DEPARTMENT OF GEOLOGY

COURSE CURRICULUM & MARKING SCHEME

M.Sc. GEOLOGY
Semester - III

SESSION : 2024-25

ESTD: 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A+, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

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DEPARTMENT OF GEOLOGY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG (C.G.)
M.Sc. Geology 2024-25

Program Outcomes of M.Sc. Geology

PO1: Knowledge: Acquire an overview of concepts, fundamentals and advancements of science across a range of fields, with in-depth knowledge in at least one area of study. Develop focused field knowledge and amalgamate knowledge across different disciplines.

PO2: Complementary skills: Students will be able to engage in critical investigation through principal approaches or methods and through effective information search and employ highly developed conceptual, analytical, quantitative and technical skills and are adept with a range of technologies

PO3: Applied learning: Students will be able to apply disciplinary or interdisciplinary learning across multiple contexts, integrating knowledge and practice. Recognize the need for information; effectively search for, evaluate, manage and apply that information in support of scientific investigation or scholarly debate

PO4: Communication: Communicate effectively on scientific achievements, basic concepts and recent developments with experts and with society at large. Able to comprehend and write reports, documents, make effective presentation by oral and/or written form.

PO5: Problem solving: Investigate, design and apply appropriate methods to solve problems in science, mathematics, technology and/or engineering.

PO6: Environment and sustainability: Understand the impact of the solutions in ethical, societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

PO7: Teamwork, collaborative and management skills: Recognize the opportunities and contribute positively in collaborative scientific work. Engage in intellectual exchange of ideas with other disciplines.

Program Specific Outcomes of M.Sc. Geology

The student graduating with the M.Sc. Geology will be able to

1. Acquire fundamental/systematic or coherent understanding of the academic field of Geology, its different learning areas
2. Demonstrate the ability to use skills in Geology and its related areas of technology for formulating and tackling geosciences-related problems and identifying and applying appropriate geological principles and methodologies to solve a wide range of problems associated with geosciences.
3. Demonstrate competencies related to problem-solving skills that are required to solve different types of geosciences-related problems and investigative skills, including skills of independent investigation of geosciences-related issues and problems;
4. Develop Communication skills and analytical skills ability to work both independently and in Teams involving the ability to read texts and research papers analytically and to present information in a concise manner

Chairperson /H.O.D | Subject Expert | Subject Expert | Subject Expert

Senior Professor of Science Faculty | Departmental members | Alumnus | Student

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Syllabus and Marking Scheme for Third Semester

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I	Environmental Geology	80	16	20	04	05
II	Economic Geology	80	16	20	04	05
III	Mineral Exploration	80	16	20	04	05
IV	Hydrogeology	80	16	20	04	05
V	Lab Course I	100	33			04
IV	Lab Course II	100	33			04
	Total	**520**		**80**		**28**

04 Theory papers - 320

04 Internal Assessments - 80

02 Practicals - 200

Total Marks - 600

Note: 20 marks = 01 credit in Theory Papers and 25 Marks = 01 Credit in Practical/Project work.

The syllabus for M.Sc. Geology is hereby approved for the session 2024-25.

GENERAL INSTRUCTIONS FOR STUDENTS

1. The candidate has to obtain minimum 20% marks in each theory paper and internal assessment separately.
2. The candidate has to secure minimum 36% marks as an aggregate in order to pass that semester examination.
3. The internal assessment shall include class test, home assignment and seminar presentation.

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Course Outcome Paper I: Environmental Geology

At the end of the course, the students will be able to

1. Explain the fundamentals of Environmental Geology, conservation and climatic changes on different time scales.
2. Analyze the causes of natural disasters and discuss their mitigation measures.
3. Identify the problems of environment in urban and rural areas and assess the impact of human activities on soil, groundwater and other natural resources
4. Discuss environmental policies of the Government and describe the steps of preparation of EIA report and environment management plan

THIRD SEMESTER
Paper- I: Environmental Geology

Max. Marks 80 **Min. Marks 16**

UNIT 1 (i) Definition, history and scope of Environmental Geology. Basic concepts of Environmental Geology.
(ii) Environment, Ecology, Ecosystems and habitat. Nature of its degradation. Interaction of man and natural systems.
(iii) Conservation principle, conservation of mineral and fuel resources, soil and water resources.
(iv) Climatic and sea level changes on different time scales. Climate Change and global warming: causes and impact. Greenhouse effect.

UNIT 2 (i) Geological hazards- Lands slides, volcanic activity.
(ii) Earthquake.
(iii) Draught and desertification, river flooding, erosion and sedimentation, coastal erosion, cyclones and tsunamis.
(iv) Measures of mitigation of the above-mentioned geological hazards.

UNIT 3 (i) Problems of environment in urban areas, causes and remedies.
(ii) Changes in surface and subsurface by mining activities, mineral based industries and construction of large engineering structures such as dams, tunnels etc.
(iii) Human settlement and contamination of atmosphere and soil.
(iv) Human settlement and contamination of surface water and groundwater by waste disposal and agro industries.

UNIT 4 (i) Environmental policies of the Government for air and water pollution.
(ii) Environmental laws.
(iii) Environment Impact Assessment and main components of Environment Impact Assessment report
(iv) Environment management plans.

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M.Sc. Geology 2024-25

Books Recommended

Valdiya, K.S., 1987: Environmental Geology-Indian Context. Tata McGraw Hill.
Keller, E.A.,1978: Environmental Geology.Bell and Howell,USA.
Patwardhan, A.M.,1999: The Dynamic Earth System. Prentice Hall.
Subramaniyam, V.,2001: Textbook in Environmental Science.Narosa International.
Bell,F.G.,1999: Geological Hazards. Routledge, London.
Smith, K,1992: Environmental Hazards. Routledge, London.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :

Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note: 1. Question no. 1 and Question 2 will be compulsory.

2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.

3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.

Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.

4. Internal Assessment Examination will be as follows:
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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Course Outcome Paper II: Economic Geology

At the end of the course, the students will be able to

1. Explain fundamental concepts of formation of ore deposits, mode of occurrence of ore bodies and ore textures
2. Describe ores of various affiliations and their occurrence in India
3. Explain about various aspects of coal geology and coal bed methane.
4. Describe origin, mode of occurrence and distribution of petroleum and radioactive minerals in India

THIRD SEMESTER

Paper- II: Economic Geology

Max. Marks 80 **Min. Marks 16**

Unit 1. (i) Ore deposits and plate Tectonics.
(ii) Mode of occurrence of ore bodies- morphology and relationship of host rocks.
(iii) Textures, Paragenesis and zoning of ores and their significance.
(iv) Concept of ore bearing fluids, their origin and migration. Wall rock alteration.
(v) Fluid inclusions in ores- Principles, assumptions, limitations and applications.

Unit 2. (i) Ores of sedimentary affiliation in India- chemical and clastic sedimentation, stratiform and stratabound ore deposits (Mn, Fe, nonferrous ores).
(ii) Ores of metamorphic affiliations in India – metamorphism of ores, metamorphic ores.
(iii) Ores related to weathering and weathered surfaces in India – laterite, bauxite, Ni/Au laterite.
(iv) Petrological ore associations with Indian examples wherever feasible – orthomagmatic ores of mafic ultramafic association – diamonds in Kimberlite, REE in carbonatites.
(v) Indian examples of Ti-V ores, chromite, Ni ores, Cyprus type Cu – Zn, ores of silicic igneous rocks and pegmatites, Greisens, skarns, porphyry associations in Indian context.

Unit 3. (i) Definition and origin of kerogen and coal. Rank, grade and type of coal. Indian and international classifications. Chemical characterization: proximate and ultimate analyses.
(ii) Macroscopic ingredients and microscopic constituents, concept of maceral and microlithotypes.
(iii) Preparation of coal for industrial purposes, coal carbonization (coke manufacture), coal gasification and coal hydrogenation.
(iv) Detailed geology of some important coalfields in India.
(v) Coal bed methane: a new energy resource. maturation of coal and generation of methane

Unit 4. (i) Composition of petroleum and its different fractions. Origin, nature and migration of oil and gas. Characteristics of reservoir rocks and trap (structural, stratigraphic and combination).
(ii) Oil bearing basins of India and world. Geology of the productive oilfields of India.
(iii) Atomic minerals as source of energy. Mode of occurrence and association of atomic minerals in nature.
(iv) Atomic mineral deposits of India
(v) Nuclear power stations of the country and future prospects.

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THIRD SEMESTER
Paper- II: Economic Geology

Books Recommended

Chandra, D., Singh, R.M. and Singh, M.P., 2000: Textbook of Coal (Indian Context). Tara Book Agency, Varanasi.
Singh, M.P.(Ed.) 1998: Coal and Organic Petrology. Hindustan Publ. Corp., New Delhi.
Holson and Tiratsoo, E.N.,1985: Introduction to Petroleum Geology. Gulf. Publ. Houston, Texas.
Selley, R.C., 1998: Elements of Petroleum Geology. Academic Press.
Durrance, E.M., 1986: Radioactivity in Geology. Principles and Applications. Ellis Hoorwool.

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1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :

Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note: - 1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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Course Outcome Paper III: Mineral Exploration

At the end of the course, the students will be able to

1. Describe fundamentals of prospecting & exploration and estimate grade and tonnage of ore
2. Discuss geophysical techniques of exploration
3. Explain about borehole logging methods and various surveys done during the course of exploration
4. Describe application of principles of geomorphology, photogeology and remote sensing in mineral exploration and related case studies of various metallic and nonmetallic deposits

THIRD SEMESTER

Paper- III Mineral Exploration

Max. Marks 80 **Min. Marks 16**

Unit 1. (i) Prospecting & Exploration: Definition and characteristic features. Reconnaissance preliminary and detailed investigation, surface and subsurface methods.
(ii) Guides to ore search: global, regional and local guides, detailed study of regional physiographic, stratigraphic, lithological, mineralogical and structural guides. Persistence of ore in depth.
(iii) Drilling: Type of drills, Diamond drilling, Drilling records and logs, Duty of geologists during drilling.
(iv) Sampling: General principles, various methods and procedures, Average assays, weighting of samples, salting. Precautions.
(v) Calculating grade and tonnage of ore: Average grade, volume, specific gravity, tonnage factor, calculations from data obtained from bore holes, prospecting pits, trenches, ore blocks, geological maps and sections.

Unit 2. (i) Gravity Method of prospecting: Basic principles of gravimeter. Gravity field surveys. Various types of corrections applied to gravity data. Preparation of gravity anomaly maps and their interpretation in terms of shape, size and depth.
(ii) Magnetic method of prospecting: Magnetic properties. Magnetic anomaly. Magnetometer. Field survey and data reduction. Preparation of magnetic anomaly maps. Aeromagnetic surveys.
(iii) Seismic prospecting: Fundamentals of seismic wave propagation, Methods of seismic prospecting and interpretation of seismic data.
(iv) Basic principles of resistivity method. Resistivity survey. Application and interpretation of resistivity data. S. P. Method and interpretation of data obtained by S. P. Method.
(v) Radiometric prospecting. Radiometric survey. Application and interpretation of data.

Unit 3. (i) Borehole logging: Principles of various borehole-logging methods,
(ii) Interpretation of borehole log data.
(iii) Geochemical cycle, Forms of primary and secondary dispersion of elements.
(iv) Methods of lithogeochemical and pedogeochemical surveys.
(v) Methods of hydrogeochemical, atmogeochemical and biogeochemical surveys.

Unit 4. (i) Application of geomorphological principles in mineral exploration.
(ii) Application of photogeology in mineral exploration.
(iii) Application of remote sensing techniques in mineral exploration.
(iv) Case studies of exploration of non-metallic mineral deposits.
(v) Case studies of exploration of metallic mineral deposits.

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Books Recommended

Bagchi, T.C., Sengupta, D.K., Rao, S.V.L.N. (1979): Elements of Prospecting and Exploration, Kalyani Publ.
Banerjee, P.K. and Ghosh, S. (1997): Elements of Prospecting for Non-fuel Mineral deposits, Allied Publ.
Dobrin, M.B.,1976: Introduction to Geophysical Prospecting. McGraw Hill.
Parasnis, D.S. 1975: Principles of Applied Geophysics. Chapman and Hall.
Sharma, P.V., 1986: Geophysical Methods in Geology. Elsevier.

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Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
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Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note: 1.Question no. 1 and Question 2 will be compulsory.
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Course Outcome Paper IV: Hydrogeology

At the end of the course, the students will be able to

1. Explain the origin and occurrence, distribution and types of groundwater, Darcy's law and hydrologic properties of rocks
2. Discuss fundamentals of groundwater quality, hydrograph and water table contour map
3. Explain principles of well hydraulics
4. Explain the groundwater exploration methods, water well technology, water management and related techniques

THIRD SEMESTER

Paper- IV Hydrogeology

Max. Marks 80 **Min. Marks 16**

Unit 1. (i) Hydrologic cycle. Ground water: Origin, types, importance, occurrence and movement.
(ii) Groundwater reservoirs and their classification, Classification of aquifers.
(iii) Darcy's law and its validity, Reynold Number and Froude number
(iv) Hydrologic properties of rocks: Porosity, permeability, specific yield, specific retention, transmissivity, storage coefficient.
(v) Renewable and non-renewable groundwater resources.

Unit 2. (i) Ground water quality, various parameters for drinking purpose, for irrigation purpose and industrial use.
(ii) Estimation of ground water quality and methods of treatment for various uses.
(iii) Ground water quality map of India.
(iv) Water contaminants and pollutants: problem of arsenic and fluoride.
(v) Hydrographs, water table contour maps, hydrostratigraphic units, hydrogeology of arid zones and wet lands.

Unit 3. (i) Well Hydraulics: Confined, unconfined, steady, unsteady and radial flow.
(ii) Water level fluctuations: causative factors and their measurement.
(iii) Methods of pumping test and analysis of test data, evaluation of aquifer parameters.
(iv) Artificial recharge of ground water.
(v) Conjunctive use of ground water, problem of overexploitation, groundwater legislation.

Unit 4. (i)Water well technology: Well types, drilling methods, construction, design, development and maintenance of wells.
(ii) Water management in rural and urban areas.
(iii) Surface and subsurface geophysical and geological methods of ground water exploration.
(iv) Hydrogeological mapping using various techniques.
(v) Radio isotopes in hydrogeological studies.

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Books Recommended

Todd, D.K.,1980: Groundwater Hydrology. John Wiley.
Davies, S.N. and Cherry, J.A., 1979: Ground Water. Prentice Hall.
Fetter, C.W., 1990: Applied Hydrogeology. Merill Publishing.
Raghunath, H.M., 1982: Ground Water. Wiley Eastern.
Karanth, K.R., 1987: Groundwater Assessment- Development and Management.
Tata McGraw Hill.
Subramaniyam, V.,2000:Water. Kingston Publ. London.

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(Answer in one or two sentences)

Q.2 Very short answer type question **(02 Marks)**
(Answer in one or two sentences)

Q.3 Short answer type question **(Answer in 200-250 words)** **04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
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   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)

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iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

Course Outcome Lab Course - I

At the end of the course, the students will be able to

1. Demarcate the seismic zones in outline map of India
2. Identify different ores in hand specimen and their associations.
3. Evaluate environmental impact assessment
4. Estimate ore reserves and coal reserves from given data.
5. Describe mineralogical and textural characteristics of common ore minerals under ore microscope.
6. Plot various ore deposits in the outline map of India.

LAB COURSE - I

1. Study of seismic and flood- prone areas in India. Analyses for alkalinity, acidity, pH and electrical conductivity in water samples.
2. Megascopic study of structures and fabrics of different ores and their associations.
3. Presentation of chemical analyses data and plotting chemical classification diagrams.
4. Evaluation of environmental impact assessment of air pollution, ground water, landslides, deforestation, cultivation and building construction in specified areas.
5. Megascopic characterization of banded coals. Proximate analysis of coal.
6. Completion of outcrops in the given map and calculation of coal reserves.
7. Megascopic and microscopic study of cores and well cuttings.
8. Study of geological maps and sections of important oil fields of India and world.
9. Calculation of oil reserves.
10. Study of geological sections of Th-U bearing rocks of the country. Megascopic study of some uranium and thorium bearing minerals and rocks.
11. Mineralogical and textural studies of common ore minerals under ore microscope.
12. Plotting of ore deposits in the outline map of India.

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Course Outcome Lab Course - II

1. Solve problems based on geophysical survey data.
2. Delineate hydrological boundaries on water table contour maps
3. Evaluate aquifer parameters using pumping test data.
4. Analyse Hydrographs.
5. Analyze quality of water using USGS and Piper's diagram

LAB COURSE - II

1. Study of problems based on gravimeter, magnetometer and seismographs.
2. Resistivity survey.
3. Calculation of grade and tonnage of ore: Average grade, volume, specific gravity, tonnage factor, calculations from data obtained from bore holes, prospecting pits, trenches, ore blocks, geological maps and sections.
4. Delineation of hydrological boundaries on water table contour maps
5. Evaluation of aquifer parameters using pumping tests.
6. Analysis of Hydrographs and estimation of infiltration capacity.
7. Chemical analysis of water. Study of quality of water using USGS and Piper's diagram
8. Onsite study of rain water harvesting structure and submission of its report.
9. Onsite study of drilling operation and submission of its report.

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