

DEPARTMENT OF GEOLOGY

COURSE CURRICULUM & MARKING SCHEME

M.Sc. GEOLOGY

Semester - II

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 – 2025

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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DEPARTMENT OF GEOLOGY
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Syllabus and Marking Scheme for Second Semester

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I	Igneous Petrology	80	16	20	04	05
II	Sedimentology	80	16	20	04	05
III	Metamorphic Petrology	80	16	20	04	05
IV	Palaeobiology and Stratigraphy	80	16	20	04	05
V	Lab Course I	100	33			04
IV	Lab Course II	100	33			04
	Field Work/Report + Viva	100				04
	Total	620		80		32

Field Work- Every student shall have to undergo geological field work for at least two weeks (14 days) in the Second Semester also. At the end of the Second Semester, each student shall have to submit field report covering all aspects of geological field work for evaluation. It is compulsory for each student to appear in a viva and she/he shall give a presentation on the field work done by him/her.

Marks allotted for field Report: 50

Marks allotted for Viva on field work: 50

Theory	-	320
Internal Assessment	-	80
Practical	-	200
Field work/Report + viva	-	100
Total Marks	-	700

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: Igneous Petrology

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

1. Explain about the concepts of phase equilibria, Bowen's Reaction Series and petrographic province and describe various forms, structures and textures of igneous rocks.
2. Relate behavior of major and trace elements to the evolution of magma.
3. Classify the igneous rocks and describe their megascopic and microscopic characters and discuss their petrogenesis.
4. Summarize the generation of magma with reference to plate tectonics and explain petrogenesis of various igneous rocks.

SECOND SEMESTER

Course code: - MGL 201, Paper- I: Igneous Petrology

Max. Marks 80

Min. Marks 16

- Unit 1.** (i) Principles and general concept of petrology, petrography & petrogenesis.
(ii) Various forms, structures and textures of igneous rocks & their significance in petrogenesis.
(iii) Phase equilibria of unicomponent, Binary (mixed & eutectic) silicate systems.
(iv) Phase equilibria of Ternary (Albite-Anorthite-Diopside and Forsterite- Diopside-Silica) Silicate systems.
(v) Bowen's reaction series. Petrographic Province.
- Unit 2.** (i) Composition of primary magma; mantle mineralogy.
(ii) Factors affecting evolution of magma. Magmatic differentiation processes.
(iii) Partial melting of mantle – different models. Trace element behavior during partial melting.
(iv) Behavior of major and trace elements during fractional crystallization.
(v) Concurrent assimilation and fractional crystallization. Magma mixing.
- Unit 3.** (i) Criteria for classification of the igneous rocks. Factors of chemical composition & mineral composition. Tabular classification. CIPW and Niggli values. Petrogenetic study of the following rock types and their distribution in India:
(ii) Basalt and Ophiolite.
(iii) Peridotite, Komatiite,
(iv) Granite, Anorthosite.
(v) Kimberlite and Lamproite.
- Unit 4.** (i) Rock suite and series. Generation of magma with reference to plate tectonics.
(ii) Petrogenetic study of Carbonatite, Lamprophyre, and their distribution in India.
(iii) Mid-ocean ridge volcanism and oceanic intra-plate volcanism.
(iv) Magmatism associated with subduction related igneous activity- continental and island arc.
(v) Magmatism in Large Igneous Plutons and continental alkaline magmatism.

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M.Sc. Geology 2024 – 2025

Books Recommended

- Turner, F.J., 1980: Metamorphic Petrology. McGraw Hill, New York.
 Yardley, B.W. 1989: An Introduction to Metamorphic Petrology. Longman. New York.
 Philpotts, A., 1992: Igneous and Metamorphic Petrology. Prentice Hall.
 Best, M.G., 1986: Igneous and Metamorphic Petrology, CBS Publishers.
 Bose, M.K., 1997: Igneous Petrology. World Press.
 Winter, J.D., 2001: Igneous and Metamorphic Petrology. Prentice Hall India Ltd.

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: Sedimentology

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

1. Evaluate the role of various sedimentary environments in the formation of sedimentary rocks and evolution of sedimentary basins.
2. Identify various structures and textures of sedimentary rocks and classify the sedimentary rocks on the basis of their megascopic and microscopic characters.
3. Explain various aspects of analysis of sedimentary rocks.
4. Summarize Field and Laboratory techniques in Sedimentology.

SECOND SEMESTER
Paper- II : Sedimentology

Max. Marks 80

Min. Marks 16

- Unit 1.**
- (i) Earth Surface System: Liberation and flux of sediments.
 - (ii) Sedimentary environments. Continental alluvial, fluvial, lacustrine, desert, aeolian and glacial sedimentary systems.
 - (iii) Marine and continental evaporates. Shallow water carbonates. Shallow coastal clastics.
 - (iv) Deep Sea Basins. Volcanoclastics.
 - (v) Evolution of Sedimentary Basins: Tectonics and Sedimentation.
- Unit 2.**
- (i) Textures and structures of sedimentary rocks.
 - (ii) Classification of sedimentary rocks.
 - (iii) Sedimentary facies.
 - (iv) Petrographic description of sedimentary rocks.
 - (v) Evolution of Sedimentary Basins: Tectonics and Sedimentation.
- Unit 3.**
- (i) Palaeocurrent and Basin Analysis.
 - (ii) Palaeoclimate analysis.
 - (iii) Palaeoenvironment analysis
 - (iv) Top and Bottom Criteria.
 - (v) Application of trace element, rare earth element and isotope geochemistry to sedimentological problems.
- Unit 4.**
- (i) Field and Laboratory techniques in Sedimentology, recording of sedimentological structures.
 - (ii) Grain size analysis of sedimentary rocks: Graphic representation of data and calculation of statistical parameters.
 - (iii) Preparation of thin section and staining.
 - (iv) Cathodoluminescence, use of Coulter counter.
 - (v) Heavy minerals in sedimentary rocks and their significance.

Books Recommended

Alen, J.R.L., 1985: Principles of Physical Sedimentation. George Allen and Unwin.

Allen, P., :1997: Erath Surface Processes. Blackwell.

Nichols, G.,1999: Sedimentology and Stratigraphy. Blackwell.

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Pettijohn, F.J., Potter, P.E. and Siever, R., 1990: Sand and Sandstone. Springer Verlag.
 Boggs Sam Jr., 1995: Principles of Sedimentology and Stratigraphy. Prentice Hall.
 Sengupta, S., 1997: Introduction to Sedimentology. Oxford –IBH.

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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)
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Course Outcome Paper- III: Metamorphic Petrology

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

1. Describe agents and types of metamorphism, various types, forms, structures and textures of metamorphic rocks and describe their megascopic and microscopic characters.
2. Explain mineralogical phase rule, ACF, AKF, and AFM, diagrams and various facies.
3. Discuss regional and thermal metamorphism of various groups of rocks and elaborate metamorphic reactions and special types of metamorphism.
4. Explain paired metamorphic belts with reference to Plate Tectonics and influence of P-T conditions on metamorphism.

SECOND SEMESTER

Paper- III: Metamorphic Petrology

Max. Marks 80

Min. Marks 16

- Unit 1.** (i) Metamorphism: Definition, Agents, Types of metamorphism.
(ii) Structures of metamorphic rocks, metamorphic grades, Zones,
(iii) Textures of metamorphic rocks.
(iv) Classification of metamorphic rocks.
(v) Study of important metamorphic rocks- Granulite, Charnockite, Eclogite, migmatites, Khondalite, Gondite.
- Unit 2.** (i) Mineralogical phase rule of closed and open systems.
(ii) Graphic representation of metamorphic mineral assemblages, ACF, AKF, and AFM, diagrams
(iii) Metamorphic Facies,
(iv) Facies of low pressures, medium to high pressure and very high pressure with special reference to characteristic metamorphic zones and subfacies.
(v) Facies of very high pressure with special reference to characteristic metamorphic zones and subfacies.
- Unit 3.** (i) Regional and Thermal metamorphism of mafic, ultramafic rocks, pelitic sediments, and impure calcareous rocks.
(ii) Ocean floor metamorphism.
(iii) Ultra-high Temperature, ultra-high pressure metamorphism.
(iv) Metasomatism and its types.
(v) Retrograde metamorphism.
- Unit 4.** (i) Metamorphic differentiation.
(ii) Anatexis and origin of migmatites in the light of experimental studies.
(iii) Pressure – Temperature – Time paths.
(iv) Paired metamorphic Belts, Regional metamorphism and paired metamorphic belts with reference to Plate Tectonics.
(v) Nature of metamorphic reactions and Pressure-Temperature conditions of metamorphism
Isograd and isoreactiongrad.

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M.Sc. Geology 2024 – 2025

SECOND SEMESTER

Paper- III: Metamorphic Petrology

Books Recommended

- Turner, F.J., 1980: Metamorphic Petrology. McGraw Hill, New York.
Yardley, B.W. 1989: An Introduction to Metamorphic Petrology. Longman. New York.
Philpotts, A., 1992: Igneous and Metamorphic Petrology. Prentice Hall.
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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
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.

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M.Sc. Geology 2024 – 2025

Course Outcome Paper IV: Palaeobiology and Stratigraphy

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

1. Explain fundamental concepts about origin and history of evolution of life and morphology and evolution of Brachiopoda, Echinodermata and Mollusca. Evaluate the principles of Stratigraphy and details of Geological Time scale.
2. Describe morphology and evolution of plant fossils, Trilobites, Graptolites, man and horse.
3. Explain various kinds of stratigraphy and stratigraphic correlation. Describe Indian stratigraphic systems of Archean, Dharwar, Cuddapah, Kurnool, Vindhyan and Aravalli Supergroups.
4. Assess the significance of the Geological Time events of The Paleozoic, Gondwana, Triassic, Jurassic and Cretaceous and the Tertiary Group, Siwaliks, Deccan Trap and boundary problems of various ages.

SECOND SEMESTER

Paper- IV: Palaeobiology & Stratigraphy

Max. Marks 80

Min. Marks 16

Unit 1. (i) Species concept, biometrics, molecular systematics, phylogeny.

(ii) Mechanisms of evolution – origin of life, origin of metazoan.

(iii) Major events in the history of Precambrian and Phanerozoic life.

(iv) Growth and allometry, theoretical and functional morphology and evolutionary trends in Brachiopoda and Echinoderms.

(v) Growth and allometry, theoretical and functional morphology and evolutionary trends in Mollusks.

Unit 2. (i) Growth and allometry, theoretical and functional morphology and evolutionary trends in Trilobites and Graptolites.

(ii) Brief introduction and significance of vertebrate palaeontology and micropalaeontology.

(iii) Evolutionary history of man.

(iv) Evolutionary history of horse.

(v) Significance of plant fossils.

Unit 3. (i) Controls on the development of stratigraphic records.

(ii) Lithostratigraphy and chronostratigraphy, stratigraphic correlation.

(iii) Biostratigraphy – controlling factors, zonation, time significance, quantitative stratigraphy, Magnetostratigraphy.

(iv) Cyclostratigraphy, event stratigraphy, pedomorphology, seismic stratigraphy and sequence stratigraphy.

(v) Indian Precambrian stratigraphic systems of Archean, Dharwar, Cuddapah, Chhattisgarh and Vindhyan Supergroups.

Unit 4. (i) Geological Time events of The Paleozoic, Gondwana in India.

(ii) Geological Time events of Triassic, Jurassic and Cretaceous and the Tertiary Group in India

(iii) Deccan Traps.

(iv) Stratigraphy of Siwaliks in India.

(v) Boundary problems of various ages.

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SECOND SEMESTER
Paper- IV: Palaeobiology & Stratigraphy

Books Recommended

- Clarkson, E.N.K., 1998: Invertebrate Palaeontology and Evolution. IV Ed. Blackwell.
 Jain, P.C., and Anantharaman, M.S., 1996: Palaeontology – Evolution and animal distribution. Vishal Publications.
 Prothero, D.R., 1998: Bringing fossils to life- An Introduction to Palaeobiology. McGrawHill.
 Stearn, C.W. and Carrol, R.L., 1989: Palaeontology- the record of life. John Wiley.
 Boggs Sam Jr., 1995: Principles of Sedimentology and Stratigraphy. Prentice Hall.
 Kumar, Ravindra, 1985 : Fundamentals of Historical Geology and Stratigraphy of India. Wiley Eastern Ltd.
 Naqvi, S.M. and Rogers, J.J.W, 1987: Precambrian Geology of India. Oxford University Press.

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Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
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SECOND SEMESTER
PRACTICALS

Course Outcome Lab Course – I

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

1. Identify various forms, structures and textures of igneous and metamorphic rocks.
2. Draw variation diagrams.
3. Construct ACF, AKF and AFM diagrams.

LAB COURSE – I

1. Megascopic and microscopic study of igneous litho types.
2. Calculation of CIPW Norms.
3. Preparation of variation diagrams.
4. Megascopic and microscopic study of metamorphic rocks of different facies.
5. Graphic construction of ACF, AKF and AFM diagrams.

Course Outcome Lab Course – II

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

1. Identify various sedimentary rocks and primary, secondary and biogenic sedimentary structures in hand specimens, field photographs and outcrops.
2. Prepare rose diagram from palaeocurrent data.
3. Calculate statistical parameters related to Grain size analysis.
4. Identify important fossils from Indian stratigraphic horizons.
5. Plot stratigraphic horizons in the outline map of India.

LAB COURSE – II

1. Megascopic and microscopic identification of sedimentary rocks and study of primary, secondary and biogenic sedimentary structures in hand specimens, field photographs and wherever possible on the outcrops.
2. Exercises related to palaeocurrent data from different environments.
3. Grain size analysis and calculation of statistical parameters.
4. Study of Important fossils from Indian stratigraphic horizons.
5. Exercises on stratigraphic classification and correlation.
6. Plotting of stratigraphic horizons in the outline map of India.
7. Study of rocks and its sequential arrangement according to geological age.

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