

DEPARTMENT OF GEOLOGY
COURSE CURRICULUM & MARKING SCHEME

M.Sc.- IV Semester

GEOLOGY

(Based on Choice Based Credit System)

SESSION : 2025-26



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)

Phone : 0788-2212030

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

DEPARTMENT OF GEOLOGY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG (C.G.)
M.Sc. Geology 2025– 2026

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.

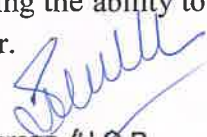
PO6: Environment and sustainability: Understand the impact of the solutions in ethical, societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

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.

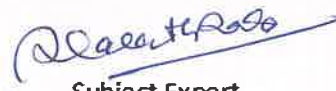
Program Specific Outcomes of M.Sc. Geology

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

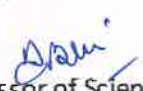
1. Acquire fundamental/systematic or coherent understanding of the academic field of Geology, its different learning areas
2. Demonstrate the ability to use skills in Geology and its related areas of technology for formulating and tackling geosciences-related problems and identifying and applying appropriate 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.

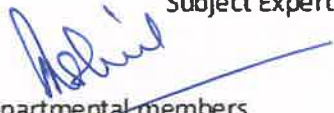

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Syllabus and Marking Scheme for Fourth Semester

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I	Photogeology and Remote Sensing	80	16	20	04	05
II	Engineering Geology and Mineral Beneficiation	80	16	20	04	05
III	Mineral Resource Development and Mining Geology	80	16	20	04	05
IV	Energy Resources	80	16	20	04	05
	Fieldwork/ Dissertation*	100				05
V	Lab Course I	50	17			02
IV	Lab Course II	50	17			02
	Total	440		60		24

* Field Work/ Dissertation (In lieu of theory paper IV Energy Resources) –
 {Project oriented Dissertation - 50 marks + Viva on Dissertation - 50 marks} Total 100 Marks
 The syllabus for M.Sc. Geology is hereby approved for the session 2025-26.

Note: 20 marks = 01 credit in Theory Papers and 25 Marks = 01 Credit in Practical

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: Photogeology and Remote Sensing

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

1. Explain basic principles of photogeology and aerial photography.
2. Discuss elements of remote sensing.
3. Describe application photogeology and remote sensing in geological studies.
4. Explain about the GIS principles and applications and apply tools and techniques of GIS in Geological studies.

FOURTH SEMESTER

Paper-I Photogeology and Remote Sensing

Max. Marks 80

Min. Marks 16

Unit 1. (i) Types and geometry of aerial photograph, tilt and relief distortion.

(ii) Elements of photogrammetry, stereoscopy, stereovision, flight planning. Height and slope rectification of aerial photographs.

(iii) Recognition of photo-elements and terrain elements like tone, texture, pattern, shape, size.

(iv) Terrain elements like drainage pattern, density, type, landform characteristics, erosion behaviour of rocks and soil material, vegetation characteristics, land use and associations.

(v) Photo-interpretation of structural and landform elements, tectonic features, features of glacial, fluvial, coastal, aeolian and denudation landforms.

Unit 2. (i) Electromagnetic energy, electromagnetic spectrum, image characteristics.

(ii) Remote Sensing data products, geometric and radiometric corrections, thermal and microwave remote sensing. Digital Image Processing, Space missions, Indian Remote Sensing Satellites.

(iii) Remote Sensing: data source, platforms and sensors. Acquisition of remote sensing data.

(iv) Remote Sensing techniques in Geosciences: Visual Interpretation of satellite images.

(v) Techniques of image interpretation using spectral, special and temporal information.

Unit 3. (i) Signature of the natural objects.

(ii) Interpretation of lithology: rock types, discrimination of igneous, sedimentary and metamorphic terrain.

(iii) Application of Remote Sensing techniques in site selection of dams, bridges, air strips, roads, tunnels, canals.

(iv) Studies in slope failure, rock failure and soil creep. Study of soils and relationship of rock types and geomorphology to various soil types, soil mapping and land use and land cover mapping.

(v) Forest types, their distribution and relationship of vegetation to rock types. Relationship between vegetation and geomorphic parameters.

Unit 4. (i). Geographic Information System: components, data presentation, vector and raster methods, input and output devices.

(ii) G.I.S. softwares and equipments.

(iii) Database design and structure. Data analysis and cartographic modeling.

(iv) Data representation and techniques of data integration. Digital Elevation Model.

(v) Global Positioning System, principle and applications.

Books Recommended

Miller, V.C., 1961: Photogeology. McGraw Hill.

Sabbins, F.F., 1985: Remote Sensing- Principles and Applications. Freeman

Drury, S.A., 1987: Image interpretation in Geology. Allen and Unwin

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FOURTH SEMESTER

Paper-I Photogeology and Remote Sensing

Lillesand, T.M. and Kieffer, R.W., 1987: Remote Sensing and Image Interpretation. John Wiley.
Pandey, S.N., 1987: Principles and Applications of Photogeology. Wiley Eastern. New Delhi.
Gupta, R.P., 1990: Remote Sensing Geology. Springer Verlag

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: Engineering Geology and Mineral Beneficiation

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

1. Describe engineering properties of rocks and physical characters of building stones and explain role of engineering geology in civil construction and mining industry.
2. Describe various stages of engineering geological investigations for civil engineering projects, associated problems therein and remedies.
3. Explain principles of mineral beneficiation techniques.
4. Describe various mineral beneficiation techniques and flow sheets of common types of mineral and ore dressing practices in India.

FOURTH SEMESTER

Paper-II Engineering Geology and Mineral Beneficiation

Max. Marks 80

Min. Marks 16

Unit 1. (i) Role of engineering geology in civil construction and mining industry.

(ii) Various stages of engineering geological investigations for civil engineering projects.

(iii) Engineering properties of rocks: rock discontinuities.

(iv) Physical characters of building stones. Metal and concrete aggregates.

(v) Case history of engineering projects and geological causes for mishaps and failures of engineering structures.

Unit 2. (i) Geological considerations for evaluation of dam and reservoir sites. Problems in Dams and their remedies.

(ii) Tunnels Method of tunneling: Classification of ground for tunneling purpose. Various types of support. Geotechnical evaluation of tunnel alignments and transport routes.

(iii) Mass movements with special emphasis on landslides and causes of hill slope instability. Seismicity and earthquakes, seismic zones of India.

(iv) Aseismic design of buildings.

(v) Influence of geological conditions on foundation and design of buildings.

Unit 3. (i) General principles, economic justification and scope of mineral dressing.

(ii) Properties of rocks and minerals as applied to mineral dressing.

(iii) Primary and secondary breaking, crushing and grinding, liberation by sizes, reduction.

(iv) Principles and methods of screening.

(v) Principles and methods of classification, classification as a means of concentration.

Unit 4. (i) Concentration methods, hand sorting, washing, jigging, tabling, heavy fluid.

(ii) Properties of rocks and minerals as applied to mineral dressing.

(iii) Magnetic and electrostatic methods of separation of minerals.

(iv) Floatation methods- Principles and techniques with examples.

(v) Concentration methods- with flow sheets of common types of mineral and ore dressing practices in India - Gold, copper, Lead-zinc, coal, beach sand, fluorite, iron, manganese, chromite and limestone.

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FOURTH SEMESTER

Paper-II Engineering Geology and Mineral Beneficiation

Books Recommended

Krynine, D.H. and Judd, W.R. (1998): Principles of Engineering Geology, CBS Publishers
Rider, M. H. (1986): Whittles Publishing, Caithness. The Geological Interpretation of Well Logs, (Rev. Ed.).
Schultz, J.R. and Cleaves, A.B. (1951): Geology in Engineering, John Willey and Sons, New York.
Singh, P. (1994): Engineering and General Geology, S.K. Kataria and Sons, Delhi.

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(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
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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.

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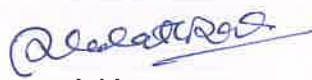
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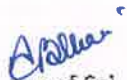
- i. Internal Test in each paper. (20 marks)
- ii. Seminar (Power point presentation) in any one of the paper. (20 marks)
- iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
- iv. Average of marks obtained in internal test + seminar in any one paper and marks 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 Resource Development and Mining Geology

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

1. Understand terms used in mining.
2. Describe the methods of open cast and underground mining.
3. Describe general concepts of RP (Reconnaissance Permit), PL (Prospecting License) and ML (Mining Lease).
4. Understand the components of mining plans.
5. Explain united nation framework classification (UNFC classification) of mineral resource/reserve.

FOURTH SEMESTER

Paper-III Mineral Resource Development and Mining Geology

Max. Marks 80

Min. Marks 16

Unit1. (i) Definition and scope of “mineral development”.

- (ii) General concepts of RP (Reconnaissance Permit), PL (Prospecting License) and ML (Mining Lease), MMDR-Mines & Minerals (Development & Regulation) Act, 1957 and amendments
- (iii) Procedure of obtaining prospecting license or mining lease in which the mineral vest in the government and other than government.
- (iv) Salient features of Mineral concession & Development Rule 1988 and amendments therein. Understanding of reconnaissance, prospecting and mining operations in context of a geologist in them.
- (v) Salient features of Mineral Concession Rules, 1960 and amendments therein. Chhattisgarh Minor Mineral Rules, 2015.

Unit 2. (i) Mining Plan, understanding the components of mining plans, understanding about its approval by appropriate authorities. Progressive and final mine closure plans.

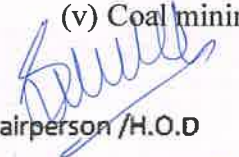
- (ii) Mine planning for major and minor minerals, studies on geologists aspects therein.
- (iii) Study of measures indicated in MCDR about protection of environment.
- (iv) Guidelines under MCDR for united nation framework classification (UNFC classification) of mineral resource/reserve.
- (v) Understanding of economic axis, feasibility axis and geological axis of classification.

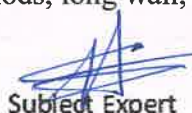
Unit 3. (i) Definition of mining terms: pitting, trenching, panning, adits, tunnels, and shafts.

- (ii) Role of geologist in mining industry.
- (iii) Geological structures of ore deposits and choice of mining methods.
- (iv) Subsidence and rock bursts, mine supports Ventilation and drainage.
- (v) Strata control in different rocks and structures.

Unit 4. (i) Open pit mining- geologic and geomorphic conditions.

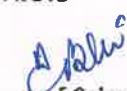
- (ii) Different methods of opencast mining, advantages and limitations.
- (iii) Geological structures of ore deposits and choice of mining methods.
- (iv) Underground mining methods- gophering, shrinkage, stoping, caving and slicing sublevel, over hand, under hand methods.
- (v) Coal mining methods, long wall, board and pillar.

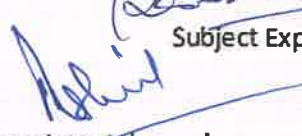

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FOURTH SEMESTER

Paper-III Mineral Resource Development and Mining Geology

Books Recommended

McKinstry, H.E., 1962: Mining Geology. II Ed. Asia Publishing House.

Arogyaswami, R.N.P., 1996: Courses in Mining Geology. IV Ed. Oxford IBH.

Sinha, R.K. and Sharma, N.L. (1976): Mineral economics, Oxford and IBH Publ.

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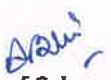
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- iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.


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FOURTH SEMESTER

Course Outcome Paper IV: Energy Resources

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

1. Describe various dimensions of energy and energy scenario.
2. Explain origin, mode of occurrence, exploration, distribution and mining of coal and thermal power production.
3. Explain origin, mode of occurrence, exploration, distribution and exploitation of petroleum.
4. Explain the potential salient features and trends in utilization of various non-conventional sources of energy.

Paper-IV ENERGY RESOURCES

Max. Marks 80

Min. Marks 16

UNIT - 1

- (i) Definition of Energy, Difference between Energy, Power and Electricity.
- (ii) Classification of energy resources. Renewable and Non-Renewable Sources of Energy
- (iii) Social, Economic, Political and Environmental Dimension of Energy.
- (iv) Energy Scenario: Indian and global, Present and future energy demands, Energy crisis.
- (v) Pattern of energy consumption.

UNIT – 2

- (i) Coal: Theories of origin and formation, analysis, classification, washing and carbonization.
- (ii) Geographical and geological distribution of Indian coal deposits.
- (iii) Methods of prospecting and exploration of coal.
- (iv) Major coal mines of India and the mining methods used in India.
- (v) Environmental impact of thermal power plants.

UNIT – 3

- (i) Petroleum: Theories of origin and formation, Generation, migration and accumulation of oil and gas.
- (ii) Concept of petroleum system. Reservoir rocks (clastic and non-clastic reservoir rocks, development and types of porosity in these rocks. Controls of permeability). Petroleum traps. Cap rocks (seals). Prospecting and exploration of petroleum.
- (iii) Oil bearing basins of India. Geology of the offshore and onshore productive oilfields of India.

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FOURTH SEMESTER
Paper-IV ENERGY RESOURCES

- (iv) Radioactive minerals – Mineralogical, geochemical survey techniques.
(v) Distribution of radioactive minerals in India.

UNIT-4

- (i) Sun as Source of Energy, Availability of Solar Energy, Nature of Solar Energy, Solar Energy & Environment. Trends in solar energy utilization.
(ii) Basic properties of wind energy. Applications of wind energy. Trends in wind energy utilization.
(iii) Biomass: Generation and utilization, Properties of biomass, Agriculture Crop & Forestry residues used as fuels. Hydro power: Hydropower generation and distribution in India.
(iv) Geothermal Energy. Recovery of Geothermal Energy, Sustainability of Geothermal Source. Trends in geothermal energy utilization, scope in India.
(v) Tidal and wave energy. Applications of tidal and wave energy. Trends in tidal energy utilization.

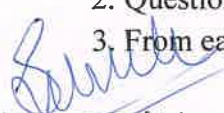
Books Recommended

Solar Energy Handbook: Kreith and Kreider (McGraw Hill)
Energy & Environment – J.M. Fowler, (McGraw Hill)
Energy for a sustainable world: Jose Goldenberg, Thomas Johansson, A.K.N.Reddy,
Renewable energy resources: Tiwari and Ghosal, Narosa publication.
Elements of Petroleum Geology. Selley, R. C. Academic Press, 1998
Coal and Organic Petrology. Singh, M. P. (Ed.) Hindustan Publ. Corp., New Delhi, 1998
Petroleum Formation and Occurrence. Tissot, B. P. and Welte, D. H. Springer Verlag, 1984
Textbook of Coal, (Indian context) Chandra, D. Singh R.M Singh M.P. Tara book agency
Varanasi. 2000

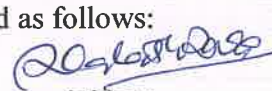
Question Paper Format and Distribution of Marks for PG Semester Examination

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:

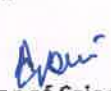
1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows:

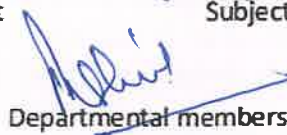

Chairperson /H.O.D


Subject Expert


Subject Expert

Subject Expert


Senior Professor of Science Faculty


Departmental members

Alumnus

Student

DEPARTMENT OF GEOLOGY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG (C.G.)
M.Sc. Geology 2025– 2026

FOURTH SEMESTER
Paper-IV ENERGY RESOURCES

- 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.

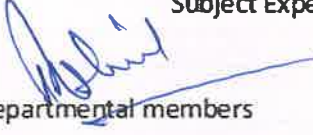

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M.Sc. Geology 2025– 2026

FOURTH SEMESTER
PRACTICALS

Course Outcome Lab Course - I

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

1. Identify terrain elements present on aerial photographs and satellite imageries.
2. Visually interpret satellite imageries.
3. Apply the knowledge of GIS software in geological studies.
4. Apply the knowledge of Global Positioning System device in geological studies.
5. Identify the satellite data for various geological applications.

LAB COURSE – I

1. Study of aerial photographs using pocket and mirror stereoscope.
2. Study of terrain elements present on aerial photographs and satellite imageries.
3. Visual interpretation of satellite imageries.
4. Use of 'Map Info' and 'Surfer' software in Geological studies.
5. Use of Erdas Imagine software in Geological studies.
6. Use of G.P.S.

Course Outcome Lab Course – II

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

1. Classify common rocks with reference to their utility in engineering projects.
2. Construct maps and models of important engineering structures such as dam sites and tunnels.
3. Interpret geological maps for suitability of construction of engineering structures.
4. Illustrate open cast and underground mining methods through diagrams and models.
5. Solve the problems based on resistivity survey data.
6. Explain about the distribution of various energy resources in India and their current status of utilization.

LAB COURSE - II

1. Resistivity survey.
2. Study of properties of common rocks with reference to their utility in engineering projects.
3. Study of maps and models of important engineering structures such as dam sites and tunnels.
4. Interpretation of geological maps for landslide problems.
5. Diagrammatic representation of open cast and underground mining.
6. Exercises on mine sampling and determination of tenor, cut off grades.
7. Demarcation of various coal fields, oil fields and radioactive mineral occurrences on outline map of India.

Chairperson /H.O.D

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