Punyashlok Ahilyadevi Holkar Solapur University, Solapur

पुण्यश्लोक अहिल्यादेवी होळकर
सोलापूर विद्यापीठ
।। विद्यया संपन्नता ।।
NAAC Accredited-2022
'B++' Grade (CGPA-2.96)

Name of the Faculty: Science & Technology

Syllabus: GEOLOGY

As per National Education Policy (NEP 2020)

Name of the Course: B.Sc. Part- III (Sem V & VI)

[Syllabus to be implemented from June- 2026]

B.Sc. Part- III Geology NEP 2020 Structure w.e.f. June- 2026

B.Sc. Part- III Geology NEP 2020 Structure							
SEM	**Faculty**		**GE/OE**	**VSC**	**IKS**	**Field Project**	**Credits**
	DSC	**DSE**					
V	DSC1-7 (3+2) **Structural Geology** (45 Period) DSC1-8 (3+2) **Hydrogeology** (45 Period) DSC1-9 (3+2) **Engineering Geology** (45 Period)	DSE1-1 (2+1) **Economic Geology** (30 Period) or DSE1-2 (2+1) **Introduction to Crystallography** (30 Period)	---	VSC 3 (2) (Hands on training related to DSE) **Economic Geology** **or** **Crystallography**	IKS2 (2) (Related to Major subject) **Historical water resources management in Maharashtra**	---	22
VI	DSC1-10 (3+2) **Environmental Geology: Hazards and Sustainability** (45 Period) DSC1-11 (3+2) **Introduction To Remote Sensing** (45 Period) DSC1-12 (3+2) **Geomorphology** (45 Period)	DSE1-3 (2+1) **Prospecting Geology** (30 Period) Or DSE1-4 (2+1) **Fundamentals of Mining Geology** (30 Period)	---	VSC 4 (2) (Hands on training related to DSE) **Prospecting geology or fundamentals of Mining**	---	FP2/CEP2/OJT1 (2) **Field mapping and Geological report writing**	22

- **PREAMBLE**

Preamble:

The purpose of education is to develop an integrated personality of the individual and the educational system. It provides all knowledge and skills to the learner. Earth science is an important scientific discipline which involves tectonic deformation affecting structures in earth, interaction with groundwater and its properties, engineering aspects of rocks. It also includes Earth's interior and near space environment related to economical geology. The present syllabus constitutes of fundamental part of earth dynamics, minerals (crystals), various structures formed in the rocks. It helps students to have knowledge of the earth, environmental geology, nature and effects of different types of natural stresses acting on and below the earth. A study of field geological terminology and various structures like folds, faults etc. give applied knowledge to students with respect to engineering geology, economic geology. Minerals are basic substances of the earth. Study of minerals along with crystals help to understand their formation, occurrence and significance. Fossils give information of historical geological events.

The syllabus developed for Geology has the provision of ensuring the integrated personality of the students in terms of providing opportunity for exposure to the students towards Discipline Specific Courses, Generic Elective Courses, Value Enhancement Courses and Skill Enhancement Courses with specific skills through practical's and other innovative transactional modes.

- **GENERAL GUIDELINES:**

1. The University follows Semester system.
2. Each B.Sc. course shall consist of four years i.e. eight semesters
3. An academic year shall consist of two semesters.
4. B. Sc. Part-III shall consist of two semesters: Semester V and Semester VI. In semester –V, there will be three theory papers of 75 marks for each. Similarly, in semester –VI there will be three theory papers of 75 marks for each. DSE 1-1 and DSE 1-2 (Sem- V) & DSE 1-3 and DSE 1-4 are Discipline specific elective. Student should select either DSE- 1-1 or DSE-2-2 in V semester. **If Student selected DSE 1-1 for Semester V then student must be select DSE 1-3 in semester VI & If Student selected DSE 1-2 for Semester V then student must be select DSE 1-4 in semester VI.**
5. Scheme of evaluation: The scheme of evaluation of performance of candidates shall be based on University assessment as well as College internal assessment. For B. Sc. Part III Sem V& VI the internal assessment will be based on Unit tests, Home assignment, viva, practicals etc. as given below. Practical course examination of 400 marks shall be conducted at the end of each semester. Each practical examination of 50 marks shall also consist of 30 marks for University practical assessment and 20 marks for college internal assessment. For University practical examination there will be two external examiners and will be appointed by the University. The internal practical assessment shall be done.

Multiple Entry and Multiple Exit Options

In accordance with the NEP 2020, the BSc Geology program incorporates a Multiple Entry and Multiple Exit framework, offering students the flexibility to enter or exit the program at various stages. This approach ensures that students can tailor their educational journey according to their personal and professional goals, with options to earn certificates, diplomas, or degrees based on the duration of study completed.

- **Year 1:**
  Upon completion of the first year, students may exit with a **Certificate in Geology**.
- **Year 2:**
  After two years, students may choose to exit with a **Diploma in Geology**.
- **Year 3:**
  Completion of the third year qualifies students for a **BSc Degree in Geology**.
- **Year 4:**
  The fourth year offers an advanced curriculum with a focus on research, allowing students to graduate with an **Honors Degree in Geology**.

Objectives:

1. To develop an understanding of concepts in Geology and geological processes
2. The ability to address real geological problems in the field.
3. To inculcate the ability to read, write and speak cogently using the language of geology..
4. To enhance the broad and balanced knowledge and understanding of economic importance and exploration of natural resources, applications of geological expertise in various fields, geological mapping, and understanding the earth's geological evolution.
5. Applications of various concepts, theories, and principles learned to demonstrate, design and perform experiments in the laboratory.
6. To develop the ability to apply the knowledge acquired in the laboratories and classroom in the field visits.
7. To enhance digital literacy and spatial thinking by imparting knowledge of remote sensing using digital resources.
8. To understand various applications and linkage of geology in interdisciplinary areas/subjects such as geography, chemistry, physics, etc.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B.Sc. Part- III Subject: Geology

[According to NEP 2020 WEF June 2026]

Sem.	Paper	Title of Paper	Credits		Marks			
			T	PR	T-CA	PR- CA	T-UA	PR-UA
V	DSC 1-7	**Structural Geology**	3	2	30	20	45	30
V	DSC 1-8	**Hydrogeology**	3	2	30	20	45	30
V	DSC 1-9	**Engineering Geology**	3	2	30	20	45	30
V	DSE 1-1	**Economic Geology**	2	1	20	10	30	15
V	DSE 1-2	**Introduction to Crystallography**	2	1	20	10	30	15
V	VSC 5	**Hands on training related to DSE**	---	2	--	20	--	30
VI	IKS-2	**Historical water resources management in Maharashtra**	2	---	20	---	30	---
VI	DSC 1-10	**Environmental Geology: Hazards and Sustainability**	3	2	30	20	45	30
VI	DSC 1-11	**Introduction To Remote Sensing**	3	2	30	20	45	30
VI	DSC 1-12	**Geomorphology**	3	2	30	20	45	30
VI	DSE 1-3	**Prospecting Geology**	2	1	20	10	30	15
VI	DSE 1-4	**Fundamentals of Mining Geology**	2	1	20	10	30	15
VI	VSC 6	**Hands on training related to DSE**	---	2	--	20	--	30
VI	FP2/CEP2 /OJT1	**Field mapping and Geological report writing**	---	2	--	20	--	30

Program Outcome (PO)

1. **Disciplinary Knowledge:**

   Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate programme. Execute strong theoretical and practical understanding generated from the specific graduate programme in the area of work.

2. **Critical Thinking and Problem solving:**

   Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.

3. **Social competence:**

   Display the understanding, behavioral skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally.

4. **Research-related skills and Scientific temper:**

   Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.

5. **Trans-disciplinary knowledge**:

   Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.

6. **Personal and professional competence:**

   Performing dependently and also collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.

7. **Effective Citizenship and Ethics**:

   Demonstrate empathetic social concern and equity centred national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.

8. **Environment and Sustainability:**

   Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

9. **Self-directed and Life-long learning**:

   Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

Program Specific Outcome (PSO):

1. **Academic competence:**

   (i) Describe the knowledge of physical and chemical properties of lithosphere and hydrosphere (minerals, rocks, soils and water etc.). (ii) Demonstrate the knowledge of geologic time and earth's history; dynamics of crustal materials with respect to Plate Tectonics theory, outline of regional geology of India. (iii) Articulate the methods of science and explain why current scientific knowledge is both contestable and testable by further inquiry and to appraise the relationship between different science communities of practice. Pursue further learning in Geology with reasonable knowledge, skills and interest.

2. **Personal and Professional Competence:**

   (i) Demonstrate the competence in fundamental geological skills like-identification of various minerals and rocks in hand specimens and under the microscope. (ii) Express clearly and convincingly about ideas of science and technology.

3. **Research Competence**

   (i) Interpret analytically aerial photographs, toposheets and satellite data. (ii) Interpret geological maps and construction of cross section, collection of field data and laboratory data.

4. **Entrepreneurial and Social competence**

   (i) Evaluate data of the societal relevance of earth systems and the processes. (ii) Apply the knowledge of geology in the fields of Engineering, Mining, Hydrogeology and other areas to solve the problems. (iii) Collaborate in various geological services with demonstration of true values of leadership, co-operation, hard work, teamwork etc. during the field works, surveys and field visits. (iv) Illustrate overall personality traits like stage daring, communication skills, presentation which is essential for future career.

SEMESTER- V

DSC 1-7: STRUCTURAL GEOLOGY

Credits: 3+2 **Lectures: 45**

Course Outcome: At the end of the course the student will acquire:

1: The students can able to talk about stress and strain of rock

2: The students can able to tell tectonics and deformation relation

3: The students can able to talk about structural properties

4: The students can able to handle clinometers/Brunton compass

5: The students identify and describe different types of geological structures with the help of Block models

6: The students solve structural problems, draw cross of geological maps and describe Geology, topography

Unit	Contents	Lectures
1.	**Fundamental of Structural Geology:** Scope and aim of structural geology, stress and strain, Concept of rock deformation and tectonics. Dip, strike, Outcrop, width of outcrop, Inliers, Outliers, Lineation and foliation.	**15**
2.	**Introduction of Fold and Fault:** 1. Fold- Definition, nomenclature, classification, types of folds, criteria for their recognition in field. 2. Fault- Definition, nomenclature, classification, types of folds, criteria for their recognition in field.	**15**
3.	**Unconformity and Joints:** 1. Unconformity- Definition, nomenclature, classification, types of unconformity, criteria for their recognition in field. 2. Joints – Definition, geometric and genetic classification	**15**

DSC 1-7: Structural Geology (Practical)

Sr. No.	Practical	No. of Practical's
1.	1. Identification of different types of folds/faults from block models 2. Exercises on structural problems dealing with true dip and apparent dip. 3. Interpretation of simple geological map with Horizontal and Inclined series, unconformity, folds and faults with reference to the topography and structure, geological succession and history, Section drawing (at least 8 maps).	9

Books Recommended:

1. Structural Geology- M.P. Billing
2. Fundamentals of Structural Geology- N.W. Gokhale
3. Structural Geology -Haakon Fossen

DSC 1-8: HYDROGEOLOGY

Credits: 3+2 **Lectures: 45**

Course Outcome: At the end of the course the student will acquire:

1. Understand parameters, geological controls, and dynamics of surface and subsurface hydrology.
2. Understanding of exploration of groundwater.
3. Understanding of applications of various structures to recharge groundwater for sustainable resource.
4. Knowledge of environmental impact, conservation and development of surface and subsurface water resources.

Unit	Contents	Lectures
1.	Definition of hydrogeology, Hydrological cycle; Hydrological parameters - Precipitation, evaporation, transpiration and infiltration, surface runoff, and their controlling factors, Origin of groundwater	**15**

2.	Vertical distribution of groundwater; Types of aquifers; Water bearing properties of rocks - Porosity and Permeability, Intrinsic permeability, specific yield, specific retentions, and their controlling factors, Transmissivity and Specific yield.	**15**
3.	Fundamentals of surface and subsurface geological methods (Resistivity, Magnetic and Gravity) of groundwater exploration. Surface exploration methods of groundwater. Types of aquifers in Maharashtra. Definition of Watershed. Elements of the watershed. Geological aspects of Watershed development.	**15**

DSC 1-8: Hydrogeology (Practicals)

Sr. No.	Practical	No. of Practical's
1.	Study of hydro-geological models: Water table, Perched aquifer, Confined and unconfined aquifer, and leaky aquifer. Preparation and interpretation of water table maps. Groundwater exploration based on topographic features, structures rock types, satellite images based on tone, texture, lineaments and vegetation cover. Interpretation of hydrologeological maps.	9

Books Recommended:

1. Karanth, K. R., 1989. Hydrogeology. Tata McGraw Hill Publ
2. Raghunath, H. M., 1990. Groundwater. Wiley Eastern Ltd.
3. Subramaniam, V., 2000. Water-Kingston Publ. London.
4. Todd, D.K.; Groundwater; John Wiley and Sons.

DSC 1-9: ENGINEERING GEOLOGY

Credits: 3+2 **Lectures: 45**

Course Outcome: On successful completion of the course:

1. The students understand the impact of natural dynamic geological processes on civil engineering structure.

2. The students will get acquainted with engineering properties of rocks and their uses in construction.

3. The students will know the significance of factors of geological consideration for the construction of large construction projects.

4. The students will get preliminary understanding of planning, design and execution stages of the structures in their professional life.

Unit	Contents	Lectures
1.	Introduction to Engineering geology: Definition and scope, Geological characteristics of rocks: Durability of rocks as construction material mineralogy, microstructure, texture, and composition. Role of Engineering geologists in planning, design, and construction of major man made structures. Site investigation and characterization.	**15**
2.	Dams and reservoirs: Types, Geological conditions for selection of dam site and reservoir sites and their environmental considerations; Geological problem of reservoirs	**15**
3.	Tunnels: geology, structure, seepage problem and role of the water table; Landslides: classification, causes, and preventative measures.	**15**

DSC 1-9: ENGINEERING GEOLOGY (Practicals)

Sr. No.	Practical	No. of Practical's
1.	**1.** Engineering properties and identification of building stones. 2. Preparation of engineering geological maps. Describing engineering properties of the area given in the map along the profile line and suggesting suitable sites for construction of dams and tunnels and reservoirs.	9

	3. Identification of various models of landslide, tunnel, and dam. 4. Study of soil profiles. 5. Use of Clinometer/Brunton compass, geological mapping techniques, and preparation of a field report based on site visits. 6. Basic tests for porosity, permeability, and water absorption of rocks.	

Books Recommended:

1. Krynine D.P. and Judd W.R., 1957. Principles of Engineering Geology & Geotechnics. McGraw-Hill Book

2. Kesavulu, N.C., 2009. A text book of engineering geology. Macmillan P publishing India Ltd.

3. Crozier. M.J., 1989. Landslides: causes, consequences and environment. Academic Press.

4. Readman, J.H., 1979. Techniques in Mineral exploration. Applied Science Publisher

5. Bell, F.G., 1983. Fundamentals of Engineering Geology. Butterworth and Co.

6. Parbin Singh., 2013. Engineering and General Geology. S.K. Kataria& Sons;

7. Bangar K.M., 2020. Principals of Engineering Geology. Standard Publishers distr

DSE 1-1: ECONOMIC GEOLOGY

Credits: 2+1 **Lectures: 30**

Course Outcome: At the end of the course the student will acquire:

1. Knowledge of geological processes of formation of various ore deposits.
2. Applications of ore deposits and their distribution.
3. Understand environmental impact of mining, and the importance conservation of mineral resources.

Unit	Contents	Lectures
1.	Definition of ore and ore deposits, ore minerals and gangue minerals; Tenor of ores; Metallic and non-metallic ore minerals; Strategic, Critical, and essential minerals,	**10**
2.	Processes of formation of ore deposits; Magmatic, contact metasomatic, Supergene sulfide enrichment, hydrothermal and	**20**

	residual. Study of essential metallic (Cu, Pb, Zn Mn, Fe, Au, Al) and non-metallic (industrial) minerals (gypsum, magnesite limestone, clay, quartz, corundum, mica and asbestos) Concerning geological occurrence and distribution in India.	
3.	Fossil fuels: their occurrence, origin, and distribution of Coal, Petroleum, and Natural Gas deposits in India.	**5**

DSE 1-1: ECONOMIC GEOLOGY (Practicals)

Sr. No.	Practical	No. of Practical's
1.	Study of major ore, economic and industrial minerals in hand specimen; Preparation of maps showing the distribution of important metallic and non-metallic deposits important coal and oil fields of India.	7

Books Recommended:

1. Brown, C. and Dey, A.K.1955. Indian Mineral Wealth. Oxford Univ.
2. Gokhale, K.V.G.K. and Rao, T.C., 1983. Ore Deposits of India. East West Press Pvt. Ltd.
3. Jense, M.L. and Bateman A.M., 1981. Economic Mineral Deposits. John Wiley and Sons.
4. Krishnnaswamy, S., 1979. India's Minerals Resources. Oxford and IBH Publ.
5. Deb, S., 1980. Industrial minerals and Rocks of India. Allied Publishers Pvt. Ltd.
6. Umeshwar Prasad, 2003. Economic Geology. CBS Publishers and distributers.
7. Sharma, N.L. and Ram, K.V.S., 1972. Introduction to India's Economic Minerals, Dhanbad.
8. Laurence Robb, 2004. Introduction to Ore-Forming Processes. Wiley Eastern Ltd.
9. Chatterjee, K.K.; An Introduction to Mineral Economics; Willey Eastern Limited.
10. A.I. Lavorsen, A.I. -Geology of Petroleum, CBS Publishers and Distributers
11. Singh, R.D. 1997 Principles and Practices of Modern Coal Mining. New Age international Publishers

DSE 1-2: INTRODUCTION TO CRYSTALLOGRAPHY

Credits: 2+1 **Lectures: 30**

Course Outcome:

1: The students get basic knowledge about minerals and their properties

2: The students understand about crystal, different terminology related with crystals

3: The students study different crystal systems, their elements of symmetry, forms, Indices

Unit	Contents	Lectures
1.	Definition of Crystal, Parts of crystals- Faces, Edges, Solid angles, elements of crystal symmetry- axis, plans and centre	**10**
2.	Study of crystal systems (Mineral type, Crystallographic Axes, different forms, their faces, indices with the help of wooden models). – Cubic, Tetragonal, Orthorhombic,	**10**
3.	Study of crystal systems (Mineral type, Crystallographic Axes, different forms, their faces, indices with the help of wooden models).- Monoclinic, Triclinic, Hexagonal	**10**

DSE 1-2: INTRODUCTION TO CRYSTALLOGRAPHY (Practicals)

Sr. No.	Practical	No. of Practical's
1	Elements of Symmetry – Planes, Axes, Centre Study of crystal systems – Cubic, Tetragonal, Orthorhombic, Monoclinic, Triclinic, Hexagonal with Mineral type, Crystallographic Axes, different forms, their faces, indices with the help of wooden models	7

Text/ Reference Books:

1. Dana, E.S. and Ford, W.E., 2002. A textbook of Mineralogy (Reprints).

2. Flint, Y., 1975. Essential of crystallography, Mir Publishers.

3. Phillips, F.C., 1963. An introduction to crystallography. Wiley, New York.

4. Berry, L.G., Mason, B. and Dietrich, R.V., 1982. Mineralogy. CBS Publ.

5. Nesse, D.W., 1986. Optical Mineralogy. McGraw Hill.

6. Read, H.H., 1968. Rutley's Element of Mineralogy (Rev. Ed.). Thomas Murby and Co.

7. Berry and Mason, 1961. Mineralogy. W.H. Freeman & Co.

8. Kerr, B.F., 1995. Optical Mineralogy 5th Ed. Mc Graw Hill, New York.

VSE - 3: Hands on Training

Credits: 2

Hands on training related to DSE Economic Geology or Crystallography

Economic Geology:- Hands on training of placer deposits.

Crystallography:- Testing gems for quality and originality

IKS - 4: Historical Water Resource management in Maharashtra

Credits: 2 **Lectures: 30**

Unit	Contents	Lectures
1.	**Rejuvenation of historical water resources and geomorphic and geologic properties any four case studies in Maharashtra**	**30**

Recommended Books

- *Traditional Water Management Practices of Maharashtra* – ICID Report.
- *The Deccan Traps* – Geological Society of India.
- *Water Management in Ancient India* – Various Archaeological Survey of India (ASI) publications.

SEMESTER- VI

DSC 1-10: ENVIRONMENTAL GEOLOGY: HAZARDS AND SUSTAINABILITY

Credits: 3+2 **Lectures: 45**

Course Outcome: At the end of the course the student will acquire:

1. Knowledge of interaction and energy exchange between earth's spheres.
2. Understand the earth's energy budget and impact of anthropological activities on environment.
3. Understand process of generation natural hazards and their impact on society.
4. Develop understanding of mitigate natural hazards by applying geological knowledge.

Unit	Contents	Lectures
1.	Earth and its spheres: atmosphere, hydrosphere, lithosphere, biosphere, and Earth resources.	**15**
2.	Geological hazards: Earthquakes, volcanism, landslides, subsidence, avalanches, floods, droughts; Disaster management. Global environments: coastal, riverine, desertic, tropical, cold, polar; Concept of global warming and climate change	**15**
3.	Energy budget: Solar radiation; Resource Management: Energy resources (Conventional and non- conventional).	**15**

DSC 1-10: ENVIRONMENTAL GEOLOGY: HAZARDS AND SUSTAINABILITY (practicals)

Sr. No.	Practical	No. Of Practical's
1.	Identification and preparation of Geological hazard maps (landslide and flood) using, toposheets, aerial photographs, and digital imageries. Study of map of seismic zones of India.	9

Books Recommended:

1. Verma, V.K., 1986. Geomorphology Earth surface processes and form. McGraw Hill.

2. Chorley, R. J., 1984. Geomorphology. Methuen.

3. Selby, M.J., 1996. Earth's Changing Surface. Oxford University Press UK.

4. Thornbury W. D., 1997. Principles of Geomorphology Wiley Eastern Ltd., New Delhi.

5. Valdiya, K. S., 1987. Environmental Geology - Indian Context. Tata McGraw Hill New Delhi.

6. Keller, E. A., 2000. Environmental Geology. Shales E. Merril Publishing Co., Columbus, Ohio.

7. Montgomery, C., 1984. Environmental Geology. John Wiley and Sons, London.

8. Bird, Eric, 2000. Coastal Geomorphology: An Introduction. John Wiley & Sons, Ltd. Singapore.

9. Liu, B.C., 1981. Earthquake Risk and Damage, Westview.

DSC 1-11: INTRODUCTION TO REMOTE SENSING

Credits: 3+2 **Lectures: 45**

Course Outcome: At the end of the course, students will acquire:

1. Understand and define basic principles of photogeology and remote sensing.
2. Acquisition, recognition, analyze, and interpret various types of remote sensing data.
3. Get skill of preliminary digital image processing and classification of digital data.

Unit	Contents	Lectures
1.	Introduction: Definition of remote sensing, Types of platforms, types of sensors; passive and active, types of data products; analog and digital	**10**
2.	Primary components of remote sensing. such as 1. electromagnetic energy: source and electromagnetic spectrum, 2. interaction of electromagnetic energy with particles in the atmosphere and atmospheric windows, 3. interaction of electromagnetic energy with earth surface and near surface objects, spectral reflectance curves of grass, soil and water. 4. EM energy detected and recorded by sensors, digital data and Digital Number (DN), brightness levels, spectral bands. Types of resolutions; spatial, spectral, radiometric and temporal	**20**
3.	Digital image processing: image processing software, metadata, loading and viewing satellite images and their various bands. Creation of various band combinations to identify land signatures such as soil, water vegetation, rock types and drainages. Indian Remote Sensing Satellite systems (ISRO), Applications of remote sensing.	**15**

DSC 1-11: INTRODUCTION TO REMOTE SENSING (Practicals)

Sr. No.	Practical	No. Of Practical's
1.	Visual interpretation of Arial photographs and FCCs. Analysis of digital satellite imagery in GIS environment: 1. Identification and understanding of peripheral information printed on aerial photographs.	

	2. Determination of photo coverage- Forward and lateral overlap. 3. Study of Stereoscopes - Lens and mirror, 4. Study of Orientation of Photo pair - under stereoscope. 5. Recognition of Photo elements- study of aerial photographs characteristics: Relief, Tone, Size, Shape etc; and their significance 6. Terrain features identifications: i. Drainage - Drainage density, patterns and stream features and their significance ii. Landforms - mesa. Butte, ridge and Questa, hill etc. iii. structures: strike and dip, fold, fault, joints etc. iv. Lineaments – Stream, Tonal contrast (structural) and Topographic contrast) v. Lithology and lithological contacts vi. Vegetation and land use pattern. 7. Tracing of lineaments, lithology, landforms, structures and drainages.	9

Books Recommended:

1. Bhatta, B., 2008. Remote Sensing and GIS. Oxford, New Delhi.

2. Gupta, R.P., 1990. Remote Sensing Geology. Springer Verlag.

3. Lillesand, T.M. and Kiffer, R.W., 1987. Remote Sensing and Image Interpretation. John Wiley.

4. Pandey, S.N., 1987. Principles and Application of Photogeology. Wiley Eastern, New Delhi.

5. Sabbins, F.F., 1985. Remote Sensing – Principles and Applications. Freeman.

6. Siegal, B.S. and Gillespie, A.R., 1980. Remote Sensing in Geology. John Wiley.

7. Rampal K.K. 1999. Hand book of aerial photography and interpretation. Concept publication

DSC 1-12: GEOMORPHOLOGY

Credits: 3+2 **Lectures: 45**

Course Outcome: At the end of the course the student will acquire:

1. Knowledge of natural forces that shapes the earth and formation of various surface features.
2. Understand the dynamism of earth's surface and effects of movements of mankind.
3. Skill of tools and techniques to prepare geomorphologic maps.

Unit	Contents	Lectures
1.	Basic principles of Geomorphology, weathering, and erosion geomorphological cycles, rejuvenation: static and eustatic, topographic evidence of rejuvenation; Geomorphic mapping-tools and techniques.	**15**
2.	Epigene/exogenic processes: degradation and aggradations. Hypogene/endogenic processes; Diastrophism and volcanism,	**15**
3.	Extraterrestrial processes; Geological work of wind, glacier, river, underground water, and ocean	**15**

DSC 1-12: GEOMORPHOLOGY (Practicals)

Sr. No.	Practical	No. Of Practical's
1.	Identification and description of features from Toposheet: 1) Mesa 2) Butte 3) Ridge 4) Questa 5) Meander 6) Incised meander 7) Point bar 8) valleys 9) marking drainage basin boundary and identification of drainage patterns. Reading longitudes, latitudes and projection system. Study of geomorphological models of work of streams, glaciers, wind, underground water and ocean. Drainage basin analysis: Determination of 1) Stream Order (Strahler's method) 2) Stream number 3) Stream length, 4) Basin area, Derivation of a) Drainage density and b) Bifurcation ratio and their significance	9

Books Recommended:

1. Allen, P., 1997. Earth Surface Processes. Blackwell

2. Bloom, A.L., 1998. Geomorphology: A systematic Analysis of Late Cenozoic Landforms (3rd Edition).

3. Pearson Education, Inc.

4. Keary, P. and Vine, F.J., 1997. Global Tectonics. Blackwell and crustal evolution. Butterworth-Heinemann.

5. Kale, V.S. and Gupta, A., 2001. Introduction to Geomorphology. Orient Longman Ltd.

6. Moores, E and Twiss. R.J., 1995. Tectonics. Freeman.

7. Patwardhan, A. M., 1999. The Dynamic Earth System. Prentice Hall.

8. Summerfied, M.A., 2000. Geomorphology and Global tectonic. Springer Verlag.

9. Valdia, K.S., 1988. Dynamic Himalaya. Universities Press, Hyderabad.

10. WD Thornbury, 2002. Principles of Geomorphology. CBS Publ. New Delhi.

DSE 1-3: PROSPECTING GEOLOGY

Credits: 2+1 **Lectures: 30**

Course Outcome: At the end of the course the student will acquire:

1. Knowledge of various methods of minerals exploration by linking interdisciplinary subject knowledge.
2. Preliminary understanding of sampling methods for exploration and ability to collect and analyze data.
3. Fundamental understanding of environmental impact of mining on society and various methods to mitigations.

Unit	Contents	Lectures
1.	Mineral exploration: Fundamentals of geological and geophysical prospecting methods: Electrical methods, Magnetic Methods, Seismic Methods, and Gravity Methods.	**10**
2.	Geochemical prospecting; primary and secondary dispersion, Geochemical association, and pathfinders	**10**
3.	Sampling methods- Random sampling, Grab sampling, Coning and Quartering, Pitting and Trenching. Resources and overburden estimation	**10**

DSE 1-3: PROSPECTING GEOLOGY (Practicals)

Sr. No.	Practical	No. Of Practical's
1.	1. Bore hole data thickness and width of the outcrop and dip of the beds (at least 8 problems) 2. Completion of Outcrops from the available data (number of outcrops, dip & strike given). 3. Bore Hole maps to ascertain Dip, Strike, and Fault. 4. Techniques of sampling for mineral analysis (e.g., channel	7

	sampling, grab sampling, chip sampling). 5. Interpretation of anomaly map using secondary data.	

Books Recommended:

1. Dobrin, M.B. &Savit, CH., 1988. Introduction to Geophysical Prospecting, McGraw- Hill.

2. Parasin D.S., 1997. Principles of applied geophysics. Chapman Hall.

3. McKinstry H.E., 1953. Mining Geology. The Prentice-Hall geology series

4. Bhattacharya Jayanta., 2003. Principles of Mine Planning Allied Publ. New Delhi.

5. Valdiya, K.S., 1987. Environmental Geology – Indian Context. Tata McGraw Hill.

6. Rajendran S., 2007. Mineral Exploration: Recent Strategies.

DSE 1-4: FUNDAMENTALS OF MINING GEOLOGY

Credits: 2+1 **Lectures: 30**

Course Outcome: At the end of the course the student will acquire:

1. Knowledge of various methods of minerals exploration by linking interdisciplinary subject knowledge.
2. Understand various mining methods both open cast and underground mining
3. Preliminary understanding of sampling methods for exploration and ability to collect and analyze data.
4. Fundamental understanding of environmental impact of mining on society and various methods to mitigations.

Unit	Contents	Lectures
1.	Types of mining- Opencast and Underground mining. Elementary idea of mining structure – Winning, Shaft, Hanging Wall, Adit, Drift, Level, Crosscut, Tunnel, raise Winze, Ore Basin, Chute, Stope, Air Crossing;	**20**
2.	Environmental considerations for mining.	**10**

DSE 1-4: FUNDAMENTALS MINING GEOLOGY (Practicals)

Sr. No.	Practical	No. Of Practical's
1.	Completion of Outcrops from the available data (number of outcrops, dip, strike given). Bore Hole Problems to ascertain Dip, Strike, and Fault.	7

Books Recommended:

1. Clark, G.B. 1967. Elements of Mining. 3rd Ed. John Wiley & Sons.
2. Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4th Ed. Oxford-IBH.
3. Moon, C.J., Whateley, M.K.G., Evans, A.M., 2006, Introduction to Mineral Exploration, Blackwell Publishing.
4. Valdiya, K.S., 1987. Environmental Geology – Indian Context. Tata McGraw Hill.

5. Rajendran S., 2007. Mineral Exploration: Recent Strategies.

6. McKinstry H.E., 1953. Mining Geology. The Prentice-Hall geology series

7. Bhattacharya Jayanta., 2003. Principles of Mine Planning Allied Publ. New Delhi.

VSE - 4: Hands on Training

Credits: 2

Hands on training related to DSE prospecting Geology or Fundamentals of Mining

1. Resource estimation of muroom, sand and basalt.
2. Bore hole problems
3. Visit to query

FP2/CEP2/OJT1

Credits: 2

Field Mapping and geological Report writing

5 days geological excursion for field mapping and geological report writing