6	4	20	80	100
	Total			36	24			600

Semester-III

S. No	Components of study		Title of the paper	Instruction hours per week	Credits	Internal assessment marks	End semester exam Marks	Total
1		GEO-301	Igneous Petrology	6	4	20	80	100

2	Core	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	6	4	20	80	100
		GEO-307	Dimensional Stones and Building Materials	6	4	20	80	100
5	Open Elective	GEO-308	Gemmology	6	4	20	80	100
		GEO-309	Surveying and Field Geology	6	4	20	80	100
	Total		36	36	24			600

***Among the Generic Electives the Student shall chooses TWO papers**

Semester-IV

S. No	Components of study		Title of the paper	Instruction hours per week	Credits	Internal assessment marks	End semester exam Marks	Total
1		GEO-401	Economic Geology	6	4	20	80	100

2	Core	GEO-402	Mineral Exploration, Mining & Engineering Geology	6	4	20	80	100
3		GEO-403P	Economic Geology	6	4	---	---	100
		GEO-404P	Project Work	---	---	---	---	100
4	*Generic Elective	GEO-405	Hydrogeology	6	4	20	80	100
		GEO-406	Environmental Geology & Natural Hazards	6	4	20	80	100
		GEO-407	Water Shed Management	6	4	20	80	100
5	Open Elective	GEO-408	Medical Geology	6	4	20	80	100
		GEO-409	Fuel Geology	6	4	20	80	100
	Total			36	24			600

*Among the Generic Electives the Student shall chooses TWO papers

CORE

SEMESTER - I

GEO 101: GEOMORPHOLOGY

Course 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.

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.

Course Outcomes

1 Able to explain conceptual approaches in geomorphology.

2 Able to describe land forms and land forming processes in different climate zones and tectonic regimes.

3 Able to explain different theories and models for landscape evolution.

4 Obtain knowledge in recognizing and minimizing the mass wasting.

Text Books:

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

CO – PO Mapping:

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

H: High; M: Medium; L: Low

CORE

GEO 102: CRYSTALLOGRALPHY AND MINERALOGY

Course Objectives:

1. To give students the description of elements of crystallography, crystal structures in terms of atom position, unit cells, crystal symmetry and twinning.
2. Describe symmetry and symmetry functions of different crystal systems and respective minerals.
3. To obtain a three dimensional molecular structures of a crystal.
4. To identify the mineralogical composition of geological materials in order to help to reveal their origin and evolution.

5. Describe the concepts of optical phenomena in thin sections of minerals.
6. Aims to provide knowledge on the structural, chemical identification of the common rock forming minerals and demonstrative how minerals make up Igneous and Metamorphic rocks.

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.

Course Outcomes

1 Students will be able to describe crystal structures, crystal symmetry and twinning
2 Students will learn the use of X-ray crystallography to determine the arrangement Atoms in a crystal.
3 Students will be able to 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 Students will get thorough knowledge about the physical chemical and optical Characteristics of minerals could lead to the discovery of new uses for Earth's mineral resources.

Text Books:

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.

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

GEO103(P) CRYSTALLOGRAPHY & MINERALOGY

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 a
5. ngle (2V);
6. Determination of extinction angle (Z^C)
7. Determination of Anorthite content and Twin laws.

Course Objectives:

1. Acquisition of knowledge that enable the identification of symmetry operations occurring in crystalline matter.
2. Acquisition of knowledge allowing the stereographic projection of crystallographic models.
3. Acquisition of knowledge and methodologies for the characterization of macroscopic properties and Megascopic properties of minerals and identification of expeditiously, minerals.
4. Students will be able to characterize the external form of crystals from the various crystal systems and identify minerals in hand specimen.
5. Understand the structural controls on the chemistry of minerals.
6. Understand the operation of the petrographic microscope and mineral identification in thin section.

Course Outcomes

1. The student understands the importance of minerals to society and to the study of the Earth.
2. Can explain how the properties of chemical elements and their bonds regulate the structure and composition of minerals.
3. Demonstrate how the crystal structure of minerals affects the external morphology and physical properties of a mineral (e.g. crystal symmetry, crystal habit).
4. Identify various minerals using Physical properties.
5. Identify various crystal forms shown by minerals belonging to different crystal system.

GEO104: GEOMORPHOLOGY AND PALAEONOTOLOGY (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, geologival age and stratigraphic position of important fossils of Mollusca family.
5. Morphology, classification, geologival age and stratigraphic position of important fossils of Brachiopoda.
6. Morphology, classification, geologival age and stratigraphic position of important fossils of Echinodermita.
7. Morphology, classification, geologival age and stratigraphic position of important fossils of Arthropoda.

8. Morphology, classification, geologival age and stratigraphic position of important fossils of Plant fossils and
9. Morphology, classification, geologival age and stratigraphic position of important fossils of Microfossils – foraminifora.

Course Objectives:

1. Paleontology has essentially three basic goals: (1) to describe the world's past biodiversity; (2) to outline the history of life on earth; and (3) to develop new ideas about evolution and ecology.Course Outcomes:
2. Some paleontologists work for the petroleum industry, and use fossils to interpret sequences of sedimentary rocks. Paleontologists who work on relatively recent fossils have developed approaches to reconstructing past climates and environments. Today, environmental change, global warming, and so on are household words.
3. In the early days, paleontology was used to make geologic maps showing the ages of rocks at the surface. The maps made it easier to locate valuable mineral deposits such as gold, copper, coal, and oil. Fossils still provide useful information in the search for natural resources.
4. Paleontology is the study of the history of life. Because that history is written in the fossil and geological record, paleontology allows us to place living organisms in both evolutionary (life-historical) and geological (earth-historical) context.

Course Outcomes

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

COMPULSORY FOUNDATION

GEO 105: STRATIGRAPHY AND PALAEOTOLOGY

Course Objectives

1. To make the students 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. Major stratigraphic boundary problems with reference to India.
4. To acquire skills on identification, classification and documentation of palaeobiota.
5. Acquire knowledge on morphology, classification and evolutionary trends of invertebrate fossils.
6. Describe evolutionary, separation and classification of different microfossils and application of micropalaeontological techniques in hydrocarbons exploration.

UNIT-I

Principles of Statigraphy: Concept of Lithofacies and Biofacies; Stratigraphic Correlation (Litho, Bio- and Chronostrarigraphic 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 Vindhyans.

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, Gondawanas and Deccan Traps.

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

UNIT- III

Fossil record in geological time scale. Classification of fossils. Modes of preservation of fossils.Morphology, classification and evolutionary history of Mollusks (Lamellibranches, 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, Conodonta, Ostracoda and Diatoms. Application of micro-plaleontology in hydrocarbons exploration.
Plant fossils – Gondwana flora and their significance.
General characters, classification and evolution of Horse, Elephant and Man

Course Outcomes

1. Students would have acquired comprehensive knowledge on principles of Stratigraphy, correlation methods classification of stratigraphic units, tectonic framework of India and Geological timescale.
2. Ability to give an account of various 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
4. Describe morphology, classification, evolutionary trends of Invertebrate fossils with geological and geographic distribution and paleoecological and paleo-enviromental relevance.
5. Ability to identify, classify and describe the morphology of the invertebrate fossils and plant fossils.
6. Application of fossils in establishing the age of the rock unit, correlation with other area, and Use of fossil in finding mineral deposits.
7. Ability to apply micropalaeotological techniques in hydrocarbon exploration.

Text Books:

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. Mehadiretta : 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. Mehadiretta : 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.

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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
CO5	H	M	M	H	M	H	M	H	H	M	M	L
CO6	H	M	M	H	M	H	L	H	H	M	M	L
CO7	H	M	H	H	M	H	M	H	H	M	M	L

ELECTIVE FOUNDATION

GEO-106: HUMAN VALUES AND PROFESSIONAL ETHICS-1

Course Objectives

1 To provide Human Values and Ethics relating to Religion, Business, Law, Media and Environment.

2 To provide in depth knowledge about the Moral and ethical values to interpretation in their day to day activities of life.

UNIT 1

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

UNIT - 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.

UNIT III

Individual and Society:
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)

UNIT -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.

UNIT V

Crime and Theories of punishment-(a) Regformative, Retributive and Deterrent. (b) Views on manu and Yajnavalka.

Course Outcomes

1 After completion of this course the students will be able to know the importance of Ethics and Human Values in various professions.

2 Students also will get in depth knowledge and understanding of moral values and ethical code of the Indian Society. Especially embedded in various scriptures.

Text Books

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.

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

CORE

SEMESTER - II

GEO 201: STRUCTURAL GEOLOGY AND GEOTECTONICS

Course 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 regines.
2. To study the diverse and types of structures in the field rock geometric 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 plate tectonic theories to obtain recent knowledge on structure and development of the earth and discussed older and new geological ideas concerning the development of the crust.

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. Lineation – problem of lineation 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.

Course Outcomes:

1. Able to demonstrate a basic understanding of stress strain, rheology of earth's lithosphere and comprehend how to describe and classify brittle and ductile structures.
2. Able to describe, identify and analyze the folds, faults and joints and their effects on outcrop pattern.
3. Knows how mountain ranges and rift basins form
4. Measure, plot and interpret structural field data and can relate these to geological maps.
5. Knows how to read geological maps and geological cross-section.
6. Knows how to apply plate tectonic theories to obtain recent knowledge on structure and development of earth's crust.

Text Books

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.

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
CO6	H	M	H	H	H	H	H	M	H	M	M	L

CORE

GEO 202: REMOTE SENSING AND GIS

Course 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.

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.

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

Text Books

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.

CO - PO Mapping:

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

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.

Course Objectives:

1. The primary goal of structural geology is to use measurements of present-day rock geometries to uncover information about the history of deformation (strain) in the rocks, and ultimately, to understand the stress field that resulted in the observed strain and geometries.

2. The main target of structural geology is to use measurements to understand the stress field that resulted in the observed strain and geometries. We can also understand the structural evolution of a particular area due to plate tectonics
3. Structural geology, scientific discipline that is concerned with rock deformation on both a large and a small scale. Its scope of study is vast, ranging from submicroscopic lattice defects in crystals to fault structures and fold systems of the Earth's crust.
4. Geology describes the structure of the Earth on and beneath its surface, and the processes that have shaped that structure. It also provides tools to determine the relative and absolute ages of rocks found in a given location, and also to describe the histories of those rocks.
5. The ultimate goal of this course is to give you the ability to make careful observations, and from these interpret and understand modern and ancient sedimentary.
6. The interpretation of ancient environmental conditions in sediment source areas and depositional sites is a key objective of much sedimentological study.

7. The objective of much sedimentological research is the interpretation of ancient environmental conditions in sediment source areas and depositional sites.

Course Outcomes:

1) The interpretation of geological maps and determination of strike and dip, Borehole problems and apparent dip, plunge and pitch of linear structures

2) Structural geology concepts and tools to understand rocks deformation in hot environments

3) Structural geology with interpretations and simple geomechanical problems and solutions

4) Structural geology issues related to new instruments in measuring structural data from rocks, paleomagnetic studies in tectonics field studies in structural geology interdisciplinary aspects of structural geology.

5) Sedimentology encompasses the study of modern sediments such as sand, silt, and clay, and the processes that result in their formation (erosion and weathering), transport, deposition and diagenesis.

6) Sedimentology, the study of sedimentary rocks and the processes by which they are formed, includes and is related to a large number of phenomena.

7) Sedimentology includes the five fundamental processes defined by the term sedimentation -- weathering, erosion, transportation, deposition and diagenesis.

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.

Course 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
5. Perform change detection analysis.
6. To prepare the Geological, Geomorphological and structural mapping using open source satellite data.
7. Characterization of different soils types through FCC satellite images.
8. To identify the groundwater potential zones through remote sensing and GIS techniques.
9. Tracking the growth of a city and changes in farmland or forests over several years or decades.
10. Preparation of contour maps through equal elevation points.
11. Analyze the scale of aerial photographs and mosaicing.

Course Outcomes:

1. Understand the concepts of Photogrametry and compute the heights of objects
2. Understand the principles of aerial and satellite remote sensing, Able to comprehend the

energy interactions with earth surface features, spectral properties of water bodies.
3. Understand the basic concept of GIS and its applications, know different types of data representation in GIS.
4. Understand and Develop models for GIS spatial Analysis and will be able to know what the questions that GIS can answer are.
5. Apply knowledge of GIS software and able to work with GIS software in various application fields.
6. Illustrate spatial and non spatial data features in GIS and understand the map projections and coordinates systems.
7. Apply knowledge of GIS and understand the integration of Remote Sensing and GIS.

COMPULSORY FOUNDATION

GEO 205: SEDIMENTOLOGY

Course Objectives

1. Aim is to study ''Sediments' to derive information on the depositional conditions which acted to deposit rock unit.
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.

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 environemtns Marine: Shelf and Deep sea sediments.

Course Outcomes

1 Able to identify different sedimentary rocks in both hand specimens and thin section and derive information on the depositional conditions and environments.

2 Able to study the sequence of sedimentary rock strata and describe the tectonic framework of sedimentation to understand the earth's history including palaeoclimatology and history of life.

Text Books

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

CO – PO Mapping:

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

ELECTIVE FOUNDATION

GEO 206: HUMAN VALUES AND PROFESSIONAL ETHICS-II

Course Objectives

1. To provide the knowledge about the value oriented education, Medical ethics, family values and ethics and Moral code of Indian society.
2. To provide the business ethics, environmental and social ethics followed and practiced in Indian society.

UNIT 1

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

UNIT 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.

UNIT 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.

UNIT IV

Environmental ethics- Ethical theory, man and nature- Ecological crisis, Pest control, Pollution and waste. Climate change, Energy and population, Justice and environmental health.

UNIT 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.

Course Outcomes

1 After completion of this course the students will be able to follow and practice good behaviour with human values and moral support to their elderly family members.

2 They also aware and get knowledge about medical ethics how the doctors will behave with patients, what type of ethics should be followed by business people. They also get in through knowledge about the protection of environment social ethics like family ethics, the role of print and electronic media in prevention and protection of Human rights in Indian society.

Text Books

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. Harold H Titus: Ethics for Today
5. Maitra. S.K. Hindu Ethics
6. William. Lilly: Introduction of Ethics
7. Sinha: A Manual of Ethics
8. Manu: Manava Dhjarama Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil(ed.) G.C. Haughton.
9. 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.
10. Caraka Samhita: Tr. Dr. Ram Karam Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I, II, III Vol I PP 183-191.
11. Ethics: Theory and Contemporary Issues, Barbara Mackinnon, Wadsworth/Thomson Learning 2001.
12. Analyzing Moral Issue, Judith, A Boss, Mayfield, Publishing Company, 1999.
13. An Introduction to Applied Ethics (Ed) John H Piet and Ayodha Prasad, Cosmo Publications.
14. Text Book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.

CO – PO Mapping:

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

SEMESTER – III

CORE

GEO 301: IGNEOUS PETROLOGY

Course Objectives

1. To impart knowledge on igneous processes, formation, structures, textures and classification of Igneous rocks – historic perspective and the IUGS system.
2. Knowledge on origin, physical and chemical characteristics and types of magma.
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 Binary and Tertiary systems.
5. To obtain knowledge on the behaviour of major and trace elements in magmatic crystallization.
6. To understand the physical and chemical processes that produce the different Igneous rocks types and their petrogenesis and distribution in the earth is crust and mantle.

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, characterstics and types magma. Bowens Reaction Principle – Reaction series and its application t 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, carbonatities, lamprophyres, ultramafic related rocks, pegmatites and kimberlites.

Course Outcomes

1. Explain 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. Obtain knowledge on the role and behaviour of major and trace elements in crystallization processes.
5. Identify different Igneous rocks both in handspecimens and thin sections in terms of their petrogenesis by studying the petrographic characteristics.

Text Books

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

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

CORE

GEO 302: METAMORPHIC PETROLOGY

Course Objectives

1. To propant knowledge on metamorphic processes, kinds of metamorphism, classification nomenclature, structures and textures of metamorphic rocks.
2. Metamorphic grades, zones, facies and facies series. Mineralogical phase rule and phase diagram.
3. Contact and Regional metamorphism faccies and their mineral assemblages and genesis of granulites and charnockites.
4. Metamorphic differentiation processes and origin of migamtites and study the classic regional metamorphic regions of the world and paired metamorphic belts.
5. Mineralization associated with metamorphic processes.

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, ecologite, genesis of grnulites, and charnockites.

UNIT- IV

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

Course Outcomes

1. Identify metamorphic minerals in thin section and interpret met textures and able to comment on met grade and types of metamorphism.
2. Describe identify and classify metamorphic rocks in hand samples based on mineral assemblages and textures.
3. Plotting quantitative and qualitative mineral and mineral to infer the metamorphic conditions and processes study of metamorphic rocks on chemical system.
4. Establish relation between metamorphism and plate tectonics.
5. Establish metamorphic reaction principles of economically important ores and minerals a ssociated with metamorphic processes.

Text Books

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. Congillen – Metamorphic Geology

CO –PO Mapping:

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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

GEO 303: PETROLOGY- PRACTICAL

1. Megascopic and microscopic examination of igneous rocks.
   a.Different types of grnites, pegmatites, syeniles, anorthosites, dunites, peridotites, pyroxinities, basalts, andesites, rhyolites, trachytes, phonolites, kimberlites, dolerites, lamprophyres.
2. Megascopic and microscopic examination of metamorphic rocks.
   a. Different types of schists, geneses, amphibolites, granulites, eclogites, slates, marbles and quarzites.
   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 Harkers and Niggli
6. Dicriminant diagrams of Pearce and Cann.

Course Objectives :

1. Igneous and Metamorphic - and the processes that form and transform them. Mineralogy is the study of the chemistry, crystal structure and physical properties of the mineral constituents of rocks.

2. The scope of igneous petrology is very large because igneous rocks make up the bulk of the continental and oceanic crusts and of the mountain belts of the world, which range in age from early Archean to Neogene, and they also include the high-level volcanic extrusive rocks and the plutonic rocks that formed deep within ...

3. Petrology (Petrologiya) is a journal of magmatic, metamorphic, and experimental petrology, mineralogy, and geochemistry. The journal offers comprehensive information on all multidisciplinary aspects of theoretical, experimental, and applied petrology.

4. Petrology plays an important role in ascertaining the physical and chemical composition of rocks and the different conditions that influence their formation.

Course Outcomes:

1) Describe the types and relative abundances of phases in a rock based on observations from hand specimens and thin sections
2) Interpret the geologic history of igneous rocks based on mineral assemblage and textures using both hand sample and microscope techniques
3) Use metamorphic mineral assemblages and textures to constrain deformation history and P-T conditions
4) Use geochemical data (partition coefficients, REE plots, etc) to constrain petrogenetic processes
5) Integrate their research findings with those of peers in developing a consensus model that (a) explains mineral occurrences and interplay (micro- and macroscopic) in field samples, and (b) holds up to public scrutiny (as a consensus model and as individual components) at a departmental mini-poster symposium
6) Design and implement a field sampling campaign
7) Use a portable X-Ray Fluorescence Spectrometer to collect elemental analyses
8) Use MS Excel to organize, plot, and evaluate the petrogenesis of CRB using elemental data

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.

Courses Objectives

1. The purpose of a geochemical survey is to give a description of the geochemical variation of a region. Numerically this can be expressed in terms of the natural "geochemical variance" of the area.

2. One of the goals of geochemistry is to determine the abundance of elements in nature, as this information is essential to hypotheses development about the origin and structure of our planet and the universe.

3. Geochemistry plays an essential role in our understanding of processes that produce economic concentrations of minerals whether by hydrothermal, magmatic, metamorphic, hydraulic (both surficial and subterranean) or weathering agents, or a combination of these. Geochemistry also contributes importantly to exploration.

4. Geochemistry is the branch of Earth Science that applies chemical principles to deepen an understanding of the Earth system and systems of other planets.

Course Outcomes:

1) Geochemistry can play a key role in helping to protect the safety of drinking water by identifying the sources, concentration and forms of potentially harmful elements such as arsenic mercury and fluoride in natural water.

2) Geochemistry and health establishes and explains links between the natural or disturbed chemical composition of the earth's surface and the health of plants animals and people.

GENERIC ELECTIVE

GEO305: GEOCHEMISTRY AND THERMODYNAMICS

Course Objectives

1. Aims to give on introduction in how chemical principles are used to explain the mechanism that controls the large geological systems such as earth's crust, mantle, ocean and atmosphere and the formation of the solar system.
2. Learn the fundamentals of thermodynamics.

UNIT- I

Defenition, scope and development of geochemistry, geochemical classification of elements, Goldschmidts geochemical principles, geochemical cycle. Meteorites – classification, mineralogy, age and origin.

UNIT- II

Atmosphere – structure, composition and evolution, Biosphere – composition – biogenetic 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

Course Outcomes

1 Use the fundamental geochemical tools and directions like aqueous geochemistry, trace element geochemistry and isotope geochemistry to understand the formation of the elements and the solar system the earth's geochemical composition and differentiation in to different spheres the age of rocks, global geochemical cycle the surface environment and chemical traces of early life.

2 Acquire basic knowledge application of thermodynamic principles i.e., the first law of thermodynamics, second law of ID, Gibbs phase rule to the geochemical problems.

Text 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. Nordstrorm, 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.

CO – PO Mapping:

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

OPEN ELECTIVE 1

GEO 308: GEMOLOGY

Course Objectives

1. To learn origin, classification, and gemstone resources and their stratigraphic units in india.
2. To learn and examine the nature, quality and rarity of the gemstones
3. To understand the physical and optical properties of gemstones
4. To give an idea about the gemstone testing instruments
5. To gain knowledge and to provide skills to become a successful gemmologist

UNIT – I

Introduction to Gemology – 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.

Course Outcomes

1. The course is focussed on a comprehensive learning in gemology
2. Understands the formation, classification and properties to final the grading and evaluation.
3. Knowledge in order to identify original gemstones and stimulants
4. Acquire skills which will be useful to them in gem industry

Text Books

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)

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

OPEN ELECTIVE 2

GEO 309: SURVEYING AND FIELD GEOLOGY

Course 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

UNIT- I

Introduction : Definition, Scales, examples and Problems, Measurement of distances with the instruments. Chair Survey : Principles, offsets, cross staff, obstacle in chasing cross staff survey: plathap. Compass Survey: Prismatic Compass, surveyors compass: Traverse with chair and compass: boa 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, opties, qualities of telescope, Measurement of angles, Traverse survey with the theodalite, 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

Plothip geological feeders or a base map, mapping geological feeders on aerial photography , Making a geological map fawn Aerial photographs, Detailed mapping and sampling, preparation of geological report.

Course Outcomes

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

Text Books

1. Surveying & Levelling (part 1st) – Late T.P. Kanethan and Prof. S.V. Kulkarni
2. Surveying and Leveling ___ B.C. Punmiya
3. Manval of field geology ___ Robent R. Compton
4. Field geology ___ Lahee.

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

SEMESTER - IV

CORE

GEO 401: ECONOMIC GEOLOGY

Course 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.

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, gnesis 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.

Course Outcomes

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.

Text Books

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

CO – PO Mapping:

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

CORE

GEO 402: MINERAL EXPLORATION, MINING AND ENGINEERING GEOLOGY

Course 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.

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.

Course Outcomes

1 This course linked to industry and aquire knowledge on techniques to locate ore bodies sampling methods mining methods for both surface and underground mining and mineral processing techniques.

2 Get awareness on National mineral policy so that students can enter the mining industry without any hassle.

3 Students will get critical knowledge on evaluation of geological condition at the major engineering project sites.

Text Books

1. Mineral Economics, 1970, Sinha R.K., and Sharma, N.D.
2. Mining Geology _ McKNISTRY
3. Cources 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

CO – PO Mapping:

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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

GEO 403: ECONOMIC GEOLOGY - PRACTICAL

1. Megascopic study of structures and fabics 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.

Course Objectives

1) Its chief objective is to guide the exploration for mineral resources and help determine which deposits are economically worthwhile to mine. Specialists in economic geology often assist in the extraction of the mineral commodities as well.
2) The discipline that applies principles of economic theory to problems involving mineral resources, mineral economics, specifically relates concepts and ideas of general economics to the various aspects of the occurrence, exploitation, and final use of minerals.
3) Increasing interaction between the exploration teams, universities, students and private sector companies developing a high motivation for searching knowledge and learning the importance of critical reading.
4) The purpose of the study of economic geology is to gain understanding of the genesis and localization of ore deposits plus the minerals associated with ore deposits.

GEO 404P Project Work

Course Objective

1. Applied for mining lease for Dolomite mineral Venkatampalli Village, Narpala Mandal, Anantapuram District.
2. The mining plan prepared and submitted and provisions of rule under 7 (a) APMMR – 1966 for approved.
3. The applicant has done on trial pits in the applied area and found that the Dolomite mineral is in good quality and quantity.
4. The environmental control measures shall be undertaken so that, no silt is allowed to flowdown the dump slope, carring the solid particals along with the rain water and deposit in the water tank

Course Outcomes

1. Mining is global industry, which provides the raw material and energy resources needed to sustain modern civilization.

2. Demands for mineral consumptions are increasing day to day drastically and also expected to increase in decates to a head of population growth and rising and living standards.
3. Environmental awareness in relating to proper protective and mitigation measures to the environment from its damage as soon at a great amount of improvement in mining sector

GENERIC ELECTIVE

GEO 405: HYDROGEOLOGY

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
5. To insist on the management of groundwater and methods of groundwater recharge

UNIT- I

Hydrological cycle – precipitation, runoff, infiltration, evaporation, transpiration. Hydrological properties of rocks – Porasity, 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.

Course Outcomes

After the completion of this course, a successful student is 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
3 Conduct geological and geophysical investigations and give recommendations for drilling of borewells.
4 Explain causes of pollution of groundwater give remedial measures to the society.
5 Use modern methods and appropriate techniques to carrying out geophysical studies and artificial recharge methods

Text Books

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.

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	M	H	H	H	H	H	H	H

OPEN ELECTIVE 1

GEO 408: MEDICAL GEOLOGY

Course Objectives

1. Knowledge on basic concepts and development of Medical Geology
2. The public health effects of Earth materials and geological processes
3. Interaction between abundances of elements and isotopes and the health of humans
4. Geological effects on animal health and Geophagy

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

Course Outcomes

1. Able to understand the distribution of trace elements and its cyclic movement through the abiotic-biotic environment and their influence on human health, flora and fauna.

Text Books

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

CO – PO Mapping:

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CO1	H	H	H	H	M	H	H	H	H	H	H	H

OPEN ELECTIVE 2

GEO 409: FUEL GEOLOGY

Course Objectives

1. To understand the Origin and composition of petroleum, Coal and atomic minerals
2. To analyze the grades of coal
3. To demonstrate the structural traps of petroleum and coal forming epochs
4. To understand the migration of oil and gas and methods of prospecting of atomic minerals
5. To evaluate the mode of occurrence and association of atomic minerals

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. ecological 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.

Course Outcomes

1 Demonstrate the association of formation of natural fuels like coal and petroleum and atomic minerals
2 Analyze the favorable zone for entrapment of oil and gas and also grades of coal
3 Utilize the data of distribution of oil, gas and coal in India
4 Assess methods of chemical characterization of coal and prospecting of atomic minerals

Text Books

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

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	M	H	M	M	H
CO2	H	H	H	H	M	H	H	M	H	M	M	H
CO3	H	H	H	H	M	H	H	M	H	M	M	H
CO4	H	H	H	H	M	H	H	M	H	M	M	H