Sant Gadge Baba Amravati University, Amravati

Format and Template for Courses (Theory) of UG/PG Programmes

APPENDIX – A-1, A-2

General Model Scheme

Sant Gadge Baba Amravati University Amravati

Scheme of teaching, learning &Examination leading to the Degree Master of Science (Choice Based Credit System) (Two Years ... Four Semesters Degree Course- C.B.C.S)

(M.Sc. Part-II) Semester- III, Subject: Geology

Sr. No	Subjects	Subject Code	Teaching & Learning Scheme								Duration of Exams Hrs.	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits					Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory L/T	Internal Ass.	Practical	Total		Theory + M.C.Q External	Theory Internal	Practical		Total Marks	Marks	Grade
														Internal	External			
1	DSC-I (STRATIGRAPHY)	3 GOG 1	04	--	--	04	04		--	04	03	80	20	--	--	100	40	P
2	DSC-II (ORE AND MINING GEOLOGY)	3 GOG 2	04	--	--	04	04		--	04	03	80	20	--	--	100	40	p
3	DSC-III (HYDROGEOLOGY)	3 GOG 3	04	--	--	04	04		--	04	03	80	20	--	--	100	40	p
4	DSE-IV (SELECT ANY ONE) 1. (EXPLORATION METHOD) OR 2. (QUATERNARY GEOLOGY AND LIMNOGEOLOGY)	3 GOG 4 A 3 GOG 4 B	04	--	--	04	04		--	04	03	80	20	--	--	100	40	p

5	**LAB-5(STRATIGRAPHY AND ORE AND MINING GEOLOGY)**	**3 GOG 5**			**09**	**09**			**4.5**	**4.5**	**04**		**--**	**--**	**100**	**100**	**50**	**p**
6	**LAB-6 (A) (HYDROGEOLOGY AND EXPLORATION METHODS) OR LAB-6 (B) (HYDROGEOLOGY AND QUATERNARY GEOLOGY)**	**3 GOG 6 (A) OR 3 GOG 6 (B)**			**09**	**09**			**4.5**	**4.5**	**04**			**--**	**100**	**100**	**50**	**p**
7	**AEC-I**	**3 GOG 7**			**01**	**01**	**01**			**01**	**01**		**25**		**--**	**25**	**10**	**P**
8	**#Internship/Field Work/Work Experience@ Open elective/GIC/Open skill/MOOC***																	
	Total		16	00	19	**35**	17		09	**26**						**625**		

- **L: Lecture, T: Tutorial, P: Practical**
- **# Students may complete their internship/field work/work experience in first or second or third semester of M.Sc. (Geology) according to their convenience; @denotes non-examination credit**
- **Note: Internship/Apprenticeship/field work/work experience (During vacations of semester I to semester III) for duration of minimum 60 hours to maximum 90 hours mandatory to all the students, to be completed during vacations of semester I to III. This will carry 2 credits for learning of 60 hours or 3 credits for learning of 90 hours. Its credits and grades will be reflected in final semester IV credit grade report.**
- **OEC (optional) can be studied during semester I to IV.**

Suggested Activities for assessment for AEC:

Mini-project, internal evaluation: Class test or surprise test, Demonstration of task or activity assigned, assignment, seminar, or any other innovative pedagogical method.

Sant Gadge Baba Amravati University, Amravati

Format and Template for Courses (Theory) of UG/PG Programmes

APPENDIX – A-1,A-2

Sant Gadge Baba Amravati University Amravati

Scheme of teaching, learning &Examination leading to the Degree Master of Science (Choice Based Credit System) (Two Years ... Four Semesters Degree Course- C.B.C.S)

(M.Sc. Part-II) Semester- lV, Subject : Geology

Sr. No	Subjects	Subject Code	Teaching & Learning Scheme								Duration of Exams Hrs.	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits					Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory L/T	Internal Ass.	Practical	Total		Theory + M.C.Q External	Theory Internal	Practical		Total Marks	Marks	Grade
														Internal	External			
1	DSC-V (REMOTE SENSING AND GIS)	4GOG 1	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	P
2	DSC-VI (ENVIRONMENTAL GEOLOGY AND ENGINEERING GEOLOGY)	4GOG 2	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	p
3	DSC-VII (INDIAN MINERAL DEPOSIT AND MINERAL ECONOMICS)	4GOG 3	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	p
4	DSE -VIII (SELECT ANY ONE) 1. (PETROLEUM AND COAL GEOLOGY)	4GOG 4 A	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	p

	OR 2. (MARINE GEOLOGY AND OCEANOGRAPHY)	**4 GOG 4 B**																
5	**LAB-III (REMOTE SENSING AND ENGINEERING AND ENVIROMENTAL GEOLOGY)**	**4 GOG 5**			**09**	**09**			**4.5**	**4.5**	**04**			**--**	**100**	**100**	**50**	**p**
6	**LAB-IV (PROJECT REPORT)**	**4 GOG 6**			**09**	**09**			**4.5**	**4.5**	**04**			**--**	**100**	**100**	**50**	**p**
7	**AEC- II**	**4 GOG 7**	**--**	**--**	**01**	**01**	**01**	**--**		**01**	**01**	**--**	**25**	**--**	**--**	**25**	**10**	**P**
8	**#Internship/Field Work/Work Experience@**																	
9	**Open elective/GIC/OpenSkill/MOOC***																	
	Total		16	0 0	19	**35**	17		09	**26**						**625**		

- **L: Lecture, T: Tutorial, P: Practical**
- **# Students may complete their internship/field work/work experience in first or second or third semester of M.Sc. (Geology) according to their convenience; @denotes non-examination credit**
- **Note: Internship/Apprenticeship/field work/work experience (During vacations of semester I to semester III) for duration of minimum 60 hours to maximum 90 hours mandatory to all the students, to be completed during vacations of semester I to III. This will carry 2 credits for learning of 60 hours or 3 credits for learning of 90 hours. Its credits and grades will be reflected in final semester IV credit grade report.**
- **OEC (optional) can be studied during semester I to IV.**

Suggested Activities for assessment for AEC:

Mini-project, internal evaluation: Class test or surprise test, Demonstration of task or activity assigned, assignment, seminar, or any other innovative pedagogical method.

Part B

Syllabus Prescribed for Second Year 2023-24 PG Programme

Programme: M. Sc. (Geology)

Semester III

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
3GOG 1	**STRATIGRAPHY**	**60**
3GOG 2	**ORE AND MINING GEOLOGY**	**60**
3GOG 3	**HYDROGEOLOGY**	**60**
3GOG 4	**EXPLORATION METHOD**	**60**
3GOG 5	**LAB-5 (STRATIGRAPHY AND ORE AND MINING GEOLOGY)**	**60**
3 GOG 6 (A) **OR** **3 GOG 6 (B)**	**LAB-6 (A) (HYDROGEOLOGY AND EXPLORATION METHODS)** **OR** **LAB-6 (B) (HYDROGEOLOGY AND QUATERNARY GEOLOGY)**	**60**

COs (3GOG 1): STRATIGRAPHY

1. Students would be able to explain the basics principles of stratigraphy.
2. Students would be able to explain Precambrian and Proterozoic stratigraphy of India.
3. Students would be able to describe the Mesozoic stratigraphy of India.
4. Students would be able to describe the Cenozoic stratigraphy of India.
5. Students would be able to explain major events in the earth history.

Unit	Content
Unit I	Principle of Stratigraphy: Order of Superposition, Original Horizontality, Lateral Continuity, Cross-Cutting Relationships, Inclusions, Unconformities, Fossil Succession, Uniformitarianism and Catastrophism. Code of stratigraphic nomenclature and Stratigraphic Correlation: lithostratigraphy, biostratigraphy and chronostratigraphy. Concept of magnetostratigraphy, event stratigraphy, sequence stratigraphy, geochronology. **(12)**
Unit II	Precambrian chronostratigraphy of Aravalli craton, Dharwar craton, Eastern Ghats mobile belt, Bastar craton, Southern Granulite belt and Singhbhum craton. Proterozoic stratigraphy of Cuddapah, Vindhyan, Godavari Supergroup and their equivalents **(12)**
Unit III	Stratigraphy, depositional characteristics and correlation of Mesozoic sequences of India - Triassic of Spiti, Jurassic of Cutch and Rajasthan, Cretaceous of south India. Gondwana Super group including economic significance, palaeoclimate and flora. Stratigraphy of Lameta and Bagh beds. **(12)**
Unit IV	Stratigraphy, economic significance and correlation of Tertiary group of rocks-Siwalik, Assam and Andaman-Nicobar. Cretaceous/Tertiary boundary. **(12)**

Unit V	Age and stratigraphy of Deccan volcanics, Rise of Himalaya, Precambrian-Cambrian boundary, Permian-Triassic boundary, Cretaceous-Tertiary boundary. Paleogene/ Neogene boundary. Major supercontinents in the earth history. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization **(30)**

Course Material/Learning Resources

Essential Reading:

1. Ramakrishnan, M. and Vaidyanadhan, R. (2008) Geology of India, Vol.1, Geological Society of India, Bangalore.
2. Ramakrishnan, M. and Vaidyanadhan, R. (2008) Geology of India, Vol.2, Geological Society of India, Bangalore.
3. Ravindra Kumar G. R., (2020) Fundamentals of historical geology and stratigraphy of India, New Age International Private Limited; Second edition.
4. Boggs, Sam Jr., (1995) : Principles of Sedimentalogy and Stratigraphy,Prentice Hall.
5. Weller, J. M. (1960): Stratigraphic Principles and Practice, Harper and Brothers.
6. Danbar, C. O. and Rodgers, J. (1957): Principles of Stratigraphy, ohn Wiley & Sons.
7. Naqvi, S. M. and Rogers, J.J.W. (1987): Precambrian Geology of India, Oxford Univ. Press.

Suggested Reading:

1. Krishnan, M. S. (1982): Geology of India and Burma, 6th Ed., CBS Pub. & Dis.
2. Pascoe, E. S. (1960): A manual of the Geology of India and Burma. Vols. I & II Govt. of India Pub.
3. Wadia, D. N. (1967): Geology of India, McMillan & Co., London

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/251

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://youtu.be/tSrAWx70Z0Y
https://youtu.be/tSrAWx70Z0Y
https://youtu.be/4KuaeXXZwCw
https://youtu.be/LRRGByUHwMQ

COs (3GOG 2): ORE AND MINING GEOLOGY

1. Students would be able to explain basic concept of ore geology.
2. Students would be able to describe texture paragenesis and origin of ore geology.
3. Students would be able to describe trace elements, REE and different isotopes.
4. Students would be able to describe different petrological association of ore.
5. Students would be able to understand concept Mining Geology.

Unit	Content
Unit I	Introduction to Ore Geology- Modern concepts of ore genesis; Mode of occurrence of ore bodies. Morphology and relationship of host rock, Wall-rock alteration. Classification of ore deposits. Ore deposits and plate tectonics. **(12)**

Unit II	Texture, paragenesis; Paragenitic sequence and zoning of ores. Ore bearing fluids, movement. Origin and migration. Structural, physiochemical and stratigraphic control of ore localization. Fluid inclusion in ores - principles, assumption, limitation and application.	**(12)**
Unit III	Trace elements. Rare earth elements. Radio isotopes; Carbon isotopes, Study of rubidium - strontium, uranium-thorium - lead isotopes. Stable isotope (S, C, O, H) in ore genesis- geothermometry, source of ore constituents; global tectonics and mineralisation.	**(12)**
Unit IV	Petrological ore association: Orthomagmatic ores of mafic, felsic association - diamonds in Kimberlites; chromite; Cyprus type Cu-Zn; Kiruna type Fe-P; Pegmatites, Skarns. Porphyry association. Ores of sedimentary affiliation. Ores of metamorphic affiliation.	**(12)**
Unit V	Basic concepts and broad classification of mining methods: Placer mining methods, open pit methods, Underground mining methods, Coal Mining methods and Ocean bottom mining methods Mining of surface and underground mineral deposits Geological factors considered for the selection of mining method; Advantages and disadvantages of underground mining	**(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work	**(30)**

Course Material/Learning Resources

Essential Reading:

1. Evans, A. M. (1992): Ore geology and industrial minerals, Blackwell Science.
2. Jensen, M. L. & Bateman, A. M. (1981): Economic mineral deposits, John Wiley & Sons.
3. Misra, K. C. (1999): Understanding Mineral Deposits, Kluwer Academic Publishers
4. Umeshwer Prasad (2019): Economic geology, CBS; 2nd edition.
5. Tiwari, S. K. (2018) Ore Geology, Economic Minerals and Mineral Economics, Atlantic Publishers and Distributors Pvt Ltd; 1st edition
6. Umathay R. M. (2006) Mineral Deposits of India, Dattsons Publishers; First Edition
7. Arogyaswamy, R. N. P. (2017) Courses in mining geology, CBS publishers and distributors pvt ltd; fourth edition.

Suggested Reading:

1. Mookherjee, A. (1998): Ore genesis - a holistic approach. Allied Publishers.
2. Stanton, R. L. (1981): Ore Petrology, McGraw Hill.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://onlinecourses.nptel.ac.in/noc23_ce39/preview

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://youtu.be/lhx1nvZFPS4

https://youtu.be/Z6Y4WpsZ288

https://youtu.be/iM5J7u5--5U

COs (3GOG 3): HYDROGEOLOGY

1. Students would be familiar with the main aspects of the Hydrogeology.

2. Students would be able to understand the relation between surface water of catchment and underground water resources.

3. Students would be able to describe the groundwater quality.

4. Students would be familiar with the analytical instruments and its techniques used in Groundwater Exploration.

5. Students would be able to describe the Management of groundwater.

Unit	Content
Unit I	Hydrologic cycle processes and budget: Groundwater origin, types, importance. Residence time concept; Water bearing properties of rocks - Porosity, Permeability, Specific yield, Specific retention, Hydraulic conductivity ,Transmissivity and Storage coefficient. Water table contour maps and their interpretation, Fluctuation of water table **(12)**
Unit II	Groundwater flow - Darcy's Law in isotropic and anisotropic media and its applications, formation constant, flow through aquifers, storage equation, differential equation governing groundwater flow; Bernoulli equation. Evaluation of aquifer properties- aquifer test, confined, semi confined and unconfined aquifers, bounded and leaky aquifers, partially penetrated aquifers. **(12)**
Unit III	Quality of ground water - physical and chemical qualities. Presentation of the results of chemical analysis. Diagrammatic representation of geochemical data. Quality standard of ground water in domestic, agriculture& industries. Sodium adsorption ratio, Permeability index, CPHEEO, BIS standards for drinking water. Sea-water intrusion. **(12)**
Unit IV	Groundwater exploration - geomorphic and geologic control on groundwater. Groundwater provenances of India. Geologic and hydrologic methods, Surface geophysical methods, Geophysical well logging. Water well technology: well types, drilling methods, construction, design and development of wells. **(12)**
Unit V	Groundwater development and management, groundwater recharge discharge and balance. Estimation of recharge components. Estimation of groundwater discharge. Groundwater resource evaluation. Artificial recharge - spreading methods, induced recharge, recharge well method, sub-surface, dams etc. Conjunctive and consumptive use, water logging problems , Rainwater harvesting , Watershed management **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization **(30)**

Course Material/Learning Resources

Essential Reading:

1. Tolman, C. F. (1937): Groundwater, Mcgraw Hills Book co Inc. New York and London.
2. Todd, D. K. (1980): Groundwater hydrology, Toppan Co. ltd., Tokiyo, Japan
3. Ramakrishnan, S. (1998): Groundwater.
4. Freeze, R. A. and Cherry, J. A. (1979): Groundwater. Prentice Hall.
5. Karanth, K.R. 1987: Groundwater Assessment - Development and Management. Tata Mc-Graw Hill.
6. Raghunath N.M. 1982: Ground Water, Wiley Eastern.

Suggested Reading:

1. Patrick, A. (1972): Concepts and models in groundwater hydrology. McGraw Hills
2. Sharma, R. K. (1979): A text book of hydrology & water resources, Dhanpatrai & Sons.
3. Walton, W. C. (1970): Ground water resource evaluation McGraw Hills Book C.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://onlinecourses.nptel.ac.in/noc23_ge13/preview

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://youtu.be/KjaL1WMnNzQ
https://youtu.be/G7CnE5NBxZs
https://youtu.be/DvAdCsk0NeM

COs (3GOG4 A): EXPLORATION METHOD

1. Students would be able to understand the concept of Exploration Methods.
2. Students would be able to explain the process of assessing the geological qualities of an area.
3. Students would be able to understand the geophysical Method and its Application.
4. Students would be able to understand the Seismic methods and well logging.
5. Students would be able to explain Geochemical and Biogeochemical Prospecting.

Unit	Content
Unit I	Geological exploration: Stages of exploration; scope, objectives and methods of prospecting, regional exploration and detailed exploration Surface and subsurface methods. Guides for mineral search-physiographic, stratigraphic, lithological, mineralogical and structural Control of ore localization. Pitting, trenching, and drilling for prospecting, diamond and churn drilling. Sampling methods, Calculation of grade and ore reserves. **(12)**
Unit II	Electrical methods: resistivity methods - Principles, instruments, field procedures, interpretation and applications. Electromagnetic methods: Principles, instruments, lateral exploration, electromagnetic depth soundings, interpretation and applications. Induced Polarization methods: Principles, Instruments, field procedures, interpretation and applications, self potential Method. **(12)**
Unit III	Magnetic methods: Principles, instruments, field procedures, reduction of data, preparation of magnetic anomaly maps and profiles, airborne magnetometers, data interpretation and its applications. Gravity methods: Principles, instruments, field procedures, reduction of gravity datum, gravity anomaly maps, data interpretation and applications. **(12)**
Unit IV	Seismic methods - Refraction methods - principle, instruments equipments; Operational Methods ï Fan shooting, profile shooting, correlation method of refracted waves, reduction of data, interpretation of data and applications. Well Logging Methods: Classification of well logging methods. Electrical logging - Self potential logging, resistivity logging, induction logging; Radioactivity logging - Sonic logging Interpretations and applications of well logging methods. **(12)**
Unit V	Geochemical exploration - Geochemical principles - Geochemical cycle, primary and secondary dispersion patterns, geochemical anomalies and background values, geochemical surveys. Geochemical Prospecting for minerals, oil and natural gas. Biogeochemical prospecting. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization **(30)**

Course Material/Learning Resources

Essential Reading:

1. Peters, W. C. (1987): Exploration and Mining Geology. 2nd Ed., John Wiely & Sons, New York.
2. Arogyaswami, R. N. P. (1988): A course in Mining Geology, 2nd Ed., Moham Primlani (Oxford & IBH Pub. Co.), New Delhi.
3. Sharma, P.V.,(1986): Geophysical Methods in Geology, Elsevier.
4. Sharma, P.V. (1997): Environmental and Engineering Geophysics, Cambridge University, Press.
5. William Lowrie (2007): Fundamentals of Geophysics, Cambridge University Press.

Suggested Reading:

1. Bagchi, T.C., Sengupta, D.K., Rao, S.V.L.N. (1979): Elements of Prospecting and Exploration, Kalyani Publ.
2. Banerjee, P.K. and Ghosh, S. (1997): Elements of Prospecting for Non-fuel Mineral deposits, Allied Publ.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://onlinecourses.nptel.ac.in/noc23_ce39/preview

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://youtu.be/eecHyz2c_68
https://youtu.be/2L0T77jnU5E
https://youtu.be/QDgzLjnj8Gs

COs (3GOG4 B): Quaternary Geology and Limnogeology

1. Students would be able to understand the concept of Quaternary Stratigraphy.
2. Students would be able to explain scope of paleoclimatic studies.
3. Students would be able to understand the geochronological methods used in dating Quaternary events.
4. Students would be able to understand the scope of Limnogeology.
5. Students would be able to explain methods of investigations of lake signatures.

Unit	Content
Unit I	Significance of Quaternary studies; Quaternary Stratigraphy; Quaternary deposits in India; Evolution of man and cultural stages; Morphostratigraphy; Criteria used for defining Pliocene- Pleistocene boundary; Pleistocene-Holocene boundary.. **(12)**
Unit II	Scope of paleoclimatic studies; Sources of paleoclimate reconstruction; Quaternary Paleoclimate; Causes of ice ages and other climatic changes; Soils and paleosoils and their significance in interpreting Quaternary climates; Quaternary sea level changes; Linkage of the modern climate to past climatic variation (with special emphasis on the Holocene). **(12)**
Unit III	Geochronological methods used in dating Quaternary events: K-Ar and 39Ar-40Ar dating, Radiocarbon dating (14C), 12C- 13C dating, Thermoluminescence (TL), 210Pb and 137Cs Chronology;Paleomagnetic dating; Magnetic Susceptibility study and paleorainfall; Dendrochronology; Stable Oxygen isotopes and paleoclimates. **(12)**
Unit IV	Scope of Limnogeology; Major divisions of lakes; Physical, Chemical and Biological environments of lakes; Geological evolution of lake basins; Applications of the freshwater fossil Diatoms and polynomorphs in limnogeological study. **(12)**
Unit V	Methods of investigations of lake signatures: Drought, tsunami, storm, anthropogenic metal, land use changes, earthquake; Sedimentological and geochemical archive in lake deposits; Lake sediment records of carbonaceous particles from fossil fuel combustion and Soot Particle counting. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization **(30)**

Course Material/Learning Resources
Essential Reading:

1. Arnold (2002) Quaternary Environmental Micropaleontology (Ed. Simon K. Haslett), Oxford
2. Soil Survey Staff (1992) Keys to soil taxonomy, Vth Edition SMSS Monograph No. 19.
3. Tiwari, M.P. and Mohabey, D.M. (Eds.) (1999) Quaternary of India, Gondwana Geological Magazine,Spl. Vol. 4. Univ. Press, New York.
4. Benson, L., Kashgarian, M., Rye, R., Lund, S., Paillet, F., Smoot, J., Kester, C., Mensing, S., Meko, D., and Lindström, S. (2002) Holocene multidecadal and multicentennial droughts affecting Northern
5. California and Nevada: Quaternary Science Reviews, v. 21.

6. Kharaka, Y.K., Robinson, S.W., Law, L.M., and Carothers, W.W. (1984) Hydrogeochemistry of Big Soda
7. Lake, Nevada; an alkaline meromictic desert lake: Geochimica et Cosmochimica Acta, v. 48.

Suggested Reading:

1. Bagchi, T.C., Sengupta, D.K., Rao, S.V.L.N. (1979): Elements of Prospecting and Exploration, Kalyani Publ.
2. Banerjee, P.K. and Ghosh, S. (1997): Elements of Prospecting for Non-fuel Mineral deposits, Allied Publ.
3. Lebo, M.E., Reuter, J.E., and Meyers, P.A. (1994) Historical changes in sediments of Pyramid Lake, Nevada, USA: consequences of change in the water balance of a terminal desert lake: Journal of Paleolimnology, v.12.
4. Meyers, P.A., Tenzer, G.E., Lebo, M.E., and Reuter, J.E. (1998) Sedimentary record of sources and accumulation of organic matter in Pyramid Lake, Nevada, over the past 1,000 years: Limnology and Oceanography, v. 43.

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://www.youtube.com/watch?v=svO0QElVgvE&t=63s
https://www.youtube.com/watch?v=-YGD4VcnKEQ

3GOG 7 Open elective/ GIC/Open skill course/MOOC*

GIC 3 Basics of Hydrogeology **(15) hrs**

After successfully completing the course, the student will be able to

1. Understand basic idea about Hydrogeology
2. Understand origin and types of water

Unit-1 Definition of Hydrogeology, Water cycle and its processes, origin and types of water.

(7) hrs

Unit-2: Porosity, Permeability**,** Classification of rock on the basis of water bearing properties, Aquifer and its type.

(8) hrs

Course Material/Learning Resources
Essential Reading:

1. Raghunath, N.M. (1982), Ground Water, Wiley Eastern.
2. Karanth, K.R. (1987), Groundwater Assessment - Development and Management. Tata Mc-Graw Hill.
3. Reddy, P. J. (2011), A Textbook of Hydrogeology, Laxmi pub. pvt.ltd.
4. Tolman, C. F. (1937), Groundwater, Mcgraw Hills Book co inc. New York and London.
5. Subramanya K. (2008), Engineering Hydrology. The McGrawï hill company.

Suggested Reading:

1. Sharma, R. K. (1979), A text book of hydrology & water resources, Dhanpatrai & Sons.
2. Walton, W. C. (1970), Ground water resource evaluation, McGraw Hills Book Co.

Part B

Syllabus Prescribed for second Year 2023-24 PG Programme

Programme: M. Sc. (Geology)

Semester IV

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
4GOG 1	**REMOTE SENSING AND GIS**	**60**
4GOG 2	**ENVIRONMENTAL GEOLOGY AND ENGINEERING GEOLOGY**	**60**
4GOG 3	**INDIAN MINERAL DEPOSIT AND MINERAL ECONOMICS**	**60**
4GOG 4	**PETROLEUM AND COAL GEOLOGY**	**60**
4GOG 5	**LAB-7 (REMOTE SENSING AND ENGINEERING AND ENVIROMENTAL GEOLOGY)**	**60**
4GOG 6	**LAB-8 (PROJECT REPORT)**	**60**

COs (4GOG1): REMOTE SENSING AND GIS

1. Students would be able to understand the genesis of magma and also study the texture and structures of igneous rock.
2. Students would be able to explain the different types of igneous rock classification.
3. Students would be able to describe the process of magmatic evolution and differentiation.
4. Students would be able to explain the phase rule and phase equilibrium of single, binary and ternary system.
5. Students would be able to describe Petrogenesis of major igneous rock.

Unit	Content
Unit I	Remote Sensing- principles, electromagnetic spectrum and atmospheric windows. Platforms and sensors- multispectral scanners (MSS) & scanning modes. Types of remote sensing- thermal & microwave remote sensing, scale & resolutions, interpretation of panchromatic, black & white, false colour composites (FCC), colored infrared, thermal infrared, radar, MSS and hyper spectral imageries, spectral signature. Indian space missions and Satellite. **(12)**
Unit II	Photogrammetry- geometric characteristics scale, factors affecting scale & aerial photography, mosaics, film and filter combination, aerial cameras, stereoscopic parallax, relief displacement. **(12)**

Unit III	Digital image processing: Introduction, characteristics of digital images, pixel parameters. Image processing techniques applied to satellite imagery - image reduction, image magnification, image enhancement, contrast enhancement, ratioing, and principal component analysis. Filtering techniques - discrete linear operations, spatial smoothing operators, spatial sharpening operators, edge detection. Classification pattern recognition. Configuration of digital analysis system. **(12)**
Unit IV	Geological applications: Image elements - tone, colour, texture, pattern, shape, size, shadows, sites, associations. Terrain elements ï drainage patterns, landforms, erosion. Remote sensing for lithological discrimination and geological mapping. **(12)**
Unit V	Geographical information system: Definition and importance of GIS; Data input and output; GIS data - Types, representation and sources, Georeferncing, GIS data base and data base, management system; Imageries and IRS products; Application of remote sensing in groundwater exploration, petroleum exploration, engineering geology. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization **(30)**

Course Material/Learning Resources

Essential Reading:

1. Avery, T. U. and Berlin, G. L. (1992): Fundamentals of Remote Sensing and Air Photo Interpretation, McMillion Publishing Co., New York.
2. Burrough, P. A. (1986): Principles of Geographic Information Systems for Land Resources Assessment.
3. Campbell, J. B. (1996): Introduction to Remote Sensing, 622pp.
4. Drury, S. A. (1987): Image Interpretation in Geology, Chapman and Hall.
5. Gupta, R. P. (2003): Remote Sensing Geology. 2nd Ed., Springer-Verlag, Heidelberg.
6. Jensen, J. R. (1986): Introductory Digital Image Processing-A Remote Sensing Perspective, Prentice Hall, New Jersey.
7. Lillesand, T. M. and Kiefer, R. (1987): Remote sensing and image interpretation, John Wiley.
8. Miller, V. C. (1961): Photogeology, McGraw Hill Book Co., New York.

Suggested Reading:

1. Pandey, S. N. (1987): Principles and Applications of Photogeology. Wiley Eastern Ltd., Delhi.
2. Ray, R. G. (1969): Aerial photographs in Geologic Interpretation. USGS Professional Paper 373.
3. Siegal, B. S. and Gillespie, A. R. (1980): Remote Sensing in Geology. John Wiley & Sons.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://onlinecourses.nptel.ac.in/noc23_ce64/preview

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://youtu.be/4Rn0M39HOPU
https://youtu.be/qGBA_RVM-t0
https://youtu.be/4VKvZMPccjE

COs (4GOG 2): ENVIRONMENTAL GEOLOGY AND ENGINEERING GEOLOGY

1. Students would be able to explain concept and principle of environmental geology.
2. Students would be able to explain problem of urbanisation and their impact on environment.
3. Students would be able to describe earthquake and seismic hazards.
4. Students would be able to describe engineering properties of rock.
5. Students would be able to explain site selection for dams and reservoirs.

Unit	**Content**
Unit I	Concept and principle of environmental geology. Role of physical, chemical and biological parameters influencing environment Land capability classification; Land use pattern. Assessment of impact of land use & reclamation of land. Soil: Soil as a resource-nature, profile, origin and classification. Soil conservation, soil weathering; soil degradation and remedial measures. Desertification and degradation of land, causes of desertification, measures to combat desertification. Organic and inorganic contaminations of ground water and its remedial measures. **(12)**
Unit II	Problem of urbanisation, human population and their impact on environment. Disposal of industrial & radioactive waste, Fertilizer and pesticides. Impact of mining activities on the environment. Environmental impact assessment and management of mining areas, dumping of overburdens. Global warming. Green house effect. Ozone hole depletion, ocean acidification. **(12)**
Unit III	Earthquake and seismic hazards; Origin and severity of earthquake, effects of earthquakes, seismic zones of India. Landslides: Destabilizing forces, Types, Identification of landslide zones. Controlling landslides - methods for prevention or control of landslides. Floods and Floods Management: Causes of floods ï excess flows, reduced carrying capacity of rivers, runoff verses infiltration, Management of floods - reservoirs, water spreading, groundwater recharge, stream canalization, flood embankments, hazard zoning and flood forecasting and warnings. **(12)**
Unit IV	Engineering Properties of Rock: Strength characteristics - unconfined compressive strength, uniaxial tensile strength, shear strength, Deformational characters - modulus of elasticity, poisson ratio., Residual stress Engineering classification of rock masses ï Rock quality designation, rock structure rating, rock mass rating system, rock quality index system. Susceptibility or rocks towards weathering. Engineering properties of soils. Ground improvement - grouting, types, procedures, grouting applications **(12)**
Unit V	**Dams and reservoirs**: types and classification, forces acting on the dam body, reservoir induced seismicity, investigations for the construction of dams and reservoir, spillways etc., seepage problem, silting problem. **Tunnel**s- types, problems due to underground water and fault-shear zones, tunneling in hard and soft grounds, investigations for tunnel alignment, tunnel support design, tunnel linings. Ground failure in tunnels, tunnel supports. Methods of tunnelling in hard rocks and in Soft soils **Bridges:** Types, abutment and foundation problems across river and valley crossing, geological investigations for construction of bridges. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization **(30)**

Course Material/Learning Resources

Essential Reading

1. Valdia, K. S. (1987): Environmental Geology, Tata McGraw hills, New Delhi
2. Keller, A. E. (1978): Environmental Geology (5th Edt.) Charis and Merril Pub. Co.
3. Montgometry, C. W. (2016): Environmental Geology, Mc Graw Hall Global education Holding publishers.
4. Beavis, F. C. (1985): Engineering Geology.
5. Bell, F. G. (1999): Geological Hazards, Routledge, London.
6. Bieniawski, Z. T. (1989): Engineering Rock Mass Classification, John Wiley.

Suggested Reading:

1. Tonk, W. R. (1986): Environmental Geology, Oxford University Press, New York 1983
2. Legget, R. F. (1983): Handbook of geology in civil engineering, McGraw Hill, New York.
3. Schultz, J. R. & Cleaves, A. B. (1951): Geology in Engineering, John Willey & Sons, New York.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://onlinecourses.nptel.ac.in/noc23_ce64/preview

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://youtube.com/playlist?list=PL_a1TI5CC9RH5wygqmRtq-Y7-s_0T6Z9w

https://youtube.com/playlist?list=PLDF5162B475DD915F

COs (4GOG3): INDIAN MINERAL DEPOSIT AND MINERAL ECONOMICS

1. Students would be able to explain the basics concept of classification of mineral deposit.
2. Students would be able to describe mineralogy, mode of occurrence of metals.
3. Students would be able to describe mineralogy, mode of occurrence of non- metals.
4. Students would be able to explain mineral legislation in India.
5. Students would be able to compare strategic, critical and essential minerals of India.

Unit	Content
Unit I	Classification of mineral deposit, Basic Process of formation of mineral deposits. Metallurgical epoch and provinces. Mineralogy, mode of occurrence, origin, geological association, geographical distribution and use of gold, copper, lead, zinc and silver. **(12)**
Unit II	Mineralogy, mode of occurrence, origin, geological association, geographical distribution and use of metals aluminium, magnesium, iron, manganese, Chromium, nickel. **(12)**
Unit III	Mineralogy, mode of occurrence, origin, geological association, geographical distribution and use of atomic minerals, ceramic materials, metallurgical and refractory materials; Industrial and manufacturing materials; Abrasive and abrasion minerals. **(12)**
Unit IV	Mineral economics and its concept, Mineral Legislation in India, Economic consideration in mineral exploration, National mineral policy, Mineral processing, Economics of mineral production, Co-products-by products of mining and Mineral processing, Mineral dressing. **(12)**
Unit V	International scenario of mineral wealth; Strategic, critical and essential minerals of India, War minerals, Internal and External mineral trade, consumption and substitution of minerals, economical mineral conservation. **(12)**

**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization

(30)

Course Material/Learning Resources

Essential Reading:

1. Evans, A. M. (1992): Ore geology and industrial minerals, Blackwell Science.
2. Jensen, M. L. & Bateman, A. M. (1981): Economic mineral deposits, John Wiley & Sons.
3. Misra, K. C. (1999): Understanding Mineral Deposits, Kluwer Academic Publishers.
4. Umeshwer Prasad (2019): Economic geology, CBS; 2nd edition.
5. Tiwari, S. K. (2018) Ore Geology, Economic Minerals and Mineral Economics, Atlantic Publishers and Distributors Pvt Ltd; 1st edition.
6. Umathay R. M. (2006) Mineral Deposits of India, Dattsons Publishers; First Edition.

Suggested Reading:

1. Mookherjee, A. (1998): Ore genesis - a holistic approach. Allied Publishers.
2. Stanton, R. L. (1981): Ore Petrology, McGraw Hill.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://onlinecourses.nptel.ac.in/noc23_ce39/preview

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://youtube.com/playlist?list=PLrb2lGnLJld_E7C0wVAqU4JGabm2IiT38

COs (4GOG 4 A): PETROLEUM AND COAL GEOLOGY

1. Students would be able to explain the basics concept Petroleum and its origin.
2. Students would be able to explain the different hydrocarbon trap.
3. Students would be able to describe Prospecting for oil and gas.
4. Students would be able to understand the importance of coal.
5. Students would be able to explain the coal bed methane.

Unit	Content
Unit I	Petroleum: Origin and classification, chemical composition, Occurrence. Reservoir rocks: general attributes and petro-physical Properties. Classification of reservoir rocks-fragmental and chemical reservoir rocks. Reservoir rocks ï petrology, porosity and permeability; Reservoir traps ï structural, Stratigraphic and combination traps. **(12)**
Unit II	Hydrocarbon traps: Definition, anticlinal and trap theory, classification of hydrocarbon traps (Structural, stratigraphic and combination), time of trap formation and time of hydrocarbon accumulation, Cap rock - definition and general properties. Oil reservoir fluids - water, oil and gas; Oil and source rock correlation. Migration of oil and gas: primary and secondary migration. **(12)**

Unit III	Prospecting for oil and gas, well drilling methods and Logging procedures. Coring and core analysis. Application of logs in petro physical and Facies analyses. Estimation of oil and gas reserves. Geology of the productive oilfields of India. Onshore and offshore petroliferous basins of India; future prospects and the economic scenario of Petroleum. **(12)**
Unit IV	Coal: Definition and origin of coal; Sedimentology of coal bearing strata. Rank, grade and type of coal. Indian and international classifications. Chemical analysis of coal (proximate and ultimate analysis). Macroscopic ingredient and microscopic constituents, Physical properties of coal. Coal Petrology and its significance in Industrial and geological problems. Coal carbonization (coke manufacture), coal gasification and coal hydrogenation. **(12)**
Unit V	Coal bed methane: A new energy resource. Maturation of coal and generation of methane in coal beds. Fundamentals of coal bed methane exploration and production. Coal forming epochs in the geological past. Coal as a source rock for oil and gas; Geological and geographical distribution of coal and lignite deposits in India; Gondwana coals - Classification, Conditions of deposition and petrography. Methods of coal prospecting and estimation of coal reserves. Reserves and production of coal in India. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization **(30)**

Course Material/Learning Resources

Essential Reading:

1. North, F.K. (1985): Petroleum Geology, Allen and Unwin.
2. Taylor, G.H., Teichmuller, M., Davis, A., Diessel, C.F.K., Littke, R. and Robert, P., (1998): Organic Petrology, Gebruder, Borntraeger, Stuttgart.
3. Chandra, D., Singh, R.M., and Singh, M.P., (2000): Textbook of Coal (Indian Context), Tara Book Agency, Varanasi.
4. Singh, M.P. (Ed.), (1998): Coal and Organic Petrology, Hindustan Publ. Corp., New Delhi.

Suggested Reading:

1. Stach., E., Mackowsky, M.T.H., Taylor G.H., Chandra, D.Teichmuller, M., and Teichmuller, R., (1982) : Stachôs Text Book of Coal Petrology, Gebruader Borntraeger, Stuttgart.
2. Holson, G.D. and Tiratsoo, E.N., (1985): Introduction Petroleum Geology, Gulf Publ. Houston, Texas.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://www.classcentral.com/course/swayam-petroleum-technology-184177

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://youtu.be/cH526RVUKzQ

COs (4GOG 4 B): Marine Geology and Oceanography

1. Students would be able to explain the history of development of marine geology.
2. Students would be able to explain the oceanic circulation.
3. Students would be able to describe methods and instruments for exploring the ocean floor.
4. Students would be able to understand the evolution of oceans through the cenozoic.
5. Students would be able to explain the mineral resources of the ocean.

Unit	Content
Unit I	History of development of marine geology; Origin of ocean basins; A brief account of tectonic history of the oceans; Oceanic crust; Deep ocean-floor topography; Morphology of ocean margins; Marine sediments, sources and composition, sediment types and distribution; Oceanic sediments and microfossils; Deep sea sediments and their relation to oceanic processes such as productivity, solution and dilution. **(12)**
Unit II	Oceanic circulation - Surface, intermediate and deep ocean circulation; Forces that produce and effect circulation patterns in world oceans; Important phenomena associated with surface circulation; Formation and movement of deep and bottom waters; Sedimentation rates; Calcite and aragonite compensation depth. **(12)**
Unit III	Methods and instruments for exploring the ocean floor; Deep Sea Drilling Project (DSDP), Ocean Drilling Programme (ODP) and Joint Global Flux Studies (JGOFS) and their major accomplishments; Integrated Ocean Drilling Programme (IODP) and its aims and objectives; Sediment distribution in time and space as related to tectonic models; Marine stratigraphy, correlation and chronology; Deep sea hiatuses and their causes; Approaches to paleoceanographic and paleoclimatic reconstructions; Paleoceanographic changes in relation to earth system history including impact of the oceans on climate change. **(12)**
Unit IV	Evolution of oceans through the Cenozoic; Ocean gateways and their role in controlling global climates; Sea level changes during Quaternary with special reference to India; Reconstructing Quaternary climatic and oceanographic history on shorter time scales using marine records; **(12)**
Unit V	Mineral resources of the ocean including polymetallic nodules; Hydrocarbons beneath the sea floor; Marine gas hydrates and their economic potential; Marine pollution and interpreting marine pollution with the help of microfossils . **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization **(30)**

Course Material/Learning Resources

Essential Reading

1. Kennett, J.P. (1982) Laboratory Excercises in Oceanography Marine Geology, Prentice Hall.

Suggested Reading:

1. Seibold, E. and Berger, W.H. (1982) The Sea Floor, Springer-Verlag.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://onlinecourses.swayam2.ac.in/cec21_hs03/preview
https://nptel.ac.in/courses/119102007

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://youtu.be/BgNIyPnM6cE
https://youtu.be/78JPCAApA9M

4GOG7 Open elective/ GIC/Open skill course/MOOC*

GIC 4 Rain Water Harvesting and Artificial Recharge.

(15) hrs

After successfully completing the course, the student will be able to

1. Understand basic idea about rain water harvesting and artificial recharge.

2. Understand basic idea about soil and water conservation methods.

Unit-1: Rainwater harvesting: Definition, importance and process of harvesting water, basic components, benefits of rainwater harvesting. Roof water harvesting. Artificial recharge and its methods.

(7) hrs

Unit-2: Soil and water conservation practices: Conservation measures, gully control, terracing, building check dams, rock fill dams, reclamation of soil, afforestation.

(7) hrs

Course Material/Learning Resources
Essential Reading:

1. Athavale, R.N. (2003), Water Harvesting and Sustainable Supply in India. Center of Env. Ed.
2. Dr. Suresh R. (2006), Soil and water conservation engineering, Standard Publishers Distributors,Delhi-6, Reprint Edition.
3. Gupta, S.K. (2019), Fundamentals of soil and water conservation engineering.
4. Karanth, K.R. (1987), Groundwater Assessment - Development and Management. Tata Mc-Graw Hill.

Suggested Reading:

1. Bimal Chandra Mal (2011), Introduction to soil and water conservation engineering, Kalyani Publications.
2. Dr. Chandrawati Jee Shagufta, (2010), Rainwater harvesting, A P H Publishing Corporation.

(8) hrs

Sant Gadge Baba Amravati University, Amravati

Syllabus Prescribed for Second Year 2023-24 PG Programme

Programme: M. Sc. (Geology)

Semester III

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	No. of Periods/Week
3GOG 5	**LAB-5 (Stratigraphy, Ore & Mining Geology)**	**09**
3GOG 6(A)	**LAB-6(A) (Hydrogeology and Exploration Method)**	**09**
Or	**Or**	
3GOG 6(B)	**LAB-6(B) (Hydrogeology and Quaternary Geology)**	**09**

COs (3 GOG 5) - Stratigraphy, Ore & Mining Geology

Students would be able to

1. Prepare the palaeogeographic and stratigraphic maps of important periods of earth history.
2. Identify the megascopic properties of various Ore Minerals.
3. Identify the microscopic properties of various Ore Minerals.
4. Perform exercise on mine sampling and determination of tenor, cutoff grades and ore reserves.

*** List of Practical/Laboratory Experiments/Activities etc.**

1. Preparation of palaeogeographic and stratigraphic maps of important periods of earth history.
2. Megascopic study of structures and fabrics of different ores with their association and uses.
3. Mineralogical and textural studies of common ore minerals under ore-microscope.
4. Exercise on mine sampling and determination of tenor, cutoff grades and ore reserves.

Reference Books:

1. Ramakrishnan, M. and Vaidyanadhan, R. (2008) Geology of India, Vol.1, Geological Society of India, Bangalore.
2. Ramakrishnan, M. and Vaidyanadhan, R. (2008) Geology of India, Vol.2, Geological Society of India, Bangalore.
3. Ravindra Kumar G. R., (2020) Fundamentals of historical geology and stratigraphy of India, New Age International Private Limited; Second edition.
4. Umeshwer Prasad (2019): Economic geology, CBS; 2nd edition.
5. Tiwari, S. K. (2018) Ore Geology, Economic Minerals and Mineral Economics, Atlantic Publishers and Distributors Pvt Ltd; 1st edition
6. Arogyaswamy, R. N. P. (2017) Courses in mining geology, CBS publishers and distributors pvt ltd; fourth edition.

COs (3 GOG 6 A): Hydrogeology and Exploration Method

Students would be able to

1. Calculate different hydrogeological data by doing hydrogeological calculations.
2. Perform physio-chemical analysis of water.
3. Solve problems in geological interpretation of geophysical data.

*** List of Practical/Laboratory Experiments/Activities etc.**

1. Hydrogeology Well Inventory Data Collection.
2. Preparation and interpretation of water table counter maps, Fence diagrams, groundwater budgeting.
3. Estimation of Porosity and Permeability.
4. Physio-chemical analysis of water. Pumping test, groundwater provinces of India.
5. Problems in interpretation of geophysical logs for geological purpose.
6. Problems in geological interpretation of geophysical data (gravity, magnetic, electrical, seismic) in mineral exploration.
7. Problems in geological interpretation of geochemical data in mineral exploration.
8. Problems on computation of ore reserves and sampling calculations.

Reference Books:

1. Karanth, K.R. 1987: Groundwater Assessment - Development and Management. Tata Mc-Graw Hill.
2. Raghunath N.M. 1982: Ground Water, Wiley Eastern.
3. Sharma, P.V.,(1986): Geophysical Methods in Geology, Elsevier.
4. Sharma, P.V. (1997): Environmental and Engineering Geophysics, Cambridge University, Press.
5. William Lowrie **(**2007**)**: Fundamentals of Geophysics, Cambridge University Press.

COs (3 GOG 6 B): Hydrogeology and Quaternary Geology

Students would be able to

1. Calculate different hydrogeological data by doing hydrogeological calculations.
2. Perform physio-chemical analysis of water.
3. Prepare the palaeogeographic maps of Quaternary period.

*** List of Practical/Laboratory Experiments/Activities etc.**

1. Hydrogeology Well Inventory Data Collection.
2. Preparation and interpretation of water table counter maps, Fence diagrams, groundwater budgeting.
3. Estimation of Porosity and Permeability.
4. Physio-chemical analysis of water. Pumping test, groundwater provinces of India.
5. Study of palaeogeographic maps of Quaternary period; Standardization of stratigraphic sequences on the basis of facies analysis.

Reference Books:

1. Karanth, K.R. 1987: Groundwater Assessment - Development and Management. Tata Mc-Graw Hill.
2. Raghunath N.M. 1982: Ground Water, Wiley Eastern.
3. Bowen, D.Q. (1978) Quaternary Geology.
4. Tiwari, M.P. and Mohabey, D.M. (Eds.) (1999) Quaternary of India, Gondwana Geological Magazine, Spl. Vol. 4.

Sant Gadge Baba Amravati University, Amravati

Format and template for Practical/Lab Course

Syllabus Prescribed for Second Year 2022-23 PG Programme

Programme: M. Sc. (Geology)

Semester IV

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
4GOG 5	**LAB-7 (Remote Sensing, Engineering and Environmental Geology)**	**09**
4GOG 6	**LAB-8 (Practical VIII)**	**09**

COs (4GOG 5): Remote Sensing, Engineering and Environmental Geology

Students would be able to

1. Interpret the aerial photographs and satellite imageries identify the microscopic properties of various Igneous and Metamorphic Rocks.
2. Interpret the maps and models of importance engineering structure as dam sites & tunnels
3. Perform physical and chemical analysis of ground water

*** List of Practical/Laboratory Experiments/Activities etc.**

1. Interpretation of aerial photographs and satellite imageries ï Geological structure, lithology, landforms, minerals, soils, groundwater; Application of GIS in geological studies.
2. Study of maps and models of importance engineering structure as dam sites & tunnels.
3. Interpretation of geological maps for land slide problems.
4. Study of properties of common rock with reference to their utility in engineering project.
5. Physical and chemical analysis of ground water. Piper Diagrams, SAR Problems, Classification of ground water for use in drinking, irrigation in Industrial.

Reference Books:

1. Gupta, R. P. (2003): Remote Sensing Geology. 2nd Ed., Springer-Verlag, Heidelberg.
2. Pandey, S. N. (1987): Principles and Applications of Photogeology. Wiley Eastern Ltd., Delhi.
3. Valdia, K. S. (1987): Environmental Geology, Tata McGraw hills, New Delhi
4. Beavis, F. C. (1985): Engineering Geology.

COs (4GOG 6) Practical VIII

Students would be able to

1. Carry out geological field work.
2. Write the project report.

*** List of Practical/Laboratory Experiments/Activities etc.**

1. Project work, submission of report, presentation and viva