Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2022
'B^{++}' Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

Choice Based Credit System

Syllabus: Geology

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

(Syllabus to be implemented June 2024)

Preamble:

The role of the undergraduate program in geology is vital in gaining skills based on geology, geological thinking, and understanding the nature of gainful employment and/or further access to the best postgraduate program elsewhere. The New Education Policy (NEP) initiated by the Ministry of Human Resource Development (HRD), Govt. of India, actively engaged in the improvement of quality higher education by offering the highest priority to inculcate knowledge, skill, and training to achieve and magnify student's thinking, cognizance and application abilities to make them ready to compete, succeed and excel universally. The following student-centric syllabus is designed with well-defined objectives, goals, and learning outcome-based.

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.

Choice Based Credit System CBCS

With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, PunyashlokAhilyadeviHolkar Solapur University has implemented Choice Based Credit System (CBCS) of Evaluation at Undergraduate level. Credit is a numerical value that indicates students work load (Lectures, Lab works, Seminars, Tutorials, Field work etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. The contact hours are transformed into credits. As per present norms, there are 3 contact hours per paper (subject) per week which works out to be 60 contact hours / 4 credit points per paper (subject) per semester.

In PunyashlokAhilyadeviHolkar Solapur University, for B.Sc.-III Geology, there are 4 papers in each semester and Compulsory English (AECC). For B.Sc.-III Geology, there are 3 contact hours per paper (subject) per week for each paper and Compulsory English (AECC) carry 4 contact hours per week. and for semester VI total contact hours allotted are 16. Each paper has 60 contact hours, which are transformed into 4 credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured. The candidate has to appear for Internal Evaluation of 20 marks and University Evaluation for 80 marks. It is 80+20 pattern of evaluation. It is applicable for theory and practical as well. The details regarding this evaluation system are presented in the following table.

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	T	P				
Class:	**B.Sc.- III Semester – V**									
Ability Enhancement Course(AECC)		**English (Business English)**	Paper- III	4.0	--	--	50	40	10	2.0
Discipline Specific Elective (DSE) (Students can opt any one subjects among the three Subjects excluding interdisciplinary offered at B.Sc II.		**DSE-1A-Economic Geology**	Paper- IX	3	--	--	100	80	20	4.0
		DSE- 2 A-Hydrogeology	Paper -X	3	--	--	100	80	20	4.0
		DSE- 3 A-Applied Geology Part – I	Paper- XI	3	--	--	100	80	20	4.0
		DSE 4 A- Applied Geology Part – II	Paper- XII	3	--	--	100	80	20	4.0
		(Add-on-self learning)- MOOC/SWAYAM Course/Internship/Industrial Training/								
Grand Total				**16.0**	**--**	**--**	**450**	**360**	**90**	**20**
Class :	**B.Sc.- III Semester –VI**									
Ability Enhancement Course(AECC)		**English (Business English)**	Paper IV	4.0	--	--	50	40	10	2.0
DSE (Students can opt any one subjects among the three Subjects excluding interdisciplinary offered at B.Sc. II.		**SEC- 1B-Photogeology & Remote Sensing**	Paper -XIII	3.0	--	--	100	80	20	4.0
		SEC- 2B- Geomorphology and Geotectonics	Paper- XIV	3.0	--	--	100	80	20	4.0
		SEC- 3B-Environmental Geology	Paper- XV	3.0	--	--	100	80	20	4.0
		SEC 4B- Geochemistry	Paper- XVI	3.0	--	--	100	80	20	4.0

	SEC-								
Total (Theory)			**16.0**	**--**	**--**	**450**	**360**	**90**	**18**
DSE - Practical (Annual Exam)	**DSE- 1 Unit I**	Practical- IX & X	--	--	5	100	80	20	4.0
	DSE -2 Unit II	Practical- XI &XII	--	--	5	100	80	20	4.0
	SEC–1&2Unit III	Practical- XIII &XIV			5	100	80	20	4.0
	SEC–3&4 Unit IV	Practical-			5	100	80	20	4.0
		XV& XVI							
Total (practical's)					**20**	**400**	**320**	**80**	**16**
Grand Total			**34.0**		**22**	**1300**	**1040**	260	54

Abbreviations:

L: Lectures
P: Practical
CA: College Assessment
AEC: Ability Enhancement Course
SEC: Skill Enhancement Course
T: Tutorials
UA: University Assessment
CC: Core Course
DSE: Discipline Specific Elective Paper
GE: Generic Elective

Conversion of marks into Grades:

A table for the conversion of the marks obtained by a student in each paper (out of100) to grade and grade point is as given below:

Sr. No.	Range of Marks	Grade	Grade Point
1	80-100	O	10
2	70-80	A+	9
3	60-69	A	8
4	55-59	B+	7
5	50-54	B	6
6	45-49	C+	5
7	40-44	C	4
8	<39	FC	0 (Failed in Term Exam)
9	<39	FR	0 (Failed in Internal Assessment)

1. **Grade Point Average at the end of the Semester (SGPA)**

$$SGPA = \frac{(G_1 \times C_1) + (G_2 \times C_2) + \ldots\ldots\ldots\ldots..}{\Sigma Ci}$$

(Σ Ci= The total number of credits offered by the student during a semester)

2. **Cumulative Grade Point Average (CGPA)**

$$CGPA = \frac{(G_1 \times C_1) + (G_2 \times C_2) + \ldots\ldots\ldots\ldots..}{\Sigma Ci}$$

(Σ Ci= The total number of credits offered by the student upto and including the semester for which CGPA is calculated.)

3. **Final Grade Point Average (FGPA)**

It will be calculated in the similar manner for the total number of credits offered for the completion of the said course.

Where: Ci= Credits allocated for the i^{th}course.

Gi= Grade point scored in the i^{th}paper (subject)

4. **Conversion of average grade points into grades:**

SGPA/CGPA/FGPA	Letter Grade
9.5 – 10	O
8.5 – 9.49	A+
7.5 – 8.49	A
6.5 – 7.49	B+
5.5 – 6.49	B
4.5 – 5.49	C+
4.0 – 4.49	C
<3.99	FC / F
	FR

GENERAL STRUCTURE OF B. Sc. PROGRAM (CBCS PATTERN)

Class	Semester	Marks Theory	Credits Theory	Marks Practical	Credits Practical	Total Credits
B.Sc. – I	I	500	20	--		20
	II	550	20	400	16	36
B.Sc. – II	III	350	14			14
	IV	350	14	300	12	26
B.Sc. – III	V	500	22			22
	VI	500	18	400	16	36
Total		**2750**	**110**	**1100**	**44**	**154**

B.Sc. Programme:

Total Marks:	Theory + Practical's = 2750 +1100	=3950
Total Credits:	Theory + Practical's = 110 + 44	= 154
Numbers of Papers:	Theory: Ability Enhancement Course (AECC)	= 005
	Theory: Core Courses (CC)	= 008
	Theory: Discipline Specific Elective Paper (DSE)	= 004
	Skill Enhancement Courses (SEC)	= 004
	Add on self-learning course (SEC) theory + practical	= 001

STRUCTURE OF B.Sc. III

Semester	Paper No.	Title	Contact Hrs.	Credit Point	Total Marks (UA + CA)
Semester V	IX	Economic Geology	60	4	80 + 20 = 100
	X	Hydrogeology	60	4	80 + 20 = 100
	XI	Applied Geology – Engineering Geology	60	4	80 + 20 = 100
	XII	Applied Geology – Prospecting and Mining Geology	60	4	80 + 20 = 100
Semester VI	XIII	Photogeology and Remote Sensing	60	4	80 + 20 = 100
	XIV	Geomorphology and Geotectonics	60	4	80 + 20 = 100
	XV	Environmental Geology	60	4	80 + 20 = 100
	XVI	Geochemistry	60	4	80 + 20 = 100
Semester V and VI	Practical Course	Practical Examination (Two Days)(Annual Pattern)		16	320 + 80 = 400
			Total	**52**	**1300**

GENERALRULES AND STRUCTURE OF B.SC. III GEOLOGY

1. The university follows the semester system.
2. An academic year shall consist of two semesters.
3. Each B.Sc. course shall consist of three years, i.e. six semesters.
4. B.Sc. Part-III Geology shall consist of two semesters: Semester V and Semester VI.
5. **In semester V there will be four courses / Papers.**
   The students have to earn 4 credits during the Vth Semester by selecting add-on-self learning course either from online learning platforms such as MOOC / Swayam / NPTEL or by attending internship/training in the geology subject related industries. Or the candidate can select and attend any one add-on course of any stream of his/her choice published on the university's website to earn 4 credit points.
6. assessment and College internal assessment as given below. For B.Sc. Part-III Geology semester V & VI, the internal assessment will be based on Unit tests, Tutorials, Home assignment, Viva, Group discussion, attitude, sincerity, attendance, student seminars etc. A practical course examination of 100 marks for each course/paper shall be conducted at the end of the VIthsemester. The practical examination of total 400 marks shall also consist of 320 marks for University practical assessment and fieldwork and 80 marks for college internal practical assessment.
7. For University practical examination, both the examiners will be External and will be appointed by the university.
8. Scheme of Evaluation: As per the norms of the grading system of evaluation, out of 100 marks, the candidate has to appear for college internal assessment (CA) of 20 marks and external assessment, University Assessment (UA) of 80 marks.

   Semester – V

   Theory: (100 marks)

   University Examination (80 marks): No. of theory papers: 5 (1English + 4 Subjects)

   Internal Continuous Assessment: (20 marks)

   The 20 marks of College level Assessment (CA) may be distributed as 10 Marks for Internal Test and 10 Marks for Home Assignment/seminars/Viva/ Group discussion etc.

   Semester –VI

   Theory: (100 marks)

   University Examination (80 marks): No. of theory papers: 5 (1English + 4 Subjects)

   Internal Continuous Assessment: (30 marks)

   The 20 marks of College level Assessment (CA) may be distributed as 10 Marks for Internal Test and 10 Marks for Home Assignment/seminars/Viva/Group discussion etc.

   Practical Examination: (400 marks)

   University Examination (320 marks): No. of practical course 4 (4 x 80 = 320 marks)

   Internal Continuous Assessment: (80 marks)

   Scheme of marking: 80 marks – Internal test on any four practicals (4 x 20 = 80 marks) (Weightages for Lab. Journal /performance/attendance/sketching of diagrams related to syllabus.

11. **Passing Standard:** The student has to secure a minimum of 4.0 grade points (Grade C) in each paper. A student who scores less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper and shall be required to reappear for the respective course/paper. A student who failed in University Examination (theory) and passed in internal assessment of the same paper shall be given FC Grade. Such student

will have to reappear for University Examination only. A student who failed in internal evaluation and passed in University examination (theory) shall be given FR Grade. Such student will have to reappear for both University examination (theory) as well as internal assessment.

12. **Eligibility for admission to B.Sc. III semester V:** Candidate passed in all papers except 6 (six) papers combined together of semester III and IV of B.Sc. Part-II Geology examination and clearly passed in B.Sc. Part-I- Geology shall be permitted to enter the course of Semester V of B.Sc. III Geology.

SEMESTER – V
PAPER – IX
ECONOMIC GEOLOGY

Total Credit: 04 **Contact Hours: 60**

Unit	Content	Contact Hrs
I	Concept of ore and ore deposits, ore minerals and gangue minerals; Tenor of ores; Metallic and non-metallic ore minerals; Strategic, Critical, and essential minerals	**15**
II	Processes of formation of ore deposits; Magmatic, contact metasomatic, Supergene sulfide enrichment, hydrothermal, sedimentation, residual and mechanical concentration	**20**
III	Study of essential metallic (Cu, Pb, Zn Mn, Fe, Au, Al) and non-metallic (industrial) minerals (gypsum, magnesitelimestone, clay, quartz, corundum, mica) Concerning geological occurrence and distribution in India.	**20**
IV	Fossil fuels: their occurrence, origin, and distribution of Coal, Petroleum, and Natural Gas deposits in India.	**05**

Course Learning 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.

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

SEMESTER – V
PAPER – X
HYDROGEOLOGY

Total Credit: 04 **Contact Hours: 60**

Unit	Content	Contact Hrs
I	Definition of hydrogeology, Hydrological cycle;	**05**
II	Hydrological parameters - Precipitation, evaporation, transpiration and infiltration, surface runoff, and their controlling factors	**05**
III	Origin of groundwater; 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**
IV	Surface and subsurface geological methods of groundwater exploration. Surface exploration methods of groundwater. Basics of sub-surface methods of groundwater exploration like- Well observations and drilling method.	**25**
V	Types of aquifers in Maharashtra. Definition of Watershed. Elements of the watershed. Geological aspects of Watershed development and management	**10**

Course Learning 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 applicationsof various structures to recharge groundwater for sustainable resource.
4. Knowledge of environmental impact, conservation,and development of surface and subsurface water resources.

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.

SEMESTER – V
PAPER – X I
APPLIED GEOLOGY – ENGINEERING GEOLOGY

Total Credit: 04 **Contact Hours: 60**

Unit	Content	Contact Hrs
I	Role of Engineering geologists in planning, design, and construction of major man-made structural features. Site investigation and characterization.	**15**
II	Engineering properties of rocks: Specific Gravity, Porosity, Compressive strength, Tensile strength, Elasticity of rocks, residual stress, and shear stress. Geo-mechanical classification of rock mass: RMR, RQD, and SMR. Soils' engineering properties: Classification, gradation, compressive and shear strength, Consolidation, and swelling of clays, soil and Soil groups of India.	**25**
III	Dams and reservoirs: Types, Geological conditions for selection of dam and reservoir sites and their environmental considerations; Geological problem of reservoirs	**10**
IV	Tunnels: geology, structure, seepage problem and role of the water table;	**05**
V	Landslides: classification, causes, and preventative measures.	**05**

Course Learning 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.

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.

SEMESTER – V

PAPER – XII

APPLIED GEOLOGY – PROSPECTING AND MINING GEOLOGY

Total Credit: 04 **Contact Hours: 60**

Unit	Content	Contact Hrs
I	Mineral exploration: geological and geophysical prospecting: Electrical methods, Magnetic Methods, Seismic Methods, and Gravity Methods. Geochemical prospecting; primary and secondary dispersion, Geochemical association, and pathfinders	**20**
II	Sampling methods- Random sampling, Grab sampling, Coning and Quartering, Pitting and Trenching	**15**
III	Elementary idea of mining – Winning, Shaft, Hanging Wall, Adit, Drift, Level, Crosscut, Tunnel, raise Winze, Ore Basin, Chute, Stope, Air Crossing; Opencast and Underground mining.	**15**
IV	Environmental considerations for mining.	**10**

Course Learning 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.

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. Dobrin, M.B. &Savit, CH., 1988. Introduction to Geophysical Prospecting, McGraw-Hill.
7. Parasin D.S., 1997. Principles of applied geophysics. Chapman Hall.
8. McKinstry H.E., 1953. Mining Geology. The Prentice-Hall geology series
9. Bhattacharya Jayanta., 2003. Principles of Mine Planning Allied Publ. New Delhi.

SEMESTER – VI
PAPER – XIII
PHOTOGEOLOGY AND REMOTE SENSING

Total Credit: 04 **Contact Hours: 60**

Unit	Content	Contact Hrs :
I	The elementary idea about photogeology: types & geometry of aerial photographs; stereoscope and stereoscopic vision, Types and uses of aerial photographs. Taking aerial photographs: principles and errors in flying, factors affecting aerial photography; types of camera, film, and filters; factors affecting scale. Elements of photo-interpretation: fundamentals, geologic, geomorphic, structural geological, and water resource applications.	20
II	Concept, Definition, and fundamentals of remote sensing; remote sensing systems; electromagnetic spectrum; Energy interaction in the atmosphere and earth surface features; spectral reflectance curve of vegetation, soil, and water; resolutions: spatial, spectral, radiometric, and temporal remote sensing sensors; signatures of rocks, minerals, and soils. Application of remote sensing in geoscience and geomorphological studies	**20**
III	Spaceborne imaging systems of LANDSAT, IRS, SPOT, and high-resolution satellites and their characteristics – orbits, sensors, and resolution. Multispectral, Thermal, and hyperspectral sensing. Introduction to digital image processing and classification – fundamental steps in image processing – colour composites, NDVI, band combinations, rectification, restoration, enhancement, contrast manipulations; image classification – supervised and unsupervised classification. Applications – recognition of rock types and geological structures.	**20**

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

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

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

SEMESTER – VI
PAPER – XIV
GEOMORPHOLOGY AND GEOTECTONICS

Total Credit: 04 **Contact Hours: 60**

Unit	Content	Contact Hrs
I	Basic principles of Geomorphology, weathering, and erosion geomorphological cycles, rejuvenation: static and eustatic, topographic evidence of rejuvenation; Geomorphic mapping- tools and techniques.	**10**
II	Epigene/exogenic processes: degradation and aggradation. Hypogene/endogenic processes; Diastrophism and volcanism, Extraterrestrial processes; Geological work of wind, glacier, river, underground water, and ocean	**20**
III	Earth as a dynamic system. Elementary idea of continental drift, sea-floor spreading, and mid-oceanic ridges. Paleomagnetism and its application.	**20**
IV	Plate Tectonics: the concept, plate margins, orogeny, deep-sea trenches, island arcs, and volcanic arcs	**10**

Course Learning 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.

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.

SEMESTER – VI
PAPER – XV
ENVIRONMENTAL GEOLOGY

Total Credit: 04 **Contact Hours: 60**

Unit	Content	Contact Hrs
I	Earth and its spheres: atmosphere, hydrosphere, lithosphere, biosphere, and Man; Earth Material.	**10**
II	Energy budget: Solar radiation; Global environments: coastal, riverine, desertic, tropical, cold, polar; Concept of global warming and climate change	**20**
III	Geological hazards: Earthquakes, volcanism, landslides, subsidence, avalanches, floods, droughts; Disaster management.	**20**
IV	Resource Management: Energy resources (Conventional and non-conventional).	**10**

Course Learning 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.

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.

SEMESTER – VI
PAPER – XV
GEOCHEMISTRY

Total Credit: 04 **Contact Hours: 60**

Unit Content

Unit	Content	Contact Hrs
I	Introduction to geochemistry: basic knowledge about crystal chemistry. Types of chemical bonds, coordination number; Colloids in geological systems, ion exchanges and geological evidence for earlier colloids; Elementary idea of Periodic Table.	**15**
II	Cosmic abundance of elements; Composition of the planets and meteorites; Geochemical evolution of the earth and geochemical cycles;	**10**
III	Gold Schmidt's geochemical classification of elements; Distribution of major, minor, and trace elements in igneous, metamorphic, and sedimentary rocks	**15**
IV	Elements of geochemical thermodynamics; Isomorphism and polymorphism; Fundamentals of Radioactive and Radiogenic Isotope Geochemistry.	**20**

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

1. Establish linkage between knowledge of geology and chemistry.
2. Understand geochemical activities since formation of the earth and migration of the elements.
3. Knowledge of isotopes and their applications in geology.
4. Geochemistry of solar system.

Books Recommended:

1. Hoefs, J., 1980. Stable Isotope Geochemistry. Springer-Verlag.
2. Klein, C. and Hurlbut, C.S., 1993. Manual of Mineralogy. John Wiley and Sons, New York.
3. Krauskopf, K.B., 1967. Introduction to Geochemistry. McGraw Hill.
4. Mason, B. and Moore, C.B., 1991. Introduction to Geochemistry. Wiley Eastern.
5. Rollinson, H.R., 1993. Using geochemical data: Evaluation, Presentation, and Interpretation. Longman.

PRACTICAL COURSE IN GEOLOGY

Credit: 16 **Contact Hours / week: 20**

Total Marks: UA – 320 + CA – 80 = 400

UNIT – I: DSE – 1: Laboratory Course in Economic Geology and Hydrology:

1. **Economic Geology**: Study of major ore, economic and industrial minerals in hand specimen; Preparation of maps showing the distribution of important metallic and nonmetallic deposits studied in theory course and important coal and oil fields of India.
2. **Hydrology:** 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, rock types, satellite images based on tone, texture, lineaments, and vegetation cover.

UNIT – II: DSE – 2:Elements of Applied Geology:

1. **Engineering Geology :** Preparation of engineering geological maps (outcrop completion). 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. Engineering properties and identification of building stones. Identification of various models of landslide, tunnel, and dam. Study of soil profiles.
2. **prospecting and mining Geology:** Completion of Outcrops from the available data (number of outcrops, dip & strike given). Bore Hole Problems to ascertain Dip, Strike, and Fault.

UNIT – III: SEC – 1&2: Photogeology and Remote Sensing & Geomorphology and Geotectonics:

A. Photogeology and Remote Sensing:

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. **B.**

B) Geomorphology:

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.

C. 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

UNIT – IV: SEC – 3 & 4: Environmental Geology and Geochemistry

1. **Environmental Geology:** 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.
2. **Geochemistry:** Petrochemical calculations from given chemical analysis of rocks.
   - Determination of CIPW Norms (Over saturated rocks) and classification,
   - Determination of Niggli values up to quartz Values and classification
   - Determination of ACF and plotting on triangular diagrams (compare with standard diagram from Winkler)
   - Plotting of sedimentologic size analysis data on histogram and frequency curves, mode and mean, Folk and Ward's (1957) graphic measures mean, size and standard deviation. Significance of this analysis be compared with standard Table given by Krumbein and Sloss

Practical Examination Pattern

University practical examination will be conducted annually i.e. at the end of sixth semester only.

1. It will be conducted for total 320 marks
2. Two separate days for Two Practical
3. Time – 5 hours per practical day

Geological excursion and field studies.

1. Geological fieldwork in selected areas as specified in theory papers for about 07 days under guidance is compulsory. The days allotted for geological excursion can be reduced by adding one short tour (at least two days) in the nearby areas for Deccan Trap studies and flow mapping. Short tours of 1 day or multiple may be considered equivalent, subject to the jurisdiction of Examiners as special case.
2. Submission of completed journal and field report along with individual collection of rock specimens at the time of practical examination is compulsory.
3. Field project: Related to geology like survey in the nearby area or any other field work related to geology.
4. Visit to Geological laboratories / research institutes / mines / beneficiation or processing plants / geology-based establishments.

EQUIVALANCE

Sr. No.	New Syllabus w.e.f June, 2021	Old Syllabus w.e.f. June, 2018
1	P – IX Economic Geology	P – XIII Economic Geology and Prospecting
2	P – X Hydrogeology	P – XII Applied Geology – I
3	P – XI Applied Geology – Engineering Geology	P – XII Applied Geology – I
4	P – XII Applied Geology – Prospecting and Mining Geology	P – XIII Economic Geology and Prospecting
5	P – XIII Photogeology and Remote Sensing	P – XVI Applied Geology – II
6.	P – XIV Geomorphology and Geotectonics	P – IX Earths physics and dynamics P – X Geomorphology
7	P – XV Environmental Geology	P – XIV Environmental Geology
8	Geochemistry	--