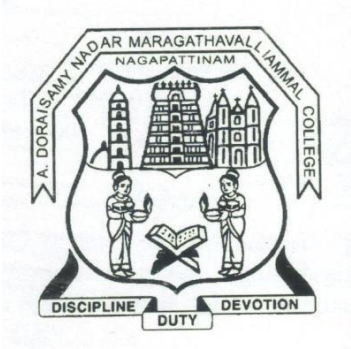
A.D.M. COLLEGE FOR WOMEN (AUTONOMOUS)
Nationally Accredited with "A" Grade by NAAC – 4th Cycle
(Affiliated to Bharathidasan University, Thiruchirappalli)
No.1, College Road, Velippalayam,
Nagapattinam – 611 001, Tamil Nadu, India

DEPARTMENT OF GEOLOGY

(For the candidates admitted from the academic year 2024-2025)



B.Sc., GEOLOGY
SYLLABUS
2024-2027

DEPARTMENT OF GEOLOGY

(For the candidates admitted from the academic year 2024-2025)

B.Sc.,GEOLOGY

Programme Educational Objectives (PEO):

PEO 1:	To study about surface geologic process and their impact on development of landforms, and ability to identify and interpret landform development.
PEO 2:	Students will use maps (topographic and geologic) to estimate distances, visualise landforms, and locate/identify geographic and geologic features.
PEO 3:	Students will identify common minerals in hand samples and in field exposures of rock using visual clues and simple tests.
PEO 4:	Students will identify common minerals in hand samples and in field exposures using observations of mineral composition and textures.
PEO 5:	To understand public issues in the geological sciences and be ready and able to contribute to their resolution.

Programme Specific Outcomes (PSO):

PSO 1	**Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.
PSO 2	**Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations
PSO 3	**PSO3 – Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.
PSO 4	**PSO4 – Contribution to Business World:** To produce employable, ethical and innovative professionals to sustain in the dynamic business world.
PSO 5	**Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values

	and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including, learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

COURSE STRUCTURE OF THE UG PROGRAMME - B.Sc GEOLOGY

Part	Title of the part	No. of Courses	Hours	Credit
I	Tamil	4	24	12
II	English	4	24	12
III	Core (T- 10, P-4)	14	71	60
	Project	1	3	3
	Minor (Allied T-4/ 5, P-2/1)	6	24	16
	Discipline Specific course	3	9	9
IV	Skill Enhancement Course	4	8	8
	Ability Enhancement Course	3	6	6
	Multidisciplinary course (NME)	2	4	4
	Internship	-	-	2
	Value Education	1	2	2
	Environmental Studies	1	2	2
	Soft Skill Development	1	2	2
V	Gender Studies	1	1	1
	Extension Studies	-		1
	Total	**45**	**180**	**140**

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A.D.M. COLLEGE FOR WOMEN (AUTONOMOUS)
DEPARTMENT OF GEOLOGY

FOR THE CANDIDATE ADMITTED FROM THE YEAR 2024-25 ONWARDS

SEMESTER – I							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part I	Language Course I	LC I – PODHU TAMIL I	6	3	3	25	75
Part II	English Course I	ELC I – GENERAL ENGLISH I	6	3	3	25	75
	Core Course I	CC I - GENERAL GEOLOGY AND CRYSTALLOGRAPHY	5	4	3	25	75
	Core Practical 1	CP I - CRYSTALLOGRAPHY AND PALAEONTOLOGY PRACTICAL	3	-	-	-	-
	FMC I	FMC I - MATHEMATICS–I / FMC I - CHEMISTRY I	4	3	3	25	75
	FMP I	FMC II - MATHEMATICS –II / FMC II - CHEMISTRY PRACTICAL 1	2	-	-	-	-
Part IV	Skill Enhancement Course I	SEC I - INTRODUCTION TO GEOLOGY	2	2	3	25	75
	VE	VALUE EDUCATION	2	2	3	25	75
*Extra Credit 1	Extra Credit I	ECC I - PROFESSIONAL ENGLISH FOR PHYSICAL SCIENCES-I	6	2	-	0	100
	Total	**6+1**	**30+6**	**17**			

SEMESTER – II							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part I	Language Course II	LC II – PODHU TAMIL II	6	3	3	25	75
Part II	English Course II	ELC II – GENERAL ENGLISH II	6	3	3	25	75
Part III	Core Course II	CC II- PALAEONTOLOGY	6	5	3	25	75
	Core Practical I	CP I - CRYSTALLOGRAPHY AND PALAEONTOLOGY PRACTICAL	2	3	3	40	60
	FMP I	FMC II - MATHEMATICS –II / FMP II - CHEMISTRY PRACTICAL 1	2	2	3	25/40	75/60
	FMC II	FMC II - MATHEMATICS –III / FMC II-CHEMISTRY III	4	3	3	25	75
Part IV	Skill enhancement course -I	SEC II- CLIMATOLOGY	2	2	3	25	75
	EVS	ENVIRONMENTAL STUDIES	2	2	3	25	75
*Extra Credit 2	Extra credit II	ECC II – (Skill course I Add on)	6	2	-	0	100
	Total	**8+1**	**30+6**	**23+2**			

SEMESTER – III							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part I	LC III	LC III – PODHU TAMIL III	6	3	3	25	75
Part II	ELC III	ELC III – GENERAL ENGLISH III	6	3	3	25	75
Part III	Core Course III	CC III - STRUCTURAL GEOLOGY AND PHOTO GEOLOGY	6	6	3	25	75
	Core Practical II	CP II - STRUCTURAL GEOLOGY, REMOTE SENSING AND SURVEY PRACTICAL	2	-	-	-	-
	Second minor course I	SMC I - PHYSICS I	4	3	3	25	75
	Second minor practical I	SMP I- PHYSICS PRACTICAL I	2	-	-	-	-
Part IV	NME I	NME I - FUNDAMENTALS OF GEOLOGY	2	2	3	25	75
	SEC III	SEC III - HYDROGEOLOGY	2	2	3	25	75
*Extra Credit 3	ECC III	ECC III – (Skill Course II-Add on)	6	2	-	0	100
	Total	**6+1**	**30+6**	**19+2**			

SEMESTER – IV							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part I	LC IV	LC IV – PODHU TAMIL IV	6	3	3	25	75
Part II	ELC IV	ELC IV – GENERAL ENGLISH IV	6	3	3	25	75
Part III	CC IV	CCIV-GEOMORPHOLOGYAND GEOTECTONICS	5	5	3	40	60
	CP IV	CP II - STRUCTURAL GEOLOGY, REMOTE SENSING AND SURVEY PRACTICAL	3	3	3	25	75
	Second Minor Practical I	SMP I - PHYSICS PRACTICAL II	2	2	3	40	60
	Second Minor Course II	SMC II - PHYSICS - III	4	3	3	25	75
Part IV	NME II	NME II - INTRODUCTION TO MINERALS, ROCKS & FOSSILS	2	2	3	25	75
	Ability Enhancement Course I	AEC I - ENGINEERING GEOLOGY	2	2	3	25	75
*Extra Credit 4	ECC IV	ECC IV –QUANDITATIVE APTITUDE	6	2	-	0	100
	Total	**9+1**	**30+6**	**23+2**			

SEMESTER – V							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part III	CC V	CC V- STRATIGRAPHY	5	5	3	25	75
	CC VI	CC VI - MINERALOGY	5	5	3	25	75
	CC VII	CC VII - IGNEOUS PETROLOGY	5	4	3	25	75
	CC VIII	CC VIII –SEDIMENTARY AND METAMORPHIC PETROLOGY	5	4	3	40	60
	CP III	CP III- MINERALOGY AND PETROLOGY PRACTICAL	3	3	3	25	75
	DSE I	DSE I – REGIONAL GEOLOGY/ DISASTER MANAGEMENT	3	3	3	25	75
Part IV	AECC II	AECC II - OCEANOGRAPHY	2	2	3	25	75
	SSD	SOFT SKILL DEVELOPMENT	2	2	3	25	75
	Summer Internship/Ind. Training	INTERNSHIP	-	2	-	-	-
*Extra Credit 5	Extra Credit course V	Value Added Course I –(Multidisciplinary)	6	2	-	0	100
	Total	**8+1**	**30+2**	**30+2**			

SEMESTER – VI							
PART	**COURSE TYPE**	**COURSES**	**HOURS**	**CREDITS**	**EXAM DURATION**	**MAX. MARKS**	
						CIA	**EXT**
Part III	Core Course IX	CC IX - ECONOMIC GEOLOGY AND MINERAL ECONOMICS	6	5	3	25	75
	Core Course X	CC X - APPLIED GEOLOGY	6	5	3	25	75
	Core Practical IV	CP IV - ECONOMIC GEOLOGY AND ORE ANALYSIS PRACTICAL	3	3	3	40	60
	CC	PROJECT	3	3	3	25	75
	DSE II	DSE II – GEOSTATISTICS/ GEOLOGY OF TAMIL NADU	3	3	3	25	75
	DSE III	DSE III – EXPLORATION TECHNIQUES/ MARINE GEOLOGY	4	3	3	25	75
Part IV	AEC III	AEC III - MINING GEOLOGY	2	2	3	25	75
	SEC IV	SEC IV- ENVIRONMENTAL GEOLOGY	2	2	3	25	75
Part V	RGS	GENDER STUDIES	1	1	3	25	75
	EA	EXTENSION ACTIVITIES	-	1	-	-	-
*Extra Credit 6	VAC II	VAC II – FIELD GEOLOGY (Same Disciplinary)	6	2	-	0	100
	Total	**7+1**	**30+6**	**28+2**			

Grand Total – Credit 140 & Extra Credit 12

Semester-I / Core Course-I	GENERAL GEOLOGY AND CRYSTALLOGRAPHY	Course Type: CC I
Instruction Hours: 5	Credits: 4	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 – Creating	
Course Objectives	• The main objective of this course is to enumerate the origin of Earth. • To describe the concepts of Dating and internal structure of the Earth. • To explain various components of crystals and crystallography. • To study various class and forms of a crystal system. • To determine various crystallographic properties of crystals with suitable examples.	
UNIT		**HOURS**
UNIT I	Universe – Evolution of the Universe – Stellar system – Milky Way Galaxy –Evolution of Galaxy. Solar System – Inner and outer planets – characteristics of solar system. Satellites – Asteroids – Meteors – comets. Earth – movements – revolution – rotation – solstice – equinox – time – GMT – IST. Atmosphere – Monsoon- El Nino – hydrosphere – lithosphere- Origin of the Earth – Nebular and Planetesimal hypothesis – Tidal & Vonweizacker's hypothesis – merits and demerits of the above hypotheses	15
UNIT II	Age of the Earth – old methods – new methods – Radioactivity – Half-life period – Radiometric methods – Uranium / Lead method – Rubidium / Strontium method – Lead / Lead method – Potassium/Argon -Carbon 14 method. Numerical methods in dating. Interior of the Earth – Density – Shape – Seismic waves – Composition and thickness of the crust, mantle and core. Discontinuities: Conrad Discontinuity – Mohorovicic Discontinuity – Weichert-Guttenberg Discontinuity	15
UNIT III	Definition of crystal – Unit cell, Bravais Lattices, Plane groups, Point groups & Space groups - Crystallographic axes – Symmetry Elements – Division of crystals into systems and Point groups – Axial Ratio – Parameters – Indices – Miller Indices – Symbol – Hermann Mauguin notations –Law of Rational Indices – Forms – simple – combination – open – closed – unit – holohedral – hemihedral – tetrahedral – hemimorphic – enantiomorphous forms – Interfacial angle and its measurement with Contact Goniometer. Types of Goniometers	15
UNIT IV	Study of common forms and combinations of the following systems and classes: Isometric System: Hexoctahedral, Diploidal, Hextetrahedral – Tetragonal System: Ditetragonal bipyramidal, Tetragonal bipyramidal,	15

	Tetragonal Pyramidal, Tetragonal Sphenoidal – Hexagonal System: Dihexagonal Bipyramidal, Hexagonal Bipyramidal Trigonal System – Ditrigonal Scalenohedral - Ditrigonal pyramidal, Trirhombohedral, Trigonal trapezohedral.	
UNIT V	Study of common forms and combinations of the following systems and classes: Orthorhombic System: Rhombic Bipyramidal, Rhombic pyramidal, Rhombic Disphenoidal – Monoclinic System: Prismatic – Triclinic System: Pinacoidal – Twinning in crystals – laws of twinning – types: contact, interpenetration, polysynthetic, repeated – important examples from six systems – Irregularities of crystals-An introduction to stereographic projection.	15

Text Books:

1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition.
2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi.
3. Patwardhan, A.M., Dynamic Earth System, Prentice Hall, New Delhi(1999)
4. Mukherjee A.K, Principles of Geology, EW Press, Kolkata(1990)
5. Reed, J.S. &T.H. Wicander, Essentials of Geology, McGraw Hill., New York (2005).

Reference Books:

1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA.
2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.
3. Crystals and Crystal Structures – Richard J. D. Tilley (2006), John Wiley & Sons, England.
4. Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns (1967), 2nd edition, Springer
5. Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996)

Web – Resources:

1. *"Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005*. Retrieved 2006-01-10.
2. *Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London.*
3. Geo.libretexts.org
4. www.nationalgeographic.org
5. Solarsysytem.nasa.gov

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the origin of Galaxy, Our Solar System and Crystal Science.
CO 2: Knowledge on Dating of Earth Age.
CO 3: Correlate various Hypothesis on Origin of Earth.
CO 4: Analyze the importance of Crystallography Studies.
CO 5: Various Type minerals and their respective crystal system.

Mapping of Course outcomes with Programme Outcomes & Programme Specific Outcomes:

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	M	M	S	S	S	M	S	M
CO2	S	S	M	M	S	M	S	M	S	M
CO3	M	S	M	M	S	M	S	M	S	M
CO4	S	S	M	M	S	M	S	M	S	M
CO5	S	M	M	M	S	S	S	M	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-I & II / CP I	CRYSTALLOGRAPHY AND PALAEONTOLOGY PRACTICAL	Course Type: CP I
Instruction Hours: 5	Credits: 3	Exam Hours: 3
Internal Marks: 40	External Marks:60	Total Marks: 100

Cognitive Level	**K1 –Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• The main objective of this course is to enumerate the origin of Earth. • To describe the concepts of Dating and internal structure of the Earth. • To explain various components of crystals and crystallography. • To study various class and forms of a crystal system. • To determine various crystallographic properties of crystals with suitable examples.	
UNIT		**HOURS**
UNIT I	Isometric System: Normal Class – Galena, Fluorite, Magnetite, Garnet, and Leucite, Copper- Pyritohedral class – Pyrite, Tetrahedral Class – Tetrahedrite. Tetragonal System: Normal Class – Zircon, Vesuvianite, Cassiterite, and Rutile. Tripyramidal – Scheelite, MeioniteSphenidal Class – Chalcopyrite. Hexagonal System: Normal Class – Beryl, Tripyramidal – Apatite, Hemimorphic – Zincite, Rhombohedral Normal – Calcite, Trapezohedral Class – Quartz.	15
UNIT II	Orthorhombic System: Normal – Barite, Sulphur, Stibnite, Topaz, Staurolite, and Aragonite. Hemimorphic – Calymene, Sphenoidal Class – Epsomite. Monoclinic System: Normal – Gypsum, Pyroxenes and Amphiboles. Triclinic System: Normal – Axinite, Albite, and Rhodonite. Twin Crystals: Contact and Penetration twins of Fluorite, Iron Cross Twin of Pyrite, Knee type twin of Cassiterite, Polysynthetic twin of Aragonite, Cyclic twin of Cerussite, Swallow Tail of Gypsum, Twins of Carlsbad, Baveno, Manebach, Albite law of Albite.	15
UNIT III	Identification and description of the following fossils: Lamellibranchs: Arca, Meretrix, Pecten, Cardita, Lima, Allectronia, Inoceramus, Gryphaea, Exogyra, Radiolites, Ostrea, Unio, Trigonia. Gastropods: Turritella, Turbo, Cerithium, Trochus, Physa, Murex, Voluta, Helix, Euomphalus, Cyprea.	15
UNIT IV	Cephalopods: Nautilus, Orthoceras, Ceratite, Goniatite, Belemnites,	15

	Baculites, and Perisphinctes. Echinodermata: Cidaris, Holaster, Hemiaster, Stigmatophygus, Apiocrinus. Trilobites: Paradoxides, Olenus, Olenellus, Phacops, Calymene.	
UNIT V	Corals: Calceola, Zaphrentis, Lithostrotion, Omphyma, Thecosmelia. Brachiopoda: Terebratula, Spirifer, Productus, Monograptus, Tetragraptus, Diplograptus.	15

Text Books:

1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition.
2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi.
3. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi (1995).
4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D (2005).
5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952).

Reference Books:

1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA.
2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.
3. Crystals and Crystal Structures – Richard J. D. Tilley (2006), John Wiley & Sons, England.
4. Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns (1967), 2nd edition, Springer.
5. Colbert E.H. et al., Evolution of the Vertebrates, Wiley. New Delhi (2002).

Web – Resources:

1. *Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005.* Retrieved 2006-01-10.
2. *Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London.*
3. Digitalatlas.cose.ISU.edu>geo>basics>fossil
4. www.sciencedirect.com>topic>hemichordata
5. w.qm.qid.au>biodiscovery>corals

Course Outcomes

On Completion of the course, Students should be able to

CO 1: The main objective of this course is to enumerate the fundamental aspects of Mineralogy in such a way as to stimulate the minds of the post-graduate students.

CO 2: To describe the concepts of Mineralogy is essential to comprehend the concepts of Petrology.

CO 3: To explain the importance of instrumentation techniques for better analysis.

CO 4: To compare and contrast between the fascinating plethora of colorful minerals and crystals, this discipline requires good knowledge of Chemistry, and poses several intriguing questions, leading to sustained interest in this subject.

CO 5: Can evaluate the accuracy and summaries the methods adapted for certain practical activities.

Mapping of Course outcomes with Programme Outcomes & Programme Specific Outcomes:

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	M	M	S	S	S	M	S	M
CO2	S	S	M	M	S	M	S	M	S	M
CO3	M	S	M	M	S	M	S	M	S	M
CO4	S	S	M	M	S	M	S	M	S	M
CO5	S	M	M	M	S	S	S	M	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-I / SEC I	INTRODUCTION TO GEOLOGY	Course Type: SEC I
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Study the evolution of solar system and age of the Earth. • Learn about the endogenic process like earthquake, volcanoes and orogenic activity. • Describe plate tectonics in general term. • Compare and contrast weathering among different rock types and different environments. • Explain the various parts of hydrologic cycle including the interaction of surface and groundwater with the solid Earth.	
UNIT		**HOURS**
UNIT I	Definition of Geology — Branches of Geology – Geology in the service of Man. The Solar system: – The Planets – Meteorites – Asteroids – Satellites – Comets; Evolution of the Solar system –Nebular hypothesis – Planetesimal hypothesis – Structure and composition of Earth's interior.	06
UNIT II	Earthquakes: Definition – causes and effects – Focus and Epicenter – Magnitude and Intensity –Prediction of Earthquakes – Tsunami - Earthquakes in India. Volcanoes: Definition - Types –Causes of volcanism – Effects of Volcanic activity - Prediction of volcanoes.	06
UNIT III	Mass movements – Definition – Classification –Causes and remedial measures. Concept of plate tectonics – Different kinds of plate margins – Evidences in favor and against the concepts of Continental Drift and Plate Tectonics.	06
UNIT IV	Weathering of Rocks –weathering processes chemical and mechanical weathering- Economic importance of weathering. Atmosphere – Its composition and zones. Wind – Geological actions of wind- sand dunes and their types.	06
UNIT V	Running water –erosion, transportation and deposition – brief study of land forms resulting from erosion and deposition. Underground water – sources – water table – zones of groundwater – springs and wells – artesian wells – geysers– aquifer. Glaciers – origin and types of glaciers. Seas and Oceans – waves, tides and currents– sea as a geological agent.	06

Text Books:

1. Thornbury, W.D., (2004) Principles of Geomorphology. II edition. Wiley Eastern Ltd. New Delhi.
2. Dana, F.S. (1955) : A text book of mineralogy - Asia Publishing House -Willey.
3. Krishnan M.S. (2003) - Geology of India and Burma, 6th Edition, CBS.
4. Karanth, K.R. (1998), Groundwater Management, S.R. Technico Book house, Ashok Raj path, patna-6.

Reference Books:

1. Arthur Holms: Principles physical Geology Thomos Nelson & sons, London.
2. Walhstrom, E.F.1960 - Optical crystallography – John Wiley.
3. Moore, R.C., Laliker , C.G.&Fishcher, A.G.: Invertebrate Fossils , Harper brothers.
4. Gregory, J.W. and Barret B.H - General stratigraphy mathuen.

Web – Resources:

1. https://byjusexamprep.com/upsc-exam/origin-and-evolution-of-the-earth
2. https://www.britannica.com/science/earthquake-geology
3. https://www.pmfias.com/continental-drift-theory-tectonics-evidences-continental-drift
4. https://www.geolearningpoint.com/2022/02/geological-works-of-rivers.html?m=1
5. https://osme.co.in/wp-content/uploads/2018/08/GEOLOGICAL-ACTION-OF-GLACIER.pdf

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Gain a better understanding of the Planets, Moons and other objects of our solar system in addition to their distribution and dynamical relationships.

CO 2: Understanding the geological origins of especially important natural hazards including Earthquakes, Tsunami, Volcanic eruptions and Landslides.

CO 3: Understand plate tectonics and its central role as the unifying theory of geology.

CO 4: Understand the concepts of weathering.

CO 5: Know the sources of groundwater and its features.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	M	M	M	S	S	S	S	M
CO 2	S	S	M	M	M	S	S	S	M	M
CO 3	S	S	S	S	S	S	S	S	M	M
CO 4	S	S	S	M	S	S	S	S	S	M
CO 5	S	S	S	M	M	S	S	S	S	M

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-II / CC II	PALAEONTOLOGY	Course Type: CC II
Instruction Hours: 6	Credits: 5	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	K1 –Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 – Creating	
Course Objectives	• Understand the basics of Fossils. • Understand the importance of fossils in Geological studies. • Know different phylum and their species with morphological changes. • Understand and correlate fossil with various rock formations. • Understand the importance of Palaeontology in dating and evolution studies.	
UNIT		**HOURS**
UNIT I	Fossils –Definition-conditions required for fossilization-Modes of preservation-Uses of fossils. Geological time scale.	18
UNIT II	The morphology and geological distribution of Mollusca- classes, Pelecypoda, gastropoda, Cephalopoda – orders - Nautiloidea, Ammonoidea, Dibranchia – Belemnites.	18
UNIT III	Phylum – Brachiopoda, Phylum – Coelenterata.ClassAnthozoa – Subclass Zoantharia Orders Rugosa, Tabulata and Scaleractina. Phylum – Hemichordata – Class Graptozoa, order Dendroidea, Order Graptolitoidea.	18
UNIT IV	Phylum – Arthropoda Class – Trilobita Phylum – Echinodermata Class - Echinoidea Class – Crinoidea. Class: Blastoidea. Introduction to Paleobotany, Gondwana Flora.	18
UNIT V	Short account of the following Dinosaurs, Saurischian Dinosaur and Ornithistian Dinosaurs, Archaeopteryx, Elementary idea of Verterbrate fossils of India, Morphological character of Phylum – Protozoa, Order – Foraminifera.	18

Text Books:

1. Palaeontology Evolution and animal distribution. .C. Jain and M.S. Anantharaman, (1996), Vishal Publications, Jalandhar.
2. Invertebrate Palaeontology - H.Woods, (1985), CBS Publishers and Distributors, New Delhi.
3. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi (1995).
4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D (2005).
5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952).

Reference Books:

1. Principles of Invertebrate Palaeontology, Shrock R.R and Twenohofel W.H, (2005), CBS Publishers and Distributors, New Delhi.
2. Invertebrate Fossils. Moore R.C, Lalicker C.G and Fisher A.G (1952) McGraw Hill.
3. The Vertebrate Story, Romer A.S, (1959) University of Chicago Press, 4th Edt. Chicago.
4. Palaeontology An Introduction, E.W.Nield and V.C.T.Tucker (1985) Pergamon Press, Oxford.
5. Colbert E.H. et al., Evolution of the Vertebrates, Wiley. New Delhi (2002).

Web – Resources:

1. *"Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005.* Retrieved 2006-01-10.
2. *Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London.*
3. Digitalatlas.cose.ISU.edu>geo>basics>fossil
4. www.sciencedirect.com>topic>hemichordata
5. w.qm.qid.au>biodiscovery>corals

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basics of Fossils.

CO 2: Understand the importance of fossils in Geological studies.

CO 3: Know different phylum and their species with morphological changes.

CO 4: Understand and correlate fossil with various rock formations.

CO 5: Understand the importance of Palaeontology in dating and evolution studies.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	M	S	S	S
CO 2	S	S	S	S	S	S	M	S	S	S
CO 3	S	S	S	S	S	S	M	S	S	S
CO 4	S	S	S	S	S	S	M	S	S	S
CO 5	S	S	S	S	S	S	M	S	S	S

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-II / SEC II	CLIMATOLOGY	Course Type: SEC II
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	K1 –Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 – Creating	
Course Objectives	• Understanding the way in which the climate affects our everyday lives. • To know what the monsoons are and what causes them. • To understand the properties of air masses and fronts • To describe how tornadoes arise. • To designate any climate station under Koppen's and Thornthwaite climatic scheme.	
UNIT		**HOURS**
UNIT I	Nature and scope of climatology: elements of weather and climate - composition and structure of the atmosphere – Insolation – heat budget – horizontal – vertical and seasonal distribution of temperature.	06
UNIT II	Atmospheric pressure: vertical and horizontal distribution of pressure - Wind: planetary, seasonal – monsoon – local winds - Atmospheric circulation – general and tri cellular model.	06
UNIT III	Humidity, - cloud – fog – precipitation: forms and types - evaporation – condensation hydrological cycle – air masses: types - fronts: classification and properties.	06
UNIT IV	Atmospheric disturbances: tropical and temperate cyclones – Anti cyclone - thunderstorms – tornadoes.	06
UNIT V	Climatic classification: Koppen's and Thornthwaite - Atmospheric pollution - global warming –sea level rise – ozone depletion.	06

Text Books:

1. McIlveen, J.R., 1986. Basic meteorology: a physical outline. Wokingham: Van Nostrand Reinhold.
2. Bonan, G., 2015. Ecological climatology: concepts and applications. Cambridge University Press.

Reference Books:

1. D.S. Lal (1998) -Climatology, Chaitanya Publishing House, Allahabad.
2. Critchfield. H (1969) General –Climatology, Prentice Hall of India Pvt, Ltd, New Delhi.
3. Keith Smith (1988). Applied Climatology, McGraw Hill, New York.
4. Das Gupta, A & Kapoor, A.N. (2001) Principles of Physical Geography,

5. S.C.Chand & Company Ltd. New Delhi.Strahler, A. H. &Strahler, A N. (2001) Modern Physical Geography (4/E), John Wiley and Sons, Inc., New York.

1. https://rwu.pressbooks.pub/webboceanography
2. *https://www.britannica.com/science/atmospheric-pressure*
3. https://scied.ucar.edu/learning-zone/how-weather-works/weather-fronts
4. https://public.wmo.int/en/our-mandate/focus-areas/natural-hazards-and-disaster-risk-reduction/tropical-cyclones#:~:text=A%20tropical%20cyclone%20is%20a,calm%20and%20free%20of%20clouds.
5. *https://www.britannica.com/science/Koppen-climate-classification*

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Demonstrate their understanding about Earth's present atmosphere evolved over time.
CO 2: Explain the causes of season.
CO 3: Explain the different clouds and how cloudiness varies from pole to pole.
CO 4: Understand the concepts of major cyclones.
CO 5: Recognize how mankind is enhancing Global warming.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	M	M	S	S	S	S	M
CO 2	S	S	S	M	M	S	S	S	S	M
CO 3	S	S	M	M	M	S	S	S	S	M
CO 4	S	S	S	M	M	S	S	S	S	M
CO 5	S	S	S	M	S	S	S	S	S	M

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-III / CC III	STRUCTURAL GEOLOGY AND PHOTO GEOLOGY	Course Type: CC III
Instruction Hours: 6	Credits: 6	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Understand the basics components of Structural Geology. • Know the formations of geological formations. • Basics of Aerial Photographs. • Understand the Application of Satellite science. • Analyse various physiographical features through GIS.	
UNIT		**HOURS**
UNIT I	Definition and scope of structural geology – topographic forms – topographic map – geological map – contour lines – stratum contours – outcrops and exposures. Attitude of beds – dip and strike – slope – Clinometer, Brunton compass and GPS (Global Positioning System) and its uses.	18
UNIT II	Fold: Definition and parts of fold; classification of folds. Joints: Description and classification. Description and origin of foliations and lineations.	18
UNIT III	Fault: Definition and parts of fault; classification of faults – Horst – Graben – Nappe – Fenster – Klippe – overthrust. Unconformity: Definition – types of unconformity – inlier and outlier.	18
UNIT IV	Aerial Remote Sensing: Definition and scope of photo geology - Aerial photographs – types – geometry of aerial photographs – tip and tilt – nadir point – principal point – fiducial marks – scale of photographs – vertical exaggeration – Stereoscopy – pocket lens and mirror stereoscope - mosaics – controlled and uncontrolled.	18
UNIT V	Satellite Remote Sensing –Principles of Remote Sensing –Components of remote sensing system Electro Magnetic Radiations (EMR) – Satellites – Sensors and platforms – Indian and foreign Satellites. Introduction to Geographic Information System (GIS); components of GIS; product generation in GIS; tools for map analysis; integration of GIS and remote sensing	18

Text Books:

1. **Structural geology, Billing. M.P. (1974), Prentice Hall, New Delhi.**
2. **An outline of Structural Geology, Hobbs, B.E., Means, W.D. and Williams, P.F. (1976), John Wiley, New York.**
3. **Curran P.B, Principles of Remote Sensing, ELBS. London (1985).**

4. **Sabins F.F, Remote Sensing Principles and Interpretation. Freeman. NewYork (1974).**
5. **Reddy A, Principles of Remote Sensing and GIS, CBS. Delhi (2010).**

Reference Books:

1. **Basic Problems of Geotectonics Belousov.V.V. (1962), McGraw Hill, New York.**
2. **Structural**
3. **Lueder. D.R. (1959), McGraw Hill, New York.**
4. **LiIIisand T.M & R.W. Geology De Sitter. L.U. (1956):, McGraw Hill, New York.**
5. **Elements of Structural Geology Hill. E.S. (1972):, John Wiley, New York.**
6. **Aerial Photographic Interpretation Kiefer, Remote Sensing and Image Interpretation, Wile Delhi (2000).**

Web – Resources:

1. **https://stratigraphy.org/**
2. **https://www.sepm.org/**
3. **https://www.geosocindia.org/**
4. **https://www.moes.gov.in/**
5. **https://isegindia.org/**

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basics components of Structural Geology CO 2: Know the formations of geological formations

CO 3: Basics of Aerial Photographs

CO 4: Understand the Application of Satellite science

CO 5: Analyse various physiographical features through GIS

Mapping of Course outcomes with Programme outcomes/ Programmes Specific

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	M	S	S	S
CO 2	S	S	S	S	S	S	M	S	S	S
CO 3	S	S	S	S	S	S	M	S	S	S
CO 4	S	S	S	S	S	S	M	S	S	S
CO 5	S	S	S	S	S	S	M	S	S	S

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-III &IV/ CP II	STRUCTURAL GEOLOGY, REMOTE SENSING AND SURVEY PRACTICAL	Course Type: CP II
Instruction Hours: 5	Credits: 3	Exam Hours: 3
Internal Marks: 40	External Marks:60	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Understand the basics components of Structural Geology. • Know the formations of geological formations. • Basics of Aerial Photographs. • Understand the Application of Satellite science. • Analyse various physiographical features through GIS.	
UNIT		**HOURS**
UNIT I	Contour Maps and their interpretation – Exercises to find out trend of the outcrop of horizontal, vertical, inclined beds with respect to topography – Reading of solid, conformable maps – Deciphering dip and strike of outcrops - Completion of map when three points over a bedding plane are given – Determination of vertical thickness of formations.	12
UNIT II	Reading of solid fold and fault maps – Determination of throw of faults – Construction of vertical sections – Reading of unconformable solid maps – Construction of sections – Reading of solid maps of areas with more than one structure and intrusion – Writing of geological history.	12
UNIT III	Solving of dip and strike problems by trigonometrical method – Determination of true thickness of beds by calculations	12
UNIT IV	Interpretation of geomorphology, lithology and geological structures on aerial photographs. Visit to nearby geological organizations	12
UNIT V	Definition – Primary divisions – classification – Chain survey – description of instruments employed – chain traverse – Compass survey – description of prismatic compass – whole circle bearings – reduced bearings – quadrantal bearings – open traverse – closed traverse – finding distance between inaccessible stations – locating the instrument station - GPS - Clinometer compass – finding dip and strike of beds – Modern Surveying	12

Text Books:

1. Gokhale, N.W., Theory of Structural Geology, CBS, Delhi (1995).
2. Sathya Narayanaswami, B.S. Structural Geology. Dhanpat Rai & Sons. New Delhi. (1994).
3. LiIIisand T.M & R.W. Kiefer, Remote Sensing and Image Interpretation, Wile Delhi (2000).
4. Reddy A, Principles of Remote Sensing and GIS, CBS. Delhi (2010).
5. Subramanian, Surveying and Levelling, Oxford University Press (2nd edition).

Reference Books:

1. Park, P.G., Foundations of Structural Geology, BIackie. London (1983).
2. Mahapatra G.B. Textbook of Physical Geology, CBS publications, Delhi (1994).
3. Ragan D.M., Structural Geology-An Introduction to geometrical Techniques. Wiley. New York (2000).
4. Guptha, R.P, Remote Sensing Geology, Springer New Delhi (2003).
5. T.P. Kanetkarand S.V. Kulkarni, Surveying and Levelling Vol. I and Vol. II, Pune Vidyarthi Griha Prakashan (2006).

Web – Resources:

1. http://www.labotka.net
2. http://www.patnasciencecollege.org
3. www.wamis.org
4. www.sciencedirect.com>earth-and-planetaryh-sciences
5. https://www.geo.cornell.edu

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basics components of Structural Geology
CO 2: Know the formations of geological formations
CO 3: Basics of Aerial Photographs
CO 4: Understand the Application of Satellite science
CO 5: Analyse various physiographical features through GIS.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	M	S	M	S	S	M	S	S	S	M
CO 2	M	S	M	S	S	M	S	S	S	M
CO 3	S	S	S	S	S	M	S	S	S	M
CO 4	S	S	S	S	S	M	S	S	S	M
CO 5	S	S	S	S	S	M	S	M	S	M

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-III /NME-I	FUNDAMENTALS OF GEOLOGY	Course Type: NME I
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks: 25	External Marks: 75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• To study the evolution of solar system and age of the Earth. • To learn about the endogenic process like earthquake, volcanoes and orogenic activity. • Clearly describe plate tectonics in general term. • To compare and contrast weathering among different rock types and different environments. • To explain the various parts of hydrologic cycle including the interaction of surface and groundwater with the solid Earth.	
UNIT	**CONTENT**	**HOURS**
I	Definition of Geology — Branches of Geology – Geology in the service of Man. The Solar system: – The Planets – Meteorites – Asteroids – Satellites – Comets; Evolution of the Solar system –Nebular hypothesis – Planetesimal hypothesis – Structure and composition of Earth's interior.	**6**
II	Earthquakes: Definition – causes and effects – Focus and Epicenter – Magnitude and Intensity –Prediction of Earthquakes – Tsunami - Earthquakes in India. Volcanoes: Definition - Types –Causes of volcanism – Effects of Volcanic activity - Prediction of volcanoes.	6
III	Mass movements – Definition – Classification –Causes and remedial measures. Concept of plate tectonics – Different kinds of plate margins – Evidences in favor and against the concepts of Continental Drift and Plate Tectonics.	6
IV	Weathering of Rocks –weathering processes chemical and mechanical weathering- Economic importance of weathering.	6

	Atmosphere – Its composition and zones. Wind – Geological actions of wind- sand dunes and their types.	
V	Running water –erosion, transportation and deposition – brief study of land forms resulting from erosion and deposition. Underground water – sources – water table – zones of groundwater – springs and wells – artesian wells – geysers– aquifer. Glaciers – origin and types of glaciers. Seas and Oceans – waves, tides and currents– sea as a geological agent.	6

Text Books:

1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition.
2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi.
3. Patwardhan,A.M., Dynamic Earth System, PrenticeHall, New Delhi(1999)
4. Mukherjee A.K, Principles of Geology, EW Press, KoIkata(1990)
5. Reed, J.S. &T.H. Wicander, Essentials of Geology, McGraw Hill., New York(2005).

Reference Books:

1. Arthur Holms: Principles physical Geology Thomos Nelson & sons, London.
2. Walhstrom, E.F.1960 - Optical crystallography – John Wiley.
3. Moore, R.C., Laliker , C.G.& Fishcher, A.G.: Invertebrate Fossils , Harper brothers
4. Gregory, J.W. and Barret B.H - General stratigraphy mathuen.

Web – Resources:

1. *"Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005.* Retrieved 2006-01-10.
2. *Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London.*
3. Geo.libretexts.org
4. www.nationalgeographic.org
5. Solarsysytem.nasa.gov

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Gain a better understanding of the Planets, Moons and other objects of our solar system in addition to their distribution and dynamical relationships.

CO 2: Understanding the geological origins of especially important natural hazards including Earthquakes, Tsunami, Volcanic eruptions and Landslides.

CO 3: Understand plate tectonics and its central role as the unifying theory of geology.

CO 4: Understand the concepts of weathering.

CO 5: Know the sources of groundwater and its features.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	S	S	M	M	M	S	S	S	S	M
CO 2	S	S	M	M	M	S	S	S	M	M
CO 3	S	S	S	S	S	S	S	S	M	M
CO 4	S	S	S	M	S	S	S	S	S	M
CO 5	S	S	S	M	M	S	S	S	S	M

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-III/ SEC III	HYDROGEOLOGY	Course Type: SEC III
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• The main objective of this course is to understand about aquifer and groundwater. • To understand the rock properties affecting groundwater. • To know about the groundwater exploration techniques. • To Understand the Sea water intrusion. • To understand the rain water harvesting methods.	
UNIT		**HOURS**
UNIT I	Definition of hydrogeology and groundwater – Types of groundwater based on origin - Hydrological cycle - Vertical distribution of ground water – Springs: types, geological conditions favouring development of springs - Definition of aquifers, aquitards and aquicludes - Types of Aquifers: unconfined, semi-confined, confined and perched – Artesian wells.	06
UNIT II	Rock properties affecting groundwater: types of openings, porosity, specific yield, specific retention and permeability – Groundwater movement – Darcy's law and its applications – Determination of permeability in field and lab – Groundwater occurrence in igneous, sedimentary and metamorphic rocks.	06
UNIT III	Groundwater exploration by electrical resistivity method – Outline of dug wells, tube wells, jetted wells, infiltration galleries and collector wells – Well design and development – Fluctuations of groundwater – Groundwater recharge methods	06
UNIT IV	Pump tests and evaluation of various aquifer parameters through pump tests – Conjunctive and consumptive use of groundwater – Sea water intrusion: causes, consequences preventive and control measures – Groundwater provinces of India – Groundwater resources of Tamil Nadu including its quality.	06
UNIT V	Groundwater quality in various rock types – Parameters considered for assessing groundwater quality, suitability for drinking and irrigation purposes – The latest drinking and irrigation water standards of WHO	06

	and BIS – Waterborne diseases – Rainwater harvesting methods	

Text Books:

1. Groundwater Hydrology. John Wiley & Sons, 656p..
2. Davis, S.N. & Deweist., R.J.M (1966). Hydrogeology, John Wiley & Sons, New York, 463p.
3. Ragunath, H.M (2007). Groundwater, New Age International Publishers, New Delhi, 520p.
4. Karanath, K.R (1987). Groundwater Assessment, Development & Management, Tata McGraw Hill, 720p.
5. Ramakrishnan, S (1998). Groundwater. K.G. Graph Arts, Chennai, 471p.

Reference Books:

1. Alain Dassargues , 2018,HydroGeology: Groundwater science & Engineering, CRC Press.
2. Charles Fitls , 2002,Groundwater Science, Elsevier
3. Kevin Hiscock& Victor Bense , 2014,HydroGeology, Willey Blackwell science.
4. Michael Kasenow , 2001 ,Applied Groundwater Hydrology, Water Resources Publications.
5. Rushton , 2004,Groundwater Hydrology: conceptuals and computational models, Willey Publishers

Web – Resources:

1. https://www.usgs.gov/special-topics/water-science-school/science/aquifers-and-groundwater
2. *https://www.ldeo.columbia.edu/~martins/climate_water/lectures/darcy.html*
3. https://iopscience.iop.org/article/10.1088/1742-6596/995/1/012094/pdf#:~:text=Electrical%20Resistivity%20Method%20(ERM)%20is%20part%20of%20geophysical%20methods%20which,geological%20environment%20of%20existing%20aquifer.
4. https://ca.water.usgs.gov/sustainable-groundwater-management/seawater-intrusion-california.html
5. *https://www.ultratechcement.com/hi/home-building-explained-single/steps-for-an-efficient-rainwater-harvesting-system?utm_source=Google_Search&utm_medium=CPC&utm_campaign=Chance_Na_Lo&utm_content=SEM&gclid=Cj0KCQjwqs6lBhCxARIsAG8YcDgVPsBaxSgdo7uJ-VAB14w30DnlSG-S-hT1k7Vo90TkTpg154BOfjMaAuZDEALw_wcB*

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Student would understand the hydrodynamics, quality of groundwater, groundwater exploration and groundwater conservation.

CO 2: Understand the components of hydrologic cycle.

CO 3: Understand measurement of ground water exploration techniques

CO 4: Understand the various artificial recharge techniques.

CO 5: Understand the quality of groundwater.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	M	S	M	M	S	S	S	M	S	S
CO 2	S	S	S	S	S	S	S	S	S	S
CO 3	M	S	M	S	S	S	S	S	S	S
CO 4	M	S	S	S	S	S	S	M	S	S
CO 5	M	S	S	M	S	S	S	S	S	S

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-IV /CC IV	GEOMORPHOLOGY AND GEOTECTONICS	Course Type: CC IV
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 –Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Know the basics of Geotectonics and landforms. • Understand the importance of various geomorphological agencies. • Process of Geomorphological features and creation of landforms. • Understand and predict Earth's Internal and external processes. • Predict the future from the past formed features.	
UNIT		**HOURS**
UNIT I	Interpretation of ial cycle - Landforms developed by running water – valley development, river capture, waterfalls, meandering, river terraces, Lakes, their types and deposits. Geological work of wind and Underground water.	18
UNIT II	Glaciers – formation, movement, types and landforms due to their erosional and transportational activity. Topography of ocean floor – erosional and depositional features of oceans – Coral reefs, types, theories for the origin of coral reefs – Submarine Canyons.	18
UNIT III	Mountains – their kinds, development and important mountain building movements. Processes of weathering – types and products- Mass Movements.	18
UNIT IV	Earthquakes – types – seismographs – intensity and Magnitude scales (Richter & Mercalli) –Tsunami-Global Distribution; Volcanoes – structure, types – products – Global Distribution.	18
UNIT V	Continental drift – Wegner Concept – various evidences. Plate tectonics – concept – plate characteristics – larger and smaller plates – types of plate boundaries – causes and mechanism of plate motions.	18

Text Books:

1. Worcester , P.G.,A Text Book of Geomorphology, East West Press Ltd. Delhi (1960).
2. Sathya Narayanaswami, B.S. Structural Geology. Dhanpat Rai & Sons. New Delhi. (1994).
3. GokhaIe,N.W. , Theory of Structural Geology, CBS, Delhi (1995).
4. Davis,G.H, Structural Geology of Rocks and Regions. Elements of Structural geology, Wiley

(1985).

5. Ragan D.M., Structural Geology-An Introduction to geometrical Techniques. Wiley. New York (2000).

Reference Books:

1. HiIIs E.S., Elements of Structural Geology, Chapman &Hall. London (1963).
2. Mahapatra G.B. Textbook of Physical Geology, CBS publications, Delhi (1994).
3. Park,P.G., Foundations of Structural Geology, BIackie. London (1983).
4. Radhakrishnan V, General Geology, V.V.P. Publications, Tuticorin (1996).
5. Bloom A., Principles of Geomorphology (1985).

Web – Resources:

1. http://www.labotka.net
2. http://www.patnasciencecollege.org
3. https://geomorphology.org.uk
4. https://gradeup.co
5. https://www.nps.gov>subjects>gla

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Know the basics of Geotectonics and landforms.

CO 2: Understand the importance of various geomorphological agencies

CO 3: Process of Geomorphological features and creation of landforms

CO 4: Understand and predict Earth's Internal and external processes

CO 5: Various Type minerals and their respective crystal system.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	M	S	M	S	S	M	S	S	S	M
CO 2	M	S	M	S	S	M	S	S	S	M
CO 3	S	S	S	S	S	M	S	S	S	M
CO 4	S	S	S	S	S	M	S	S	S	M
CO 5	S	S	S	S	S	M	S	M	S	M

S – Strongly Correlated

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W – Weakly Correlated

N – No Correlation

Semester-IV / NME - II	INTRODUCTION TO MINERALS, ROCKS AND FOSSILS	Course type: NME II
Instruction Hours:2	Credits: 2	Exam Hours: 3
Internal Marks: 25	External Marks: 75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Understanding the physical properties of minerals. • To describe the origin and uses of minerals . • To study the igneous structures and rocks. • To describe the properties of sedimentary and metamorphic rocks. • To understand the paleoclimate through fossils.	
UNIT	**CONTENT**	**HRS**
I	Definitions of Mineral, Mineraloid, Ore and Gangue. Brief study of Physical Properties of Minerals; Nature, Streak, Cleavage, Hardness, Luster and fracture Description of physical properties and chemical composition (a) Quartz group (Rock crystal, Amethyst,) (b) Feldspars (Orthoclase, Labradorite) (c) Pyroxenes (Hypersthene, Augite) and (d) Amphiboles (Anthophyllite, Hornblende).	**06**
II	Physical properties, Chemical composition, origin and uses of; Iron ores (Magnetite, Hematite), Placers (Garnet), Copper ores (Chalcopyrite). Calcite, Graphite, Asbestos, Talc, and Bauxite. Introductory knowledge about properties, origin and uses of Lignite of Neyveli.	**06**
III	Brief study of common characters of igneous rocks. Igneous structures - Dyke, Sill and Batholith. Descriptive study of structure, texture, mineralogy and origin of; 1. Granite 2. Gabbro 3. Basalt 4. Anorthosite .	**06**
IV	Common properties of sedimentary rocks. Simple classification of sedimentary rocks – Mechanical, Chemical, Organical and Residual. Description of texture, mineralogy and origin of (a) Conglomerate (b) sandstone (c) Shale. General characters of metamorphic rocks. Agents and kinds of metamorphism. Brief	**06**

	study of slate, schist and gneiss.	
V	Definition of Palaeontology —. Definition of fossils – Types of preservation of fossils. Uses of fossils. Megascopic identification and description of the following fossils:- Brachiopoda: Productus, Terebratula; Pelecypoda: Arca, Pectan; Gasteropoda: Turbo, Physa; Cephalopoda: Goniatites, Ceratites.	**06**

Text Books:

1.. Dana, F.S. 1955 - A text book of mineralogy – Asia publishing House, Wiley.

2. Tyrrel, G.W. 1978 - The principles of petrology – Chapman and Hall Ltd., London.

3. Mahapatra, G.B. - A text book of Geology, CBS, Delhi

Reference Books:

1. Raup, D.M. and Stanely, M.S. Principles of Palaeontology, CBS Publishers.

2. Berry , Mason, Dietrich,2000 - Mineralogy, CBS Publication

3. Cornelis Klen and Cornelius S. Hurlbut , 1985 – Manual of Minerology, John wiley & Sons

4. Turner,F,J &Verhogen,J -Igneous and Metamorphic Petrology, MC Graw Hill

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understanding the general geological settings of Tamilnadu and their structural aspects.

CO 2: Gain a better understanding of the structures and tectonics of shear zones of TamilNadu.

CO 3: Understanding the Archean systems and Proterozoic formations of charnockite, migmatite and granite.

CO 4: Articulate the relationship between Gondwana and Terani formations

CO 5: Understand the mineral wealth of Tamilnadu.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	M	S	S	S	S	S	S	S	S	M
CO 2	M	S	S	S	S	S	S	S	S	M
CO 3	M	S	S	S	S	S	S	S	S	M
CO 4	M	S	S	S	S	S	S	S	S	M
CO 5	M	S	S	S	S	S	S	S	S	M

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Semester-IV / AECC 1	ENGINEERING GEOLOGY	Course Type: AECC 1
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 – Creating	
Course Objectives	• To understand the engineering properties of rocks. • To learn about the different types of dam construction. • To understand about the reservoirs and its associated problems. • To know about tunnel construction and their condition. • To understand the role of foundations in engineering.	
UNIT		**HOURS**
UNIT I	Definition and scope of Engineering Geology. Engineering properties of rocks. Soils: definition and engineering properties. Geological Investigations in engineering sites. Slope stability: definition, slope failure and safety, geological factors, groundwater conditions and remedial measures.	06
UNIT II	Dams: definition, types, geological conditions, and site investigations. Short note on dam foundations and geological conditions. Outline of important Indian Dams.	06
UNIT III	Reservoirs: definition, selection of reservoir sites, and groundwater conditions. Problems in reservoirs: sedimentation, slope control, leakage and seismicity. Short account of Indian reservoirs.	06
UNIT IV	Tunnels: definition, parts of a tunnel, types, tunnelling in hard and soft rocks, geological investigations, and groundwater conditions.	06
UNIT V	Foundations: definition, geological investigations, and ground water problems. Outline of support structures: rods, bolts, anchors, arches, rings, linings, and retaining walls.	06

Text Books:

1. Parbin Singh,B.(2005). A Textbook of Engineering and General Geology. S.K.Kataria & Sons.Delhi.
2. ChennaKesavulu, 2016, Textbook of Engineering Geology, Trinity press
3. AureleParriaux, 2009, Geology Basics for Engineers, CRC Press
4. K.V.G.K.Gokhale, 2016, Principles of Engineering Geology, BSP Books Private Limited.
5. Fox, C.S 1949 Engineering Geology, New York

Reference Books:

1. Bell,F.G.(2005).Fundamentals of Engineering Geology. B.S.Publications. Hyderabad.
2. Krynine,P.D. & W.R. Judd.(1956). Principles of Engineering Geology & Geotechnics. CBS. Delhi.
3. Legget,R.F. & A.W.Hatheway.(1988). Geology and Engineering. 3 rd ed. McGraw Hill. New York.
4. Blyth,F.G.H. & M.H.De Freitas.(1984).A Geology for Engineers. 7th ed. Elsevier. New Delhi
5. Gokhale K.V.G.K and Rao, D.M .1981 Experiments in Engineering Geology, Mcgraw Hill.

Web Resources:

1. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/earth_sciences/geo-engineering_&_enviornmental_systems/01._engineering_properties_of_rocks_/et/1425_et_et441.pdf
2. https://www.britannica.com/technology/dam-engineering
3. https://www.britannica.com/technology/reservoir
4. https://old.amu.ac.in/emp/studym/99991103.pdf
5. https://civiltoday.com/geotechnical-engineering/foundation-engineering/161-types-of-foundation

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Able to understand the engineering properties of rocks.
CO 2: Able to learn about the different types of dam construction.
CO 3: Able to understand about the reservoirs and its associated problems.
CO 4: Able to know about the tunnel construction and their condition.
CO 5: Learn and Understand the role of foundations in engineering.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	M	M	S	S	S	S	M
CO 2	S	S	S	M	M	S	S	S	S	M
CO 3	S	S	M	M	M	S	S	S	S	M
CO 4	S	S	S	M	M	S	S	S	S	M
CO 5	S	S	S	M	S	S	S	S	S	M

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Semester-V / CC V	STRATIGRAPHY	Course Type: CC V
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 –Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Understand the basic of Historical Geology. • Know the Important group of Stratigraphic systems. • Know various economic importances of various periods. • Understand the various rocks of different periods from the formation of Earth. • Present is the Key to the Past – Critical Analyse.	
UNIT		**HOURS**
UNIT I	General Stratigraphy: Principles of Stratigraphy, – Time units – Time rock units – Standard Geological Time scale. Indian stratigraphy: Archaean: dharwar super group – Champian Gneiss – Peninsular Gneiss – Closepet Granite - Sakoli Series – Saucer Series – Bundelkhand Gneiss – Banded gneissic complex – aravalli super group – Raiolo Series - Singhbhum Iron ore Series – Singhbhum copper belt shear zone – Newer Dolerite – Mineral riches of Archaean.	15
UNIT II	PROTEROZOIC: Cuddapah Super group – Kaladgi series – Delhi Super group – Erinpura Granite – Malani Igneous suite – Hazara slates – Attock slates – Dogra Slates – Mineral riches of Cuddapah – Vindyan Super group – Kurnool Super group – Bhima Series – Mineral riches of Vindhyan.	15
UNIT III	PALAEOZOIC: Cambrian of Salt range – Age of Saline series – Haimanta System – Muth Quartzites – Kanawar System – Fenestella Shales – Kuling System – Everest Limestone – Panjal Volcanic Series. Gondwana Super group – Climate and Sedimentation – Classification – Lithology – Fossil contents – Distribution of Coal Deposits.	15
UNIT IV	MESOZOIC: Triassic of Spiti – Succession and fossil contents Jurassic of Kutch – Succession and fossil content – Cretaceous of Tiruchirapalli and Bagh beds. CENOZOIC: Deccan traps – Age – Distribution – Petrology – Lametabeds – Infratrappean and Intertrappean beds	15
UNIT V	Tertiary of Assam and Tamil Nadu Siwalik Super group – Varkala and Quilon beds of Kerala – Tertiary of Cambay a Karewa formation – Rise of Himalayas- Pleistocene Glaciation – Indo-Gangetic alluvium – Laterite.	15

Text Books:

1. Geology of India and Burma M.S. Krishnan, (2010), 6th Edi., C.B.S publishers and Distributors, Delhi
2. Geology of India, D.N. Wadia, (1966), McMillan company, London
3. Vaidyanadhan.R & M.Ramakrishnan, Geology of India. Geological Society of India. Bangalore (2008)
4. Mehdiratta R.C, Geology of India, Pakistan, Bangladesh and Burma. Atma Ram & Sons. Delhi (1974)
5. Geology & Mineral Resources of the States of India. Misc Pub.No.30.Geological Survey of India. Kolkata. (Several individual volumes available online at GSI portal) GSI (2005).

Reference Books:

1. Fundamentals of Historical Geology and Stratigraphy of India, Ravindra kumar (1985), Wiley Eastern ltd, New Delhi.
2. Principle of Stratigraphy, Dunbar and Roggers, (1964), John Wiley and co, New York.
3. An Introduction in Stratigraphy, Stamp L.D, (1964), Thomas Murby, Museum St, WCI, London.
4. Stratigraphic Principles and Practices, Weller, J.M, (1962), Harper & Bros, New York.
5. Kumar R, Fundamentals of Historical Geology and Stratigraphy of India, WiIey. New Delhi (1988).

Web Resources:

1. https://stratigraphy.org/
2. https://www.sepm.org/
3. https://www.geosocindia.org/
4. https://www.moes.gov.in/
5. https://isegindia.org/

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basic of Historical Geology.
CO 2: Know the Important group of Stratigraphic systems.
CO 3: Know various economic importances of various periods.
CO 4: Understand the various rocks of different periods from the formation of Earth.
CO 5: Present is the Key to the Past – Critical Analyse.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	S	S	S	M
CO 2	S	S	S	S	S	S	S	S	S	M
CO 3	S	S	S	S	S	S	S	S	S	M
CO 4	S	S	S	S	S	S	S	S	S	M
CO 5	S	S	S	S	S	S	S	S	S	M

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Semester-V / CC VI	MINERALOGY	Course Type: CC VI
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 –Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Understand the basics of Minerals. • Understand the importance of Minerals in Geological studies. • Know different group of minerals systems. • Understand the descriptive mineralogy of different groups. • Understand the importance of Minerals and mineralogical studies.	
UNIT		**HOURS**
UNIT I	Definition of mineral – General principles of chemistry as applied to minerals. Atoms, Molecules, Atomic Number, Valence, Ionic Radii, Coordinating Number, Bonding. Isomorphism, Polymorphism, Pseudomorphism. Physical properties of minerals depending upon Cohesion and Elasticity, Specific Gravity, Light, Heat, Electricity, Magnetism and of the Senses.	15
UNIT II	Nature of light – ordinary and polarized light – monochromatic light – Refraction and Reflection – Refractive Index – Critical Angle and Total reflection – Single refraction - Double refraction – Nicol Prism. Petrological Microscope and its parts – Behavior of light in its passage through a petrological microscope – Uses of quartz wedge, gypsum plate and mica plate - Classification of minerals into Isotropic and Anisotropic.	15
UNIT III	Uniaxial and Biaxial minerals – Uniaxial and Biaxial indicatrices – Dichroism and Pleochroism – Types of Extinction – straight or parallel, symmetrical and inclined – Extinction angle – Determination of extinction angle - A brief account of Silicate structure	15
UNIT IV	Descriptive mineralogy of the following essential rock forming minerals:- Quartz and its varieties – Families of Feldspar and Feldspathoids - Olivine and Garnet groups-Epidote, Beryl & Tourmaline	15
UNIT V	Descriptive mineralogy of the following rock forming mineral groups: - Amphibole and Pyroxene. Mica and Chlorite groups – Serpentine – Kaolin- Talc and Steatite. Zircon – Sphene – Topaz – Andalusite –	15

	Sillimanite – Kyanite – Staurolite - Rutile – Calcite – Dolomite – Apatite – Fluorite.	

Text Books:

1. A Text book of Mineralogy, E.S. Dana, (2000) CBS Publishers & Distributors, New Delhi.
2. Rutley's Elements of Mineralogy, C.D. Gribble, (1991), CBS Publishers and Distributors, New Delhi.
3. Wenk,H.R & A. Bulakh, Minerals, Cambridge University Press, New Delhi(2006).
4. Perkins D, 3rd ed. Prentice Hall India, New Delhi (2010).
5. HaIdar,S.K. & J.Tisjlar, Introduction to Mineralogy and Petrology, Elsevier, (2014).

Reference Books:

1. Dana's Manual of Mineralogy, C. Hurlbut, John Wiley & Sons, New York.
2. Optical Mineralogy, P.F. Kerr, (1959), McGraw Hill Book company, New York.
3. An Introduction to Rock forming Minerals, Deer, Howie and Hussmann, (1982), 2nd Edit., Orient Longman, London.
4. Deer,W.A.,R.A.Howie & J.Zussman. An Introduction to the Rock-Forming Minerals. ELBS. London (1992).
5. Berry L.G.,B.Mason & R.V. Dietrich, Mineralogy, CBS New Delhi (1985).

Web Resources:

1. https://en.m.wikipedia.org/wiki/mineral
2. https://britannica.com/science/chlorite-mineral
3. https://mineralseducationcoalition.org/minerals-database/zeolite
4. https://www.britannica.com/science/epidote
5. https://www.abracom.es

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basics of Minerals.
CO 2: Understand the importance of Minerals in Geological studies.
CO 3: Know different group of minerals systems.
CO 4: Understand the descriptive mineralogy of different groups.
CO 5: Understand the importance of Minerals and mineralogical studies.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	S	S	S	M
CO 2	S	S	S	S	S	S	S	S	S	M
CO 3	S	S	S	S	S	S	S	S	S	M
CO 4	S	S	S	S	S	S	S	S	S	M
CO 5	S	S	S	S	S	S	S	S	S	M

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N – No Correlation

Semester-V / CC VII	IGNEOUS PETROLOGY	Course Type: CC VII
Instruction Hours: 5	Credits: 4	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Understand the basic Petrology. • Know the textures and micro-structures. • Know composition of magma and various system of rock formation. • Understand the Petrographical characters of rocks. • Analyse Origin of various rock types.	
UNIT		**HOURS**
UNIT I	Rocks – Classification into Igneous, Sedimentary and Metamorphic groups. Distribution of elements in the crust – Divisions of igneous rocks as plutonic, hypabyssal and volcanic – Intrusive and extrusive forms – Structures.	12
UNIT II	Textures and Microstructures – Classification of Igneous rocks (Tyrell and Streikeisen).	12
UNIT III	Composition and constitution of magma – Study of unicomponent magma – Binary system: Diopside and Anorthite, Albite and Anorthite, and Forsterite and Silica systems – Ternary System represented by Albite – Anorthite – Diopside – Bowen‘s reaction principle	12
UNIT IV	Petrographic characters of Granites, Diorites, Syenites, Gabbros, Dolerite, Basalt, Pegmatites, Aplites and Lamprophyres.	12
UNIT V	Origin of igneous rocks - Differentiation – Assimilation, - Petrography of special rock types, Anorthosite and Carbonatites.	12

Text Books:

1. Best, M.G, Igneous and Metamorphic Petrology, Wiley. New Delhi (2003).
2. Mcbirney A.R, Igneous Petrology, CBS New Delhi (1993).
3. Best M.G, Igneous Petrology. Wiley. New Delhi (2005).
4. Hatch, F.H. et al, Petrology of the Igneous Rooks, CBS Delhi.
5. Hyndman D.W, Petrology of the Igneous and Metamorphic Rocks McGraw Hill. NewYork (1985).

Reference Books:

1. Tyrell, G.W, Principles of Petrology, B.I. Publications, New Delhi (1958).

2. Haung, W.T, Petrology, Mc Graw Hill. New York (1962).
3. Winter, J.D, Principles of Igneous and Metamorphic Petrology, PHI. New.
4. Middlemost E.A.K, Magmas and Magmatic Rocks. Longman UK (1985).
5. Winkler, H.G.F, Petrology of the Metamorphic Rocks. Springer, New Delhi (1970).

Web Resources:

1. https://minerva.union.edu/hollochk/c-petrology/resources.html
2. https://topex.ucsd.edu/es10/lecture/lecture10/lecture10.html
3. https://geology.com/rocks/igneous-rocks.shtml
4. https://course.lumenlearning.com/wmopen-geology/chapter/outcome-metamorphic-rocks/
5. https://serc.carleton.edu/NAGTWorkshops/coursedesign/goalsdb/10875.html

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basic Petrology.
CO 2: Know the textures and micro-structures.
CO 3: Know composition of magma and various system of rock formation.
CO 4: Understand the Petrographical characters of rocks.
CO 5: Analyse Origin of various rock types.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	S	S	S	S
CO 4	S	S	S	S	S	S	S	S	S	S
CO 5	S	S	S	S	S	S	S	S	S	S

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W – Weakly Correlated

N – No Correlation

Semester-V / CP III	MINERALOGY AND PETROLOGY PRACTICAL	Course Type: CP III
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks: 40	External Marks:60	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Understand the basic Petrology. • Know the macro and micro-structures. • Know various agents of sedimentary and metamorphic petrology. • Understand the Petrographical characters of rocks. • Analyse Origin of various rock types.	
UNIT		**HOURS**
UNIT I	Megascopic identification and description of the following: quartz, chalcedony, opal, agate, flint, jasper, amethyst, rose quartz, orthoclase, microcline, albite, oligoclase, labradorite, adularia, sanidine, nepheline, sodalite, lapislazuli, hornblende, Actinolite, tremolite, enstatite, bronzite, hypersthene, augite, olivine, serpentine, muscovite, biotite, phlogopite, lepidolite, vermiculite, chlorite, epidote, garnet, apophyllite, stilbite, heulandite, talc, steatite, beryl, kaolin, cordierite, apatite, andalusite, staurolite, sillimanite, kyanite, tourmaline, topaz, calcite, dolomite and fluorspar.	12
UNIT II	Microscopic identification and description of the following: quartz, orthoclase, albite, oligoclase, andesine, labradorite, anorthite, nepheline, leucite, sodalite, hypersthene, augite, diopside, aegerine, hornblende, tremolite, actinolite, glaucophane, riebeckite, muscovite, biotite, phlogopite, olivine, serpentine, chlorite, epidote, garnet, apatite, zircon, sphene, magnetite, tourmaline, calcite, dolomite, andalusite, staurolite, sillimanite and cordierite.	12
UNIT III	Megascopic identification and description of the following rocks: granite, graphic granite, pegmatite, aplite, orbicular granite, schorl rock, tourmaline rock, granite porphyry, Syenite, dolerite, gabbro, anorthosite, olivine, gabbro, dunite, pyroxenite, norite, dolerite porphyry, basalt, trachyte, rhyolite, vitrophyre, obsidian, pumice, scoria, pitchstone, volcanic tuff and volcanic breccia.	12
UNIT IV	Megascopic identification and description of the following: conglomerate, breccia, laterite, sandstone, arkose, greywacke, grit,	12

	shales, limestones, chert, flint, peat, bituminous coal, anthracite, lignite, chalk, gneisses, schist, phyllite, slates, quartzite, marble, ophicalcite, itabirite, jaspillite, quartz-magnetite rock, amphibolite, eclogite, leptynite, khondalite, kodurite, gondite, charnockite, calc granulite and basic granulite.	
UNIT V	Microscopic identification and description of the following: mica granite, hornblende granite, tourmaline granite, schorl rock, aplite, graphic granite, quartz syenite, mica syenite, hornblende syenite, nephelinesyenite, quartz diorite, hornblende diorite, olivine gabbro, hypersthene gabbro, troctolite, dunite, peridotitegranite porphyry; syenite porphyry, diorite porphyry, quartz porphyry, dolerite, minette, anorthosite, rhyolite, trachyte, andesite, basalt, leucite, phonolite, nosean, and volcanic breccia.	12

Text Books:

1. Economic Mineral deposits, Bateman, A.N. (1981), Asian publishers House, New Delhi.
2. Economic Geology – Economic Mineral Deposits, Umeshwar Prasad, (2010), CBS Pub. & Dist, New Delhi.
3. Krishnasamy S, India's Mineral Resources, Oxford & IBH. Delhi (1988).
4. Sharma N.L & R.K.Sinha. Mineral Economics, Oxford & IBH. Delhi (1985).
5. Prasad U, Economic Mineral Deposits, CBS. Delhi (2003).

Reference Books:

1. India's Mineral Resources, Krishnaswamy.S revised by Shina, R.K, (1986), III Edi., Oxford & IBH Pub., Co., Ltd., New Delhi.
2. Introduction to Indian Economic minerals, Sharma, N.L and Ram, K.S.V., (1970), Dhanbad publications, Dhanbad.
3. Industrial Minerals, Sinha, R.K,(1986), Oxford 7 IBH Pub. Co., New Delhi.
4. Craig, R.C & D.V. Vaughan. Ore Microscopy and Ore Petrography. Wiley. New York.(1985)
5. Aiyengar, N.K.N, Minerals of Madras, Dept. of Industries &Commerce. Guindy, Madras, (1964).

Web Resources:

1. https://www.britannica.com/topic/economic-geology
2. https://en.m.wikipedia.org/wiki/supergene-(geology)
3. https://energymining.sa.gov.au/minerals/mineral-commodities
4. https://www.slideshare.net/mobile/monokaonaBoruah/magmatic-deposits-economic-geology
5. https://link.spring.com/

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basic Petrology.

CO 2: Know the textures and micro-structures.

CO 3: Know composition of magma and various system of rock formation.

CO 4: Understand the Petrographical characters of rocks.

CO 5: Analyse Origin of various rock types.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	S	S	S	S	S	S	M	S	S	S
CO 2	S	S	S	S	S	S	M	S	S	S
CO 3	S	S	S	S	S	S	M	S	S	S
CO 4	S	S	S	S	S	S	M	S	S	S
CO 5	S	S	S	S	S	S	M	S	S	S

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-V / CC VIII	SEDIMENTARY AND METAMORPHIC PETROLOGY	Course Type: CC VIII
Instruction Hours: 5	Credits: 4	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Understand the basic Petrology. • Know the macro and micro-structures. • Know various agents of sedimentary and metamorphic petrology. • Understand the Petrographical characters of rocks. Analyse Origin of various rock types.	
UNIT		**HOURS**
UNIT I	Classification (Tyrrel and Pettijohn) – Structures – Descriptive Petrography of Residual sediments	12
UNIT II	Descriptive Petrography of clastic - Arenaceous, Argillaceous and Rudaceous - Chemical and Organic deposits.	12
UNIT III	Definition – Agents and kinds of metamorphism – structure and textures – Depth zones – A brief study of Facies and grades.	12
UNIT IV	Cataclastic metamorphism and its products, thermal and dynamothermal metamorphism on Quartzo Felspathic, argillaceous, calcareous and basic igneous rocks.	12
UNIT V	Plutonic metamorphism on Quartzo-felspathic, argillaceous, calcareous and basic igneous rocks – Charnockites – Metasomatism – A brief account of migmatites – Anatexis and palingenesis and retrogressive metamorphism.	12

Text Books:

1. **Principles of Petrology, G.W. Tyrrel, (1985), C.B.S Publishers and Distributors, Delhi.**
2. **Petrology for sediments, S.R. Nockolds, R.W.O. Knott& G.A Chinner, (1979), Cambridge University Press, London.**
3. **Green smith J.T, Petrology of the Sedimentary Rocks, CBS. Delhi (1976).**
4. **Williams, H. et al, Petrography, CBS.New Delhi (1982).**
5. **Haung, W.T, Petrology, McGraw Hill. NewYork (1962).**

Reference Books:

1. Metamorphism, B. Baskar Rao, (1986), Oxford I.B.D., New Delhi.

Web Resources:

1. https://www.britannica.com/science/geology/sedimentary-petrology
2. https://limk.springer.com/chapter/10
3. https://www.geo.mtu.edu/UPSeis/hazards.html
4. https://www.omafra.gov.on.ca/english/engineer/facts/
   https://geology.com/rocks/rock-salt.shtml

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basic Petrology.

CO 2: Know the macro and micro-structures.

CO 3: Know various agents of sedimentary and metamorphic petrology.

CO 4: Understand the Petrographical characters of rocks.

CO 5: Analyse Origin of various rock types.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	M	S	S	S	S	S	S	S	S	S
CO 2	M	S	S	S	S	S	S	S	S	S
CO 3	M	S	S	S	S	S	S	S	S	S
CO 4	M	S	S	S	S	S	S	S	S	S
CO 5	M	S	S	S	S	S	S	S	S	S

S – Strongly Correlated

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W – Weakly Correlated

N – No Correlation

Semester-V / DSE I	REGIONAL GEOLOGY	Course Type: DSE I
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Understand various Geological formations at Regional Scale. • Know the Important Stratigraphic landforms. • Know various economic importance of regional geology. • Know the mode of occurrence and uses of minerals. • To predict mineral formations in an unknown region.	
UNIT		**HOURS**
UNIT I	Geomorphology: Tectonic and Shear Zones of Tamil Nadu - Physiography – The Western and Eastern Ghats of Tamil Nadu and their structural aspects. The Cauvery and Tambraparani Rivers – Soil types of Tamil Nadu..	12
UNIT II	Archaean Group – Anorthosites of Sittampundi, Kadavur and Oddanchatram – Alkali Rocks of Sivanmalai, Cordierite Sillimanite rocks of Trichy and Madurai, Charnockites of Pallavaram - Thiruttani Dyke swarms.	12
UNIT III	Gondwana Supergroup – Sriperumbudur beds and Therany clay beds - Cretaceous of Trichy District – Cenomanian Marine transgression – Tertiary group of Cauvery basins. Distribution of petroleum and natural gas in Tamil Nadu..	12
UNIT IV	Cuddalore Sandstone, Neyveli Lignite Deposits - Mode of occurrence & distribution of precious and Semi - precious stones in Tamil Nadu. Distribution of commercial granites, Heavy mineral sands (Zircon, Rutile, Ilmenite and Garnet) and Thorium deposits of Manavalakurichi in Tamil Nadu.	12
UNIT V	Mode of occurrence, uses, origin, and distribution in Tamil Nadu of the followings mineral deposit: Iron ores of Kanjamalai, Gauthimalai; Magnesite deposits of Chalk hills; Bauxite deposits of Shaveroy hill; Graphite beds of Sivaganga- Silica Sands of coastal areas in Kanchipuram, Thiruvallur, Cuddalore and Nagapattinam districts- River sand deposits of Tamil Nadu.	12

Text Books:

1. Geology of India and Burma M.S. Krishnan, (2010), 6th Edi., C.B.S publishers and Distributors, Delhi.
2. Geology of India, D.N. Wadia, (1966), McMillan company, London.
3. Vaidyanadhan.R & M.Ramakrishnan, Geology of India. Geological Society of India. Bangalore (2008).
4. Geology& Mineral Resources of the States of India. Misc Pub.No.30.Geological Survey of India. Kolkata. (Several individual volumes available online at GSI portal) GSI (2005).

Kumar R, Fundamentals of Historical Geology and Stratigraphy of India, WiIey. New Delhi(1988)..

Reference Books:

1. Fundamentals of Historical Geology and Stratigraphy of India, Ravindra kumar (1985), WileyEastern ltd, New Delhi.
2. Principle of Stratigraphy, Dunbar and Roggers, (1964), John Wiley and co, New York
3. An Introduction in Stratigraphy, Stamp L.D, (1964), Thomas Murby, Museum St, WCI, London.
4. Stratigraphic Principles and Practices, Weller, J.M, (1962), Harper & Bros, New York

Wadia, D.N, Geology of India, McMillan India Delhi(1953)

Web Resources:

1. **https://stratigraphy.org/**
2. **https://www.sepm.org/**
3. **https://www.geosocindia.org/**
4. **https://www.moes.gov.in/**
5. **https://isegindia.org/**

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basic of Historical Geology.

CO 2: Know the Important group of Stratigraphic systems. CO 3: Know various economic importance of various periods

CO 4: Understand the various rocks of different periods from the formation of Earth. CO 5: Present is the Key to the Past – Critical Analyse.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	M	S	S	S	S	S	S	S	S	S
CO 2	M	S	S	S	S	S	S	S	S	S
CO 3	M	S	S	S	S	S	S	S	S	S
CO 4	M	S	S	S	S	S	S	S	S	S
CO 5	M	S	S	S	S	S	S	S	S	S

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Semester-V/ AECC II	OCEANOGRAPHY	Course Type: AECC II
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	● To understand the basic techniques used in bathymetry ● To understand the Ocean currents, upwelling and downwelling. ● To know about the types of shoreline and the hard stabilization in beaches. ● To kmow about the marine environment. ● To know about the marine pollutants.	
UNIT		**HOURS**
UNIT I	**Marine provinces :** Techniques used in Ocean bathymetry: Echo soundings, Satelite images and seismic reflection profile. Features exsut in Continental Margin, Deep ocean basin and mid oceanic ridges.	06
UNIT II	**Ocean Circulation :** Ocean current: surface current and deep current: Origin and Components-causs of upwelling and downwelling. Origin of thermohaline circulation	06
UNIT III	**Shoreline processes and coastal Ocean :** Beach terminology – beach composition. Types of shoreline. Movements perpendicular to the shoreline and parallel to the shoreline. Hard stabilization and their alternatives.	06
UNIT IV	**Marine life and Marine environment** Classification of marine organisms: Plankton, Nekton and Benthos, Division of marine environment: Pelagic and benthic environment. Deep sea hydrothermal vent kcommunities.	06
UNIT V	**Marine pollution** Marine pollution – Environmental bioassay –oil spill – sewage sludge – Biological pollution seaweed Caulerpa taxifolia and zebra mussels.	06

Text Books:

1. Kuenen, Ph.H., Marine Geology. John Wiley and sons, 1950.
2. King, C.A.M.- Beaches and coasts, Edward Arnold, London 1959.
3. King C.A.M. - Introduction to marine Geology and Geomorphology. Edward Arnold London 1975.
4. Alan P. Trujillo, Harold V. Thurman, 2005. Essential of oceanography. Pearson prentice hall.

Reference Books:

1. Radhakrishnan, V. General geology V.V.P. Publishers, Tuticorin, 1996.
2. Siddhartha, K. 2002. Oceanography, A brief introduction, Kisalaya Publications Pvt Ltd, 347p.
3. Shepard, F.P Geological Oceanography, Heonmann, London, 1978.
4. The Ocean, A Scientific American book, W.H. Freeman and company, SanFranciscco, 1969.

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basics of oceanography

CO 2: Understand about the ocean features.

CO 3: know about the marine environment.

CO 4: Understand the ocean circulation.

CO 5: To learn the impact of marine life.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	S	S	S	S	S	S	M	S	S	S
CO 2	S	S	S	S	S	S	M	S	S	S
CO 3	S	S	S	S	S	S	M	S	S	S
CO 4	S	S	S	S	S	S	M	S	S	S
CO 5	S	S	S	S	S	S	M	S	S	S

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Semester-VI / CC IX	ECONOMIC GEOLOGY AND MINERAL ECONOMICS	Course Type: CC IX
Instruction Hours: 6	Credits: 5	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Understand basics of Economic minerals. • Know the various process of mineral formation. • Know the various modes of mineral deposits. • Know the physical and chemical characters of minerals. • To understand various uses of minerals.	
UNIT		**HOURS**
UNIT I	Definition of ore, tenor, grade and metallic and non-metallic minerals. Geologic thermometry – Classification of ore deposits, (Lindgren and Bateman).Process of mineral formations – magmatic concentration – sublimation, contact metasomatism- Hydrothermal process – sedimentation – evaporation.	18
UNIT II	Processes of mineral formation: Residual and mechanical concentration – Oxidation and supergene sulphide enrichment – metamorphism. Coal deposits: Use, origin, Mode of Occurrence, distribution in India. Petroleum deposits: Origin and distribution in India. Mineralogy, origin, mode of occurrence, uses and distribution in India of the following: - Gold Deposits, Iron deposits, and copper deposits.	18
UNIT III	Mineralogy, origin, mode of occurrence, uses and distribution in India of the following: - manganese deposits, lead and zinc deposits, bauxite deposits and chromite deposits. Granite Industry I: Building stones – properties – cost, color, durability, crushing strength, transverse strength, absorption, density, frost and fire resistance, structural features, texture. Important building stones, physical and chemical properties and uses of granite, marble, limestone, sandstone, slate. Classification of commercial granites in pre-cambrian terrain of south India.	18
UNIT IV	Physical properties, chemical composition, mode of occurrence and distribution in India of minerals required for the following industries: – Abrasives, fertilizers and refractory. Descriptive mineralogy, Mode of occurrence, uses, distribution in India of the following ores and industrial minerals: realgar, orpiment, cinnabar, fluorite, ilmenite,	18

	rutile, graphite, magnesite, asbestos and chrysotile.	
UNIT V	Granite Industry II: Granite blocks - quarrying techniques – pre quarrying phase – operational phase – quarrying in earlier and recent times – blasting methodology – primary and secondary cutting – supporting machineries – problems encountered in granite mining. Granite trade, marketability, Resource estimation	18

Text Books:

1. Economic Mineral deposits, Bateman, A.N. (1981), Asian publishers House, New Delhi.
2. Economic Geology – Economic Mineral Deposits, Umeshwar Prasad, (2010), CBS Pub. &Dist, New Delhi.
3. Krishnasamy S, India's Mineral Resources, Oxford &IBH. Delhi (1988).
4. Sharma N.L & R.K.Sinha. Mineral Economics, Oxford &IBH. Delhi (1985).
5. Prasad U, Economic Mineral Deposits, CBS. Delhi (2003).

Reference Books:

1. India's Mineral Resoruces, Krishnaswamy.S revised by Shina, R.K, (1986), III Edi., Oxford & IBH Pub., Co., Ltd., New Delhi.
2. Introduction to Indian Economic minerals, Sharma, N.L and Ram, K.S.V., (1970), Dhanbad publications, Dhanbad.
3. Industrial Minerals, Sinha, R.K,(1986), Oxford 7 IBH Pub. Co., New Delhi.
4. Craig,R.C& D.V. Vaughan. Ore Microscopy and Ore Petrography. Wiley. New York. (1985).
5. Aiyengar, N.K.N, Minerals of Madras, Dept.of Industries &Commerce. Guindy, Madras, (1964).

Web Resources:

1. https://www.britannica.com/topic/economic-geology
2. https://en.m.wikipedia.org/wiki/supergene-(geology)
3. https://energymining.sa.gov.au/minerals/mineral-commodities
4. https://www.slideshare.net/mobile/monokaonaBoruah/magmatic-deposits-economic-geology
5. https://link.spring.com/

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basics of Minerals.

CO 2: Understand the importance of Minerals in Geological studies.

CO 3: Know different group of minerals systems.

CO 4: Understand the descriptive mineralogy of different groups.

CO 5: Understand the importance of Minerals and mineralogical studies.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	M	S	S	S	S	S	S	S	S	S
CO 2	M	S	S	S	S	S	S	S	S	S
CO 3	M	S	S	S	S	S	S	S	S	S
CO 4	M	S	S	S	S	S	S	S	S	S
CO 5	M	S	S	S	S	S	S	S	S	S

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W – Weakly Correlated

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Semester-VI / CC X	APPLIED GEOLOGY	Course Type: CC X
Instruction Hours: 6	Credits: 5	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 – Creating**	
Course Objectives	• Understand the basics of Hydrological Cycle. • Know the various hydrological parameters. • Know the various water bearing formations. • Know the application of Geological methods in groundwater investigations. • To explore groundwater regime through various geophysical methods.	
UNIT		**HOURS**
UNIT I	Engineering Geology: Dams, Reservoirs and Tunnels – Brief description of the types of dam, Reservoir, spillways, Tunnels, bridges and highways. Engineering properties of Rocks: Porosity – permeability – elasticity characteristics of rocks.	18
UNIT II	Environmental Geology: Environmental science – Introduction; Environmental impacts due to mining and mineral process. A short account of renewable and non-renewable resources. Effects of urbanization on surface and subsurface water- causes for ground water pollution.	18
UNIT III	Soil – Definition -types of soils - formation of soils - Soil size parameters for building construction – expensive soil and its problem for building construction. Dam Construction: Types of Dams, Geological factors for consideration for dams and reservoirs sites selection process-Dam foundation problems –criteria for Reservoir site selection	18
UNIT IV	Sampling – Principles – types – collection of sample –core samples and their preservation. Methods of breaking rocks: short note on explosives. Outline of the method of metal mining. open cast and underground mining. Alluvial mining:Principles and scope of ore dressing, Physical and chemical properties of ore dressing: crushers, grinders, and classifiers, Concentration of ore minerals by magneto–electrostatic and floatation processes	18
UNIT V	Coastal erosion: types of erosion - Planning and methods of coast protection works- Coastal protection structures–Remote Sensing techniques forcoastal studies. Applications of Geostatistics in Geotechnical studies: Graphical representation of data- Correlation – Principal component analysis – cluster analysis. Application Geophysics in Engineering projects	18

Text Books:

1. Outlines of Geophysical Prospecting - A manual for geologists by Ramachandra Rao, M.B., Prasaranga, University of Mysore, Mysore, 1975.
2. Groundwater Hydrology, Todd. D.K. (1980) John Wiley Sons, Inc.
3. Coppola D.P, Introduction to International Disaster Management, Butterworth Heinemann (2007).
4. Pine, J.C, Natural Hazards Analysis: Reducing the Impact of Disasters, CRC Press, Taylor and Francis Group (2009).
5. Smith K, Environmental Hazards: Assessing Risk and Reducing Disaster Rout ledge Press (2001).

Reference Books:

1. Groundwater Drilling, Handa.O.P (1984) Oxford & I.B.H. Publishing Co.
2. Groundwater, Raghunath. H.M. (1987) 2nd Edition, Wiley Eastern Ltd.
3. Groundwater Assessment Development and Management, Karanth. K.R. (1987) Tata McGraw Hill Publishing Company, Ltd.
4. Miller T.G. Environmental Science. Wadsworth Publishing. US (2004).
5. Coates, D.R. Environmental Geology. McGraw Hill. New York (1984).

Web Resources:

1. https://www.britannica.com/science/geology/sedimentary-petrology
2. https://limk.springer.com/chapter/10
3. https://www.geo.mtu.edu/UPSeis/hazards.html
4. https://www.omafra.gov.on.ca/english/engineer/facts/
5. https://geology.com/rocks/rock-salt.shtml

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand basics of Hydrological Cycle.
CO 2: Know the various hydrological parameters.
CO 3: Know the various water bearing formations.
CO 4: Know the application of Geological methods in groundwater investigations.
CO 5: To explore groundwater regime through various geophysical methods.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	M	S	S	S	S	S	S	S	S	S
CO 2	M	S	S	S	S	S	S	S	S	S
CO 3	M	S	S	S	S	S	S	S	S	S
CO 4	M	S	S	S	S	S	S	S	S	S
CO 5	M	S	S	S	S	S	S	S	S	S

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W – Weakly Correlated

N – No Correlation

Semester-VI / CP IV	ECONOMIC GEOLOGY AND ORE ANALYSIS PRACTICAL	Course Type: CP IV
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks: 40	External Marks:60	Total Marks: 100

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• Understand the basics of Minerals. • Understand the importance of Minerals in Geological studies. • Know different group of minerals systems. • Understand the descriptive mineralogy of different groups. • Understand the importance of Minerals and mineralogical studies.	
UNIT		**HOURS**
UNIT I	Megascopic identification, description of visible characteristics, mode of occurrence and uses of the following ores: galena, anglesite, cerrusite, sphalerite, zincite, willemite, bornite, azurite, chalcopyrite, cuprite, malachite.	15
UNIT II	Megascopic identification, description of visible characteristics, mode of occurrence and uses of the following ores: haematite, magnetite, siderite, goethite, pyrolusite, psilomelane, rhodochrosite, rhodonite, chromite, cinnabar, bauxite, realgar, orpiment, stibnite, molybdenite, pyrite, coal and its varieties.	15
UNIT III	Megascopic identification and description of: monazite, samarskite, columbite, tantalite, beryl, zircon, Megascopic identification and description of the following minerals used for industrial purposes – magnesite, calcite, dolomite, gypsum, strontianite, celestite, fluorite,apatite.	15
UNIT IV	Megascopic identification and description of the following minerals used for industrial purposes: barite, witherite, limonite, asbestos, quartz, feldspar, kaolin, garnet, rutile and ilmenite.	15
UNIT V	Identification of the following mineral powders by blowpipe methods: galena, chalcopyrite, haematite, magnetite, celestite, strontianite, witherite, gypsum, bauxite, apatite, pyrite, siderite, orpiment, realgar, calcite, psilomelane, rhodochrosite, smithsonite and ilmenite.	15

Text Books:

1. Economic Mineral deposits, Bateman, A.N. (1981), Asian publishers House, New Delhi.

2. Economic Geology – Economic Mineral Deposits, Umeshwar Prasad, (2010), CBS Pub. & Dist, New Delhi.
3. Krishnasamy S, India's Mineral Resources, Oxford & IBH. Delhi (1988).
4. Sharma N.L & R.K. Sinha. Mineral Economics, Oxford & IBH. Delhi (1985).
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2. Introduction to Indian Economic minerals, Sharma, N.L and Ram, K.S.V., (1970), Dhanbad publications, Dhanbad.
3. Industrial Minerals, Sinha, R.K,(1986), Oxford 7 IBH Pub. Co., New Delhi.
4. Craig,R.C & D.V. Vaughan. Ore Microscopy and Ore Petrography. Wiley. New York.(1985)
5. Aiyengar, N.K.N, Minerals of Madras, Dept. of Industries &Commerce. Guindy, Madras, (1964).

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1. https://www.britannica.com/topic/economic-geology
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3. https://energymining.sa.gov.au/minerals/mineral-commodities
4. https://www.slideshare.net/mobile/monokaonaBoruah/magmatic-deposits-economic-geology
5. https://link.spring.com/

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the basics of Minerals.
CO 2: Understand the importance of Minerals in Geological studies.
CO 3: Know different group of minerals systems.
CO 4: Understand the descriptive mineralogy of different groups.
CO 5: Understand the importance of Minerals and mineralogical studies

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	M	S	S	S
CO 2	S	S	S	S	S	S	M	S	S	S
CO 3	S	S	S	S	S	S	M	S	S	S
CO 4	S	S	S	S	S	S	M	S	S	S
CO 5	S	S	S	S	S	S	M	S	S	S

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.Semester-VI / DSE II	GEOSTATISTICS	Course Type: DSE II
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks: 25	External Marks: 75	Total Marks: 100

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• The main objective of this course is to importance of statistics in science. • To describe the concepts of basic statistics. • To explain various components of advanced statistical methods. • To study various graphical methods and its applications. • To determine various correlation and regression studies and its importance in the field of Geology.	
UNIT		**HOURS**
UNIT I	Definition and scope of statistics-Tabulation of data- Formation of Frequency Distribution-Diagrammatic representation of data-Bar diagrams, Pie diagrams-Graphic Representation of data-Histogram, Frequency polygon- gives.	09
UNIT II	Measures of Central Tendency-Arithmetic Mean Median, Mode, Combined arithmetic mean-merits and demerits.	09
UNIT III	Measures of Dispersion- Absolute and Relative measures Range, Quartile deviation, Mean deviation, Standard deviation	09
UNIT IV	Cure filling by the Method of Least square-Fitting straight line of the form Y=ax+b and parabola Y= a x^2 + b x +c (Simple problems)	09
UNIT V	Correlation-Karl person's coefficient of correlation, Rank correlation-Spearman's Rank correlation coefficient. Regression-regression equation and their properties.	09

Text Books:

1. Statistics – R.S.N. Pillai and V. Bhagavathi, Publications S. Chand.
2. Statistical Methods, Gupta, S.P. (2007): Sultan Chand & Sons Pvt Ltd, New Delhi, 35th Revised Edition.
3. Statistics for Geoscientists - Marsal, D. Pergamon press, New York.
4. *Cline, Graysen (2019).* Nonparametric Statistical Methods Using R. *EDTECH.* ISBN 978-1-83947-325-8. OCLC 1132348139. Archived *from the original on 2022-05-15*. Retrieved 2021-09-16.
5. Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) Introduction to Statistics: Concepts and

Applications, pp. 5–9. West Group. ISBN 978-0-314-03309-3

Reference Books:

1. Statistics for Geoscientists - Marsal, D. Pergamon press, New York.
2. Statistics – R.S.N. Pillai and V. Bhagavathi, Publications S. Chand.
3. Statistical Methods, Gupta, S.P. (2007): Sultan Chand & Sons Pvt Ltd, New Delhi, 35th Revised Edition.
4. *Cline, Graysen (2019).* Nonparametric Statistical Methods Using R. *EDTECH*. ISBN 978-1-83947-325-8. OCLC 1132348139. Archived *from the original on 2022-05-15*. Retrieved 2021-09-16.
5. Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) Introduction to Statistics: Concepts and Applications, pp. 5–9. West Group. ISBN 978-0-314-03309-3

Web Resources:

1. https://en.wikipedia.org/wiki/Statistics
2. http://onlinestatbook.com/2/introduction/descriptive.html
3. https://socialresearchmethods.net/kb/statdesc.php
4. https://en.wikipedia.org/wiki/Descriptive_statistics
5. Philosophy of Statistics from the Stanford Encyclopedia of Philosophy

Course Outcomes

On Completion of the course, Students should be able to

CO 1: To describe the definition, scope, classification, tabulation, drawing diagrams and plotting graphs of Statistics through Geological information.

CO 2: To measure and interpret the various measures of averages using Geological data.

CO 3: To measure and interpret the various measures of dispersions using Geological data.

CO 4: To measure and interpret the relationship among the geological variables and to estimate and predict the unknown and future value through the regression lines using geological data.

CO 5: To fit the curve using geological data.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	S	M	S	S
CO 2	S	S	S	S	S	S	S	M	S	S
CO 3	S	S	S	S	S	S	S	M	S	S
CO 4	S	S	S	S	S	S	S	M	S	S
CO 5	S	S	S	S	S	S	S	M	S	S

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-VI / DSE III	EXPLORATION TECHNIQUES	Course Type: DSC III
Instruction Hours: 4	Credits: 3	Exam Hours: 3
Internal Marks: 25	External Marks: 75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	• To understand about the detailed geological exploration. • To understand about the geophysical exploration. • To understand about the logging methods. • To know about the magnetic methods. • To learn about the geochemical exploration methods.	
UNIT		**HOURS**
UNIT I	Geological Exploration: Criteria for controlling the choice of sites for geological prospecting-Marginal Information of Toposheets and study of field equipment. Field documentation and basic field procedures. Mineralogical, Structural, Stratigraphical and Geomorphological guides to ore search.	12
UNIT II	Geophysical Exploration: Limitations and applications of geophysical exploration methods-Electrical methods- Self potential method-Electrical Resistivity method- Induced Polarization method-Electromagnetic method- Well logging techniques	12
UNIT III	Gravity methods: Density logging - Seismic methods: Seismic Refraction and Seismic Reflection - Sonic logging techniques.	12
UNIT IV	Magnetic Methods:Concepts and principles of magnetic prospecting-magnetism of Earth and Palaeomagnetism; Radioactive Method: Radioactive decay-Radioactivity of rocks and minerals-radioactive survey.	12
UNIT V	Geochemical Exploration: Origin and abundance of elements in the earth's crust-Mobility of elements-geochemical dispersion-Geochemical anomaly-Application of Geochemistry in Georesources exploration-Outline of biogeochemical exploration.	12

Text Books:

1. Beck, A. E. (1981). Physical principles of exploration methods: an introductory text for geology and geophysics students.
2. Reedman, J. H. (Ed.). (2012). *Techniques in mineral exploration*. Springer Science & Business

Media.
3. Hinze, W. J. (1982). Physical principles of exploration methods.
4. Beck, A. E. (1981). Physical principles of exploration methods: an introductory text for geology and geophysics students.

Reference Books:

1. Lerche, I. (1997). *Geological risk and uncertainty in oil exploration*. Academic Press.
2. Trice, R., Cannon, S. J. C., & Ellis, D. (2014). Hydrocarbon Exploration to Exploitation West of Shetlands.
3. Smyth, H. R., Morton, A., Richardson, N., & Scott, R. A. (2014). Sediment provenance studies in hydrocarbon exploration and production: an introduction. Geological Society, London, Special Publications, 386(1), 1-6.
4. Lerche, I., & MacKay, J. A. (1999). Economic risk in hydrocarbon exploration. Elsevier.

Web Resources:

1. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/geological-exploration#:~:text=Abstract,emerging%20challenges%20for%20the%20exploration.
2. https://pubs.usgs.gov/of/1995/ofr-95-0831/CHAP3.pdf
3. https://wiki.aapg.org/The_gravity_method
4. https://www.epa.gov/environmental-geophysics/magnetic-method#:~:text=The%20magnetic%20method%20employs%20a,1992%3B%20Telford%2C%201990).
5. https://pubs.usgs.gov/bul/1000f/report.pdf

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Gain a better understanding of the detailed geological exploration.
CO 2: Understand the geophysical exploration.
CO 3: Understand about the different logging methods.
CO 4: Understand about the magnetic methods.
CO 5: Understand the about the geochemical exploration methods.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	S	M	S	S
CO 2	S	S	S	S	S	S	S	M	S	S
CO 3	S	S	S	S	S	S	S	M	S	S
CO 4	S	S	S	S	S	S	S	M	S	S
CO 5	S	S	S	S	S	S	S	M	S	S

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-VI/ AECC III	MINING GEOLOGY	Course Type: AECC III
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To understand the sampling and drilling types. • To understand about the alluvial mining methods. • To know about the different mining terms and subsurface mining methods. • To understand the caving methods. • To learn the impact of mining in the environment.	
UNIT		**HOURS**
UNIT I	Sampling – Principles – types – collection of sample – core samples and their preservation. Drilling – brief account of different types of drilling – Geological logging of borehole samples.	06
UNIT II	Methods of breaking rocks – A short note on explosives. Surface mining open cast. Alluvial mining: Panning – Sluicing – Hydraulicking – Dredging – mine support and stopes.	06
UNIT III	Subsurface mining: Criteria affecting the subsurface mining, Definition of mining terms: Shaft, Level, Adit, Hanging wall, Footwall, Drive, Cross cut, Tunnel, Raise, Winze and Chute. – Shrinkage stopes, Glory hole mining.	06
UNIT IV	Caving methods: Top slicing, Coal mining, Prospecting and Planning – Strip mining – Augering – Room and Pillar method – Long wall method.	06
UNIT V	Impact of Mining activities in the surround environment –Remedial measures.	06

Text Books:

1. Arogyaswamy, R.N.P. Courses in Mining Geology – Oxford &IBH, New Delhi.
2. Thamus, P.J. 1979 An introduction to mining, Methun.
3. Mc Kinstry, H.E 1960 Mining Geology, New york.
4. Arogyaswamy , 2017,Courses in mining Geology, Oxford & IBH publisher 23 Co.Pvt.ltd.
5. Singh , 1997,Principles & practices of modern coal mining , Newage international publishers.

Reference Books:

1. Young, G. J. (1923). *Elements of mining*. McGraw-Hill book Company, Incorporated.

2. Lewis, R.A. and Clark, G.A. :- Elements of Mining
3. Arogyaswamy, R.N.P. Courses in Mining Geology – Oxford &IBH, New Delhi.
4. McKinstry, H. E. (1955). Mining geology; retrospect and prospect. *Economic Geology*, *50*(8), 803-813.
5. Sheryanthov, L.: - Mining of Mineral deposits

Web Resources:

1. https://www.gsi.ie/en-ie/programmes-and-projects/minerals/activities/mineral-exploration/Pages/Drilling.aspx#:~:text=%E2%80%8BDrilling%20is%20the%20process,providing%20samples%20for%20chemical%20analysis.
2. *https://www.911metallurgist.com/alluvial-mining-methods/*
3. https://fuchenglhd.com/blog/complete-guide-for-subsurface-mining-methods/
4. https://www.e-education.psu.edu/geog000/node/910
6. *https://www.abebooks.com/Elements-Mining-Lewis-Robert-George-Clark/31257251836/bd*

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the sampling and drilling types.

CO 2: Understand about the alluvial mining methods.

CO 3: know about the different mining terms and subsurface mining methods.

CO 4: Understand the caving methods.

CO 5: To learn the impact of mining in the environment.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	M	S	S	M	S	S	M	S	S	M
CO 2	M	S	S	M	S	S	M	S	S	M
CO 3	M	S	S	M	S	S	M	S	S	M
CO 4	M	S	S	M	S	S	M	S	S	M
CO 5	M	S	S	M	S	S	M	S	S	M

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-VI/ SEC IV	ENVIRONMENTAL GEOLOGY	Course Type: SEC IV
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks: 25	External Marks:75	Total Marks: 100

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 – Creating	
Course Objectives	• To understand the different ecosystems. • To know about the environmental hazards and its impact on earth. • To know the environmental hazards related to volcano and earthquake. • To understand the Environmental degradation due to mining. • To understand the environmental degradation of coastal environment.	
UNIT		**HOURS**
UNIT I	Definition of ecology and environmental geology. Different Ecosystems. Classification of Natural resources. A short account of renewable and nonrenewable resources.	06
UNIT II	Environmental problems due to exogenic processes, causes, hazards and remedial measures relating to landslides, floods and soil erosion. Impact of wind on environment and Global warming.	06
UNIT III	Influence of endogenetic processes – Earthquake hazards- Earthquake prediction control and warning; Reservoir induced seismicity -origin and impact of tsunami – hazards of volcanism- Techniques of volcanic prediction and human adjustments to volcanic environments. Benefits of volcanism.	06
UNIT IV	Man as an agent of environmental modification. Environmental degradation due to mining and mineral processing – effects of urbanization on surface water, Causes of groundwater pollution.	06
UNIT V	Coastal Environment - Degradation of coastal environment and measures for coastal protection. Population explosion and their pressure on geological Environments.	06

Text Books:

1. Valdiya, K.S (1987). Environmental Geology – Indian Context. Tata McGraw-Hill., New Delhi
2. Kellar, E.A. 1979 Environmental Geology, Charless. Merrill publishing Co. ohio.

3. Lundgren, l. 1986 Environmental Geology , Prentice Hall.
4. Howard, A.D. & Ramson. I.1978, Geology in environmental planning. McGraw Hill, New Delhi

Reference Books:

1. Keller, E.A (2010). Environmental Geology (9th Edition), Pearson Publishers, New Delhi, 624p.
2. Lundgren, L (1986). Environmental Geology, Prentice Hall Publishers, New
3. Jersey, 528p.
4. Montgomery (2013). Environmental Geology (10th Edition), McGraw Hill
5. Publishers, New Delhi, 576p.
6. Valdiya, K.S (2013). Environmental Geology: Ecology, Resource and Hazard Management (2nd Edition), McGraw Hill Publishers, New Delhi, 432p.
7. Erach bharuca , third edition ,textbook of environmental studies, orient blackswan knodel , 2020,environmental Geology, springer

Web Resources:

1. https://www.britannica.com/science/natural-resource
2. *https://climate.nasa.gov/global-warming-vs-climate-change/*
3. https://www.usgs.gov/programs/earthquake-hazards
4. https://eco-intelligent.com/2016/11/20/mining-environmental-degradation-caused-by-improper-practices/
5. *https://www.researchgate.net/publication/325806922_Degradation_of_Coastal_Ecosystems_Causes_Impacts_and_Mitigation_Efforts*

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Able to understand the different ecosystems.
CO 2: Able to know about the environmental hazards and its impact on earth.
CO 3: Able to know the environmental hazards related to volcano and earthquake.
CO 4: Able to understand the Environmental degradation due to mining.
CO 5: Able to understand the environmental degradation of coastal environment.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	M	S	S	M	S	S	M	S	S	M
CO 2	M	S	S	M	S	S	M	S	S	M
CO 3	M	S	S	M	S	S	M	S	S	M
CO 4	M	S	S	M	S	S	M	S	S	M
CO 5	M	S	S	M	S	S	M	S	S	M

S– Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-VI / VAC II	FIELD GEOLOGY	Course Type: VAC II
Instruction Hours: 6	Credits: 2	Exam Hours: 3
Internal Marks: 40	External Marks:60	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	• To understand the field essentials like understanding a map, the basic equipments, traversing and field markings. • To understand the basic field equipments • To learn about the compass uses in clinometers and bearing and reading directions. • To learn about the different component of maps. • To know about the field procedures and sampling techniques.	
UNIT		**HOURS**
UNIT I	Previous Literature and Maps, Destruction of Rocks, Physiography, Topographic Expressions and Relief, Inliers and Outliers, Soils and Vegetation, Requirements for the Field, Some Field Suggestions and Precautions.	06
UNIT II	Basic equipment, Additional requirements, Supplementary supplies, Special requirements, Optional, For mapping on aerial Photographs. Geological Hammers, Pocket and Hand Lenses, Hydrochloric Acid, Streak Plate, Pocket Knife, Measuring Tapes and Scales, Haversack or Rucksack, Mohs scale of Hardness, Cold Chisel, Protractors, Pocket Calculator, Cameras, Care and Upkeep of Instruments.	06
UNIT III	The Compass and Its Uses, Dip of the Compass Needle, Magnetic Declination, Clinometer, Bearing and Reading Directions, Measuring Attitudes, Handling of the Compass, Finding Direction without a Compass.	06
UNIT IV	Base Maps, Scale of Maps, Direction of Relief, Latitudes and Longitudes, Map Grids Measurement of the Map Areas, Mounding and Folding of Field Maps, Marking on Maps.	06
UNIT V	The Notebook, Notes, Checklist for Notes, Writing Materials, Field Sketches and Drawings, Field Photographs. Trimming of Hand Specimens, Fossil	06

	Specimens, Mineral Specimens, Samples and Samplings, Numbering and Labelling of Specimens, Packing and Storage.	

Text Books:

1. Davis, G.R. 1984, Structural Geology of Rocks and Region, John Wiley24
2. H.W. Fairborn, 1949, Structural petrology of deformed rocks, John Wiley and sons
3. John Suppe 1985, Principles of Structural Geology, prentice Hall publications.

Reference Books:

1. Price N.J., and Cosgrove, J.W. 1990. Analysis of Geological structures, Cambridge Univ. Press.
2. Ramsay, J.G. and Huber, M.I., 1987, Modern structural Geology Vol. I and II Academic press.
3. Robert R. Compton, 1962, Manual of field geology, John Wiley and sons.

Course Outcomes

On Completion of the course, Students should be able to

CO 1: Understand the phisiography of the field.

CO 2: know about the different basic equipments used in the field.

CO 3: To learn the evolution of the environment

CO4: to learn about the different componenets of maps.

CO5: To understand the field procedure and sampling technjques.

Mapping of Course outcomes with Programme outcomes/ Programmes Specificoutcomes

CO	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	M	S	S	M	S	S	M	S	S	M
CO 2	M	S	S	M	S	S	M	S	S	M
CO 3	M	S	S	M	S	S	M	S	S	M
CO 4	M	S	S	M	S	S	M	S	S	M
CO 5	M	S	S	M	S	S	M	S	S	M

S – Strongly Correlated

M – Moderately Correlated

W – Weakly Correlated

N – No Correlation

Semester-V / DSE I	DISASTER MANAGEMENT	Course Type: DSE I
Instruction Hours:3	Credits:3	Exam Hours:3
Internal Marks:25	External Marks:75	Total Marks:100

Cognitive Level	K1-Recalling K2-Understanding K3 -Applying K4-Analyzing K5-Evaluating K6 - Creating	
Course Objectives	• To study the disaster of factors and significance • To study the earthquakes characteristics and precasers. • To learn the floods causal phenomena and characters. • Describe the cyclones characteristics, forecasting and warning systems. • To study the causes of landslide and snow avalanche.	
UNIT	**CONTENT**	**HOURS**
UNIT I	**DISASTER :**Meaning, Factors and significance ,causes and effects of disaster, Disasters :Aglobal view .Disaster profile of India – Regional and seasonal.	**09**
UNIT II	**EARTHQUAKES:** General characteristics, Pre-Casers: Instrumental and non-instrumental vulnerability, impacts and effect, nature of damage. Earthquake prone areas in India.	**09**
UNIT III	**FLOODS :** Causal phenomena and characters of floods, vulnerability, Predictability , forecasting and warning, preparedness mitigation with special reference to flood plain zoning adverse effects of flood.	**09**
UNIT IV	**CYCLONES :** Characteristics, forecasting and warming systems, preparedness, such reduction measures, effects, cyclones prone areas in India.	**09**
UNIT V	**LANDSLIDE AND SNOW AVALANCHES :** Characteristics and causes of land slide and snow avalanche. Characteristics and causes, vulnerability, Risk reduction measures, preparedness, effects and impacts.	**09**

Text Books:

1. Aravind Kumar Anmal,2006.Disaster Management–Recent Approaches
2. Ghorh.G.K Disaster Managemen.2006.A.P.H Publishy Corporation.
3. Singh,2006.Disaster Management. Rawat Publication.

Reference Books:

1. NarayanB., 2006.Disaster Management. A.P.H Publishy Corporation.
2. Nikij Kumar.,2006. Disaster Management. Alfa Publication.

Course Outcomes
On completion of the course students should be able to

CO1:Understand the disaster regional and seasonal a global view

CO2:Understand the geological origin of especially important on enatural hazards earthquake
CO3: Know the preparedness mitigation with special reference to flood plain zoning adverse effects.
CO4:Determine the cyclones characteristics such as reduction measures and effects.
CO5:Understand the nature of the landslide.

Mapping of Course Outcomes with programme outcomes and programme specific outcome

CO	PO					PSO				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	M	S	S	M	S	S	M	S	S	M
CO 2	M	S	S	M	S	S	M	S	S	M
CO 3	M	S	S	M	S	S	M	S	S	M
CO 4	M	S	S	M	S	S	M	S	S	M
CO 5	M	S	S	M	S	S	M	S	S	M

S – Strongly Correlated

M- Moderately correlated

W- Weekly Correlated

N – No Correlation

Semester-VI / DSE II	GEOLOGY OF TAMILNADU	Course Type:DSE II
Instruction Hours: 3	Credits: 3	Exam Hours:3
Internal Marks:25	External Marks:75	Total Marks:100

Cognitive Level	K1-Recalling K2-Understanding K3 -Applying K4-Analyzing K5-Evaluating K6-Creating	
Course Objectives	• To study the geomorphological and ghats of tamilnadu. • To study the structures of shearzones. • Understanding the components of proterozoic formations. • To estimate gondwana formations of tamilnadu. • The study of recent and subrecent formations of marine coasta ldeposits.	
UNIT		**HOURS**
UNIT I	**GEOMORPHOLOGY AND PHYSIOGRAPHY OF TAMIL NADU** Geological Timescale of India. General Geological setting of Tamilnadu. Geomorphology: Physiography–Western and Eastern Ghats of Tamil Nadu and their structural aspects.	**09**
UNIT II	**STRUCTURES, TECTONICS AND SHEAR ZONES OF TAMIL NADU** Structure and Tectonics of Tamil Nadu. Shear zones of Tamil Nadu–Palghat–Cauvery, Moyar–Bhavani, Salem-Attur and Gangavalli-Achankovilshear Zones.	**09**
UNIT III	**ARCHEAN SYSTEMS AND PROTEROZOIC FORMATIONS OF TAMIL NADU** Archean systems–Sathiyamangalam Greenstone Belt – Penninsular gneiss, Charnockite, Khondalites, Proterozoic formations– Charnockite-Migmatite and Granite.	**09**
UNIT IV	**FORMATIONS OF TAMIL NADU** Gondwana formations–Sivaganga formations, Sriperamabalur beds, Terani formations, Creataceous of Trichinopolymarine formations.	**09**

UNIT V	**MINERALWEALTH OF TAMIL NADU** Tertiary formations–Cuddalore formations–Neyveli Lignite formation, Karaikal formations, Panamparai Sandstone– Recent Sub-recent fluvio-marine coastal deposits– Manavalakuruchi, Thoothukudi. Mineral wealth of Tamilnadu.	**09**

ReferenceBook:

1. Kumar1985.FundamentalsofHistoricalGeologyand StratigraphyofIndia.

TextBooks:

1. SubramaniamK.SandSelvamT.A.,2001.Geology of Tamilnadu and Pondicherry. Geological society of India,Bangalore 192 pp.
2. KrishnanM.S.,1968.Geology of India and Burma,Higginbothams
3. WadiaD.N.,1953.Geology Of India.MacmillianandCo.

Course outcomes:

On completion of the course students should be able to,

CO1: Understanding the general geological settings of Tamil Nadu and their structural aspects.
CO2: Gained better understanding of the structures and tectonics of shearzones of Tamil Nadu.
CO3: Understanding the Archean systems and Proterozoic formations of charnockite, migmatite and granite.
CO4: Articulate the relationship between Gondwana and Terrain formations
CO5: Understand the mineral wealth of Tamil Nadu.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcome

CO	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	S	S	S	S	S	S	S	S	M
CO2	M	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	M
CO4	M	S	S	S	S	S	S	S	S	M
CO5	M	S	S	S	S	S	S	S	S	M

S- STRONGLY CORRELATED

M-MODERATELY CORRELATED

W-WEEKLYCORRELATED

N- NO CORRELATED

Semester-VI / DSE III	MARINE GEOLOGY	Course Type: DSE III
Instruction Hours: 4	Credits: 3	Exam Hours: 3
Internal Marks:	External Marks: 100	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	• To study the history of marine geology and sampling techniques. • To understand the waves, tides, currents and bottom of the sea. • To study the ocean currents tsunamis causes, generation and effects. • To study the beach minerals and instruments applications in sea. • It deals in detail about the law of the sea, marine deposits.	
UNIT		**HOURS**
UNIT I	HISTORY OF MARINE GEOLOGY AND SAMPLING TECHNIQUES : History of marine geology. Principles and application echo sounder, side scan sonar, position fixing at sea. Bottom sediment samples.	12
UNIT II	WAVES AND TIDES: Waves: Definition, parts of waves, types of waves, classification of waves and wave interactions with the shore. Tides: Definition, classification and types.	12
UNIT III	OCEAN CURRENTS TSUNAMIS: Defination, causes, generation, propagation and effecs. Ocean Currents: Definition and causes. Littoral processes.	12
UNIT IV	OCEAN FLOOR AND COASTLINE CLASSIFICATION: Geomorphology of the ocean floor – sea floor spreading – coastline classification – Beach materials.	12
UNIT V	MARINE DEPOSITS AND COASTAL ZONE REGULATION: Eustatic sea level changes, marine deposits, laws of the sea and coastal zone regulation.	12

Text Books:

1. Kuenen, Ph.H., Marine Geology. John Wiley and Sons,1950

2. King, C.A.M. – Beaches and coasts, Edward Arnold, London 1959.

3. King, C.A.M. – Introduction to marine Geology and Geomorphology. Edward Arnold, London, 1975.

4. Manimaran G., 2007. Indian Ocean Tsunami and Related events. Renuga publications. Tirunelveli pp. 72.

Reference Books:

1. Radhakrishnan V., 1996. General geology V.V.P Publishers, Tuticorin.
2. 2. Siddhartha K., 2002. Oceanography: A Brief Introduction, Kisalaya publications
3. Pvt. Ltd, pp 347.
4. 3. Shepard, F.P., 1978. Geological Oceanography, Heinmann, London.
5. 4. Freeman W.H and Sanfrancis Co., 1969. The Ocean. A Scentific American book
6. and company.

Course Outcomes:

On completion of the course students should be able to,

CO 1: Gain a better understanding of the principles and application of echo sounder, side scan sonar relationship.
CO 2: Determining the waves and tides.
CO 3: Know the sources of ocean currents causes and littoral processes
CO 4: Know the weathering process of geomorphology of the ocean floor.
CO 5: Articulate the relationship between marine deposits and coastal zone regulation.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcome

CO	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	S	S	S	S	S	S	S	S	M
CO2	M	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	M
CO4	M	S	S	S	S	S	S	S	S	M
CO5	M	S	S	S	S	S	S	S	S	M

S- STRONGLY CORRELATED

M-MODERATELY CORRELATED

W-WEEKLYCORRELATED

N- NO CORRELATED