

| Session: 2025-26                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |               |
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| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |               |
| Name of Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |               |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |               |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Advanced Igneous and Metamorphic Petrology                                                                                                                                                                                                                                                                                                                                                                                                                   |           |               |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | M24-GGY-301                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |               |
| Course Type                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CC-9                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |               |
| Level of the course                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500-599                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |               |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                  | NIL                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |               |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                           | CLO 301.1: Understand magma genesis and crystallization based on modern experimental studies.<br>CLO 301.2: Understand classification and petrogenesis of igneous rocks.<br>CLO 301.3: Know about mineral assemblages and their stability under different P-T conditions.<br>CLO 301.4: Know about metamorphism under different geological settings.                                                                                                         |           |               |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Theory                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Practical | Total         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0         | 4             |
| Teaching Hours per week                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0         | 4             |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0         | 30            |
| End Term Exam Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 70                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0         | 70            |
| Max. Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0         | 100           |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 hours                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |               |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |               |
| <b>Instructions for Paper- Setter:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks. |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |               |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           | Contact Hours |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Magma generation and emplacement in the crust, mantle and their relation to plate tectonics. Factors affecting magma and evolution of magma (differentiation, assimilation, mixing and mingling). Phase equilibrium of ternary system: (a) Ab-An-Di system, (b) Fo-An-SiO <sub>2</sub> system (c) Fo-Di-SiO <sub>2</sub> and their relation to magma genesis and crystallization in the light of modern experimental work.                                   |           | 15            |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | IUGS classification of plutonic and volcanic rocks. Variation diagrams. CIPW Norms. Texture, chemical composition, distribution and petrogenesis of major igneous rock types such as granite, pegmatite, granodiorite, rhyolite, syenite, diorite, trachyte, andesite, gabbro, basalt, komatiite, alkaline and mono-mineralic rocks.                                                                                                                         |           | 15            |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ACF, AKF, AFM diagrams. A detailed description of each facies of low-pressures, medium- to high- pressures, very high pressure with special reference to characteristic metamorphic zones and sub-facies. Nature of metamorphic reactions and pressure- temperature conditions of metamorphism. Mineral assemblages and application of mineralogical phase rule to metamorphic rocks. Iso-reactiongrad, schreinemakers rule and construction of petrogenetic |           | 15            |

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|                                                         | grids.                                                                                                                                                                                                                                                                                                                                                                                                                    |                          |
| IV                                                      | Metasomatism, metamorphic differentiation. Anatexis and origin of migmatites, granitisation in the light of experimental studies. Regional metamorphism and paired metamorphic belts in reference to plate tectonics. Ultra-high temperature, ultra-high pressure and ocean floor metamorphism. Study of charnockite, khondalites and gondites. Regional and contact metamorphism of pelitic and impure calcareous rocks. | 15                       |
| Total Contact Hours                                     |                                                                                                                                                                                                                                                                                                                                                                                                                           | 60                       |
| Suggested Evaluation Methods                            |                                                                                                                                                                                                                                                                                                                                                                                                                           |                          |
| Internal Assessment: 30                                 |                                                                                                                                                                                                                                                                                                                                                                                                                           | End Term Examination: 70 |
| ➤ Theory                                                | 30                                                                                                                                                                                                                                                                                                                                                                                                                        | ➤ Theory: 70             |
| • Class Participation:                                  | 5                                                                                                                                                                                                                                                                                                                                                                                                                         | Written Examination      |
| • Seminar/presentation/assignment/quiz/class test etc.: | 10                                                                                                                                                                                                                                                                                                                                                                                                                        |                          |
| • Mid-Term Exam:                                        | 15                                                                                                                                                                                                                                                                                                                                                                                                                        |                          |
| Part C-Learning Resources                               |                                                                                                                                                                                                                                                                                                                                                                                                                           |                          |
| 1.                                                      | Igneous and metamorphic petrology, Turner, F.J. and Verhoogen, J., CBS Publishers.                                                                                                                                                                                                                                                                                                                                        |                          |
| 2.                                                      | Igneous petrology, Best, M.G., CBS Publishers.                                                                                                                                                                                                                                                                                                                                                                            |                          |
| 3.                                                      | Igneous and metamorphic petrology, Philipotts,A., Prentice Hall.                                                                                                                                                                                                                                                                                                                                                          |                          |
| 4.                                                      | Igneous petrology, Bose, M.K., World press.                                                                                                                                                                                                                                                                                                                                                                               |                          |
| 5.                                                      | Igneous petrogenesis, Wilson, M., Unwin Hyman Ltd, London.                                                                                                                                                                                                                                                                                                                                                                |                          |
| 6.                                                      | Metamorphic petrology, Turner, F.J., McGraw Hill, NY.                                                                                                                                                                                                                                                                                                                                                                     |                          |
| 7.                                                      | An introduction to metamorphic petrology, Yardley, B.W., Longman, NY.                                                                                                                                                                                                                                                                                                                                                     |                          |
| 8.                                                      | Petrogenesis of metamorphic rocks, Bucher, K. and Frey, M., Springer - Verlag.                                                                                                                                                                                                                                                                                                                                            |                          |
| 9.                                                      | Petrogenesis of metamorphic rocks, Winkler, H.G.F., Narosa publishers, New Delhi.                                                                                                                                                                                                                                                                                                                                         |                          |
| 10.                                                     | Petrography, Williams, H., Turner, F.J. and Gilbert, C.M., CBS Publishers, New Delhi.                                                                                                                                                                                                                                                                                                                                     |                          |
| 11.                                                     | Metamorphic crystallisation, Kretz, R., John Wiley.                                                                                                                                                                                                                                                                                                                                                                       |                          |
| 12.                                                     | Physical chemistry of magmas, Perchuk, L.L. and Kushiro, I. (eds), Springer Verlag.                                                                                                                                                                                                                                                                                                                                       |                          |
| 13.                                                     | Igneous petrology, Mc Birney, A.R., Jones & Bartlet, Publ.                                                                                                                                                                                                                                                                                                                                                                |                          |
| 14.                                                     | A descriptive petrography of igneous rocks, Johansen, A., Allied Pacific Pvt. Ltd, Bombay.                                                                                                                                                                                                                                                                                                                                |                          |
| 15.                                                     | Petrology of metamorphic rocks, Mason, R., CBS publishers.                                                                                                                                                                                                                                                                                                                                                                |                          |
| 16.                                                     | The study of rocks in thin sections, Moorhouse, W.W., CBS publishers.                                                                                                                                                                                                                                                                                                                                                     |                          |
| 17.                                                     | Atlas of igneous rocks and their textures, Mackenzie, W.S., Donaldson, C.H. and Guilford, C., ELBS/Longman                                                                                                                                                                                                                                                                                                                |                          |

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| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |               |
| Name of Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |               |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Geohydrology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |               |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | M24-GGY-302                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |               |
| Course Type                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CC-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |               |
| Level of the course                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500-599                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |               |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                  | Nil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                           | <p>CLO 1: Know about the basics of geohydrology, water quality and need to focus on surface and groundwater.</p> <p>CLO 2: Gain knowledge about the water bearing properties of rocks and their determination, and concepts and measurement of groundwater flow.</p> <p>CLO 3: Know about characteristics of rocks and soils in relation to groundwater, remote sensing in groundwater studies, groundwater exploration, and water well development and drilling.</p> <p>CLO 4: Gain knowledge regarding the basics and applied aspects of geophysical methods in groundwater exploration.</p> |           |               |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Theory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Practical | Total         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0         | 4             |
| Teaching Hours per week                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0         | 4             |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0         | 30            |
| End Term Exam Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0         | 70            |
| Max. Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0         | 100           |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |               |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |               |
| <b>Instructions for Paper- Setter:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |               |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           | Contact Hours |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Introduction to hydrology, geohydrology and hydrogeology, Hydrologic cycle, Water budget on earth, Water balance studies, Origin of groundwater, Springs, their classification and characteristics, Quality of groundwater, drinking water criteria, standards of industrial and agricultural use of water.                                                                                                                                                                                                                                                                                    |           | 15            |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Hydrological properties of water bearing materials: porosity, void ratio, permeability, transmissivity, storativity, specific yield, specific retention, diffusivity, Field and laboratory methods of determination of permeability. Movement of groundwater and aquifer performance tests. Darcy law and its range of validity. Theory of groundwater flow under steady and unsteady conditions, Determination of permeability, transmissivity and storativity by discharging well methods.                                                                                                   |           | 15            |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Mode of occurrence of ground water, Classification of rocks with respect to their water bearing characteristics: aquifers, aquicludes,                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           | 15            |

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|                                                                                               | aquitards, aquifuse, Classification of aquifers, Photogeological and remote sensing studies for water resources evaluation, Groundwater exploration, Water well drilling, Development of wells, Groundwater management, Hydrograph analysis.                                                                |                          |
| IV                                                                                            | Physical properties used for groundwater exploration, Groundwater exploration methods, Resistivity method, concept of apparent and true resistivity, profiling and sounding, range of resistivity values for various rocks and minerals, Application of seismic refraction method for groundwater problems. | 15                       |
| Total Contact Hours                                                                           |                                                                                                                                                                                                                                                                                                             | 60                       |
| Suggested Evaluation Methods                                                                  |                                                                                                                                                                                                                                                                                                             |                          |
| Internal Assessment: 30                                                                       |                                                                                                                                                                                                                                                                                                             | End Term Examination: 70 |
| ➤ Theory                                                                                      | 30                                                                                                                                                                                                                                                                                                          | ➤ Theory: 70             |
| • Class Participation:                                                                        | 5                                                                                                                                                                                                                                                                                                           | Written Examination      |
| • Seminar/presentation/assignment/quiz/class test etc.:                                       | 10                                                                                                                                                                                                                                                                                                          |                          |
| • Mid-Term Exam:                                                                              | 15                                                                                                                                                                                                                                                                                                          |                          |
| Part C-Learning Resources                                                                     |                                                                                                                                                                                                                                                                                                             |                          |
| Recommended Books/e-resources/LMS:                                                            |                                                                                                                                                                                                                                                                                                             |                          |
| 1. A text book of Geomorphology, Worcester, P.G., East West Press.                            |                                                                                                                                                                                                                                                                                                             |                          |
| 2. Ground water Hydrology, David K. Todd., John Wiley and Sons.                               |                                                                                                                                                                                                                                                                                                             |                          |
| 3. Principle of Hydrology, Ward, R.C. and Robinson, M., Tata McGraw Hill.                     |                                                                                                                                                                                                                                                                                                             |                          |
| 4. HandBook of applied Hydrology, Chow, V.T., McGraw Hill.                                    |                                                                                                                                                                                                                                                                                                             |                          |
| 5. Introduction to groundwater hydrology, Heath, R.C. and Trainer, F.W., John Wiley and Sons. |                                                                                                                                                                                                                                                                                                             |                          |
| 6. Hydrology, Meinzer, O.E., Dover.                                                           |                                                                                                                                                                                                                                                                                                             |                          |
| 7. Hydrogeology, Davis, S.N., and Dewiest. R.J.M., John Wiley and Sons.                       |                                                                                                                                                                                                                                                                                                             |                          |
| 8. Ground water, Toman, C.F., McGraw Hill.                                                    |                                                                                                                                                                                                                                                                                                             |                          |
| 9. Hydrology, Wister, C.P. & Brater, E.F., Yoppen Co. Ltd, Tokyo.                             |                                                                                                                                                                                                                                                                                                             |                          |
| 10. Geohydrology, Dewiest, R.J.M., John Wiley and Sons.                                       |                                                                                                                                                                                                                                                                                                             |                          |
| 11. Ground water, Walton, W.C., McGraw Hill.                                                  |                                                                                                                                                                                                                                                                                                             |                          |
| 12. Ground water, Raghunath, H.M., Wiley Eastern Ltd.                                         |                                                                                                                                                                                                                                                                                                             |                          |
| 13. Hydrology, Joya, P. and Reddy Remi, Laxmi Publications, Delhi.                            |                                                                                                                                                                                                                                                                                                             |                          |
| 14. Basic Exploration Geophysics, Robinson, E.S., Wiley.                                      |                                                                                                                                                                                                                                                                                                             |                          |

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| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                        |           |               |
| Name of Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                  |           |               |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III                                                                                                                                                                                                                                                                                                    |           |               |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Coal and Petroleum Geology                                                                                                                                                                                                                                                                             |           |               |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | M24-GGY-303                                                                                                                                                                                                                                                                                            |           |               |
| Course Type                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DEC-1                                                                                                                                                                                                                                                                                                  |           |               |
| Level of the course                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500-599                                                                                                                                                                                                                                                                                                |           |               |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                  | NIL                                                                                                                                                                                                                                                                                                    |           |               |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                           | CLO1: Understand the process of formation of coal and its composition.<br>CLO2: Understand the utilisation of coal and its impact on environment.<br>CLO3: Understand the process of formation hydrocarbon in nature.<br>CLO4: Understand the Applications of microfossils in hydrocarbon exploration. |           |               |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Theory                                                                                                                                                                                                                                                                                                 | Practical | Total         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4                                                                                                                                                                                                                                                                                                      | 0         | 4             |
| Teaching Hours per week                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                                                                                                                                                                                                                                                                                                      | 0         | 4             |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30                                                                                                                                                                                                                                                                                                     | 0         | 30            |
| End Term Exam Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 70                                                                                                                                                                                                                                                                                                     | 0         | 70            |
| Max. Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100                                                                                                                                                                                                                                                                                                    | 0         | 100           |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 hours                                                                                                                                                                                                                                                                                                |           |               |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                        |           |               |
| <b>Instructions for Paper- Setter:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks. |                                                                                                                                                                                                                                                                                                        |           |               |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Topics                                                                                                                                                                                                                                                                                                 |           | Contact Hours |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Introduction to coal, theories of origin of coal, process of coalification. Proximate and ultimate analyses of coal; lithotypes, macerals and micro-lithotypes of coal, coal gasification, coal carbonisation and coal liquefaction.                                                                   |           | 15            |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Geological and geographical distribution of coal deposits in India, Coal as a source of hydrocarbon. Coal Bed Methane (CBM). Coal mining and its impact on the environment.                                                                                                                            |           | 15            |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Kerogen, its composition and origin, transformation of organic matter, diagenesis, ketagenesis and metagenesis. Nature of migration of oil and gas, characteristics of reservoir rocks and traps. Major oil and gas fields of India.                                                                   |           | 15            |

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| IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Hydrocarbon source rock evaluation. Biogenic and thermogenic hydrocarbons. Applications of microfossils in hydrocarbon exploration. Unconventional Resources: oil shale, shale gas, tar sands, gas hydrates. Fractional distillation of petroleum. Environmental impact of hydrocarbons. | 15                       |
| Total Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                          | 60                       |
| Suggested Evaluation Methods                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                          |                          |
| Internal Assessment: 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                          | End Term Examination: 70 |
| ➤ Theory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 30                                                                                                                                                                                                                                                                                       | ➤ Theory: 70             |
| ● Class Participation:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 5                                                                                                                                                                                                                                                                                        | Written Examination      |
| ● Seminar/presentation/assignment/quiz/class test etc.:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 10                                                                                                                                                                                                                                                                                       |                          |
| ● Mid-Term Exam:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 15                                                                                                                                                                                                                                                                                       |                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 5                                                                                                                                                                                                                                                                                        |                          |
| Part C-Learning Resources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                          |                          |
| <div>1. <i>Geology of Petroleum</i>, A.I., W.H. Freeman C. San Francisco.</div> <div>2. <i>Petroleum Geochemistry and Geology</i>, 2ndEdn, Hunt, J.M., W. H. Freeman, San Francisco.</div> <div>3. <i>Petroleum Geology</i>, North, F.K., Unwin Hyman (Pub.), Boston, USA.</div> <div>4. <i>Elements of Petroleum Geology</i>, Richard, C. Selley, Academic Press, London.</div> <div>5. <i>Petroleum Geology</i>. 1983, Developments in Petroleum Science, Ser. 16, Chapman, R.E. Elsevier, Amsterdam.</div> <div>6. <i>Developments in Petroleum Geology</i>, G.D.Hobson (Ed.), Applied Science Publishers, London.</div> <div>7. <i>Textbook of coal</i> (Indian Context), Chandra, D., Singh, R.M. and Singh, M.P., Tata Book Agency, Varanasi.</div> <div>8. <i>Coal and organic Petrology</i>, Singh, M.P. (Ed), Hindustan Publication Ltd, New Delhi</div> <div>9. <i>Text book of Coal Petrology</i>, Stach, E., Mackowsky, M.T.H., Taylor, G.H., Chandra, D., Teichmuller, M., and Teichmuller, R. 1982, Gebruder Borntraeger, Stuttgart.</div> <div>10. <i>Introduction to Petroleum Geology</i>, Holson, G.D. and Tiratsoo, E.N. 1985, Gulf PublicationHouston, Texas</div> <div>11. <i>Petroleum formation and occurrence</i>, Tissot, B.P. andWelte, D.H. 1984, Springer-Verlag</div> <div>12. <i>Elements of Petroleum Geology</i>, Selley, R.C., 1998, AcademicPress.</div> <div>13. <i>Coal Geology and Coal Technology</i>, Ward, C.R. 1984, Blackwell Scientific, Australia.</div> <div>14. <i>Coal Industry in India</i>, Kumarmangalam, S.M. 1973, Oxford and IBH.</div> <div>15. <i>Geology of Petroleum</i>, Levenson, A.I., CBS.</div> <div>16. <i>Introduction to Petroleum Geology</i>, Hobson, G.D., Houston, Texas, U.S.A., Gulf Pub Co.</div> <div>17. <i>Petroleum Geology</i>, Chapman, R.E., Elsevier Science Pub Co.</div> |                                                                                                                                                                                                                                                                                          |                          |

| Session: 2025-26                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                         |           |               |
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| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                         |           |               |
| Name of Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                                                                                                   |           |               |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III                                                                                                                                                                                                                                                                                                                                                                                                     |           |               |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Geoscientific Instrumentation and Analytical Techniques</b>                                                                                                                                                                                                                                                                                                                                          |           |               |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | M24- GGY-304                                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Course Type                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DEC-1                                                                                                                                                                                                                                                                                                                                                                                                   |           |               |
| Level of the course                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500-599                                                                                                                                                                                                                                                                                                                                                                                                 |           |               |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                  | NIL                                                                                                                                                                                                                                                                                                                                                                                                     |           |               |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                           | <p>CLO 1: Gain knowledge about the evolution of technology and instrumentation in the field of Geosciences.</p> <p>CLO 2: knowledge about various sample and slide preparation as well as remote sensing and GIS technique.</p> <p>CLO 3: learn about sedimentology techniques and various spectrometry and spectroscopy.</p> <p>CLO 4: learn about groundwater and engineering geology techniques.</p> |           |               |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Theory                                                                                                                                                                                                                                                                                                                                                                                                  | Practical | Total         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4                                                                                                                                                                                                                                                                                                                                                                                                       | 0         | 4             |
| Teaching Hours per week                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                                                                                                                                                                                                                                                                                                                                                                                                       | 0         | 4             |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30                                                                                                                                                                                                                                                                                                                                                                                                      | 0         | 30            |
| End Term Exam Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 70                                                                                                                                                                                                                                                                                                                                                                                                      | 0         | 70            |
| Max. Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100                                                                                                                                                                                                                                                                                                                                                                                                     | 0         | 100           |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 hours                                                                                                                                                                                                                                                                                                                                                                                                 |           |               |
| Part B-Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                         |           |               |
| <b>Instructions for Paper- Setter:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks. |                                                                                                                                                                                                                                                                                                                                                                                                         |           |               |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Topics                                                                                                                                                                                                                                                                                                                                                                                                  |           | Contact Hours |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Introduction: uses of analytical techniques, evolution with technological development, importance of sophisticated instruments and accurate analysis. Sample and sampling in geosciences, modal count techniques, techniques of photography in geosciences.                                                                                                                                             |           | 15            |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Preparation thin section and polished section making: cutting, grinding and polishing; powder sample preparation crushing & pulverizing. Techniques in microfossils slide preparation. Remote sensing and GIS techniques: aerial photograph studies, image interpretation and classification techniques.                                                                                                |           | 15            |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Sedimentological techniques: sieves & sieve shaking. Sample etching & staining, heavy minerals & clay minerals methods, size & shape of sediments studies. Geochemistry techniques: flame photometer, UV                                                                                                                                                                                                |           | 15            |

|                                                                                                            |                                                                                                                                                                                                                                                                                                                 |                          |
|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|                                                                                                            | spectrophotometer, (AAS) Atomic Absorption Spectrophotometry, ICP-Mass spectrometry, X-ray fluorescence spectrometry, Electron microscopy and electron-probe microanalysis, cathodoluminescence & thermoluminescence spectrometry.                                                                              |                          |
| IV                                                                                                         | Engineering geology techniques & instrumentation: in-situ and lab testing of strength of materials. Hydrogeological techniques & instrumentation: groundwater flow measurement, water quality measurement and water harvesting systems. Geophysical instrumentations: principles, working and data acquisition. | 15                       |
| Total Contact Hours                                                                                        |                                                                                                                                                                                                                                                                                                                 | 60                       |
| Suggested Evaluation Methods                                                                               |                                                                                                                                                                                                                                                                                                                 |                          |
| Internal Assessment: 30                                                                                    |                                                                                                                                                                                                                                                                                                                 | End Term Examination: 70 |
| ➤ Theory                                                                                                   | 30                                                                                                                                                                                                                                                                                                              | ➤ Theory: 70             |
| • Class Participation:                                                                                     | 5                                                                                                                                                                                                                                                                                                               | Written Examination      |
| • Seminar/presentation/assignment/quiz/class test etc.:                                                    | 10                                                                                                                                                                                                                                                                                                              |                          |
| • Mid-Term Exam:                                                                                           | 15                                                                                                                                                                                                                                                                                                              |                          |
| Part C-Learning Resources                                                                                  |                                                                                                                                                                                                                                                                                                                 |                          |
| Recommended Books/e-resources/LMS:                                                                         |                                                                                                                                                                                                                                                                                                                 |                          |
| 1. Laboratory handbook of petrographic techniques, Hutchinson, C. S., John Wiley.                          |                                                                                                                                                                                                                                                                                                                 |                          |
| 2. Using geochemical data, Hugh Rollinson, Routledge.                                                      |                                                                                                                                                                                                                                                                                                                 |                          |
| 3. Modern geotechnical engineering, Alam Singh, IBI Publisher.                                             |                                                                                                                                                                                                                                                                                                                 |                          |
| 4. Geophysical practice in mineral exploration and mapping, T.S. Ramakrishna, Geological Society of India. |                                                                                                                                                                                                                                                                                                                 |                          |



| Session: 2025-26                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                 |               |       |
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| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                 |               |       |
| Name of Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                           |               |       |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III                                                                                                                                                                                                                                                                                                                             |               |       |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Isotope Geochemistry                                                                                                                                                                                                                                                                                                            |               |       |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | M24-GGY-305                                                                                                                                                                                                                                                                                                                     |               |       |
| Course Type                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DEC-1                                                                                                                                                                                                                                                                                                                           |               |       |
| Level of the course                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500-599                                                                                                                                                                                                                                                                                                                         |               |       |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                  | NIL                                                                                                                                                                                                                                                                                                                             |               |       |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                           | CLO 305.1: Know about fundamentals of isotope geochemistry.<br>CLO 305.2: Acknowledge the radiogenic isotope systems and geochronology<br>CLO 305.3: Understand the principle and application of stable isotope geochemistry.<br>CLO 305.4: Understand the application of isotope geochemistry in earth and planetary sciences. |               |       |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Theory                                                                                                                                                                                                                                                                                                                          | Practical     | Total |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4                                                                                                                                                                                                                                                                                                                               | 0             | 4     |
| Teaching Hours per week                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                                                                                                                                                                                                                                                                                                                               | 0             | 4     |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30                                                                                                                                                                                                                                                                                                                              | 0             | 30    |
| End Term Exam Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 70                                                                                                                                                                                                                                                                                                                              | 0             | 70    |
| Max. Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100                                                                                                                                                                                                                                                                                                                             | 0             | 100   |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 hours                                                                                                                                                                                                                                                                                                                         |               |       |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                 |               |       |
| <b>Instructions for Paper- Setter:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks. |                                                                                                                                                                                                                                                                                                                                 |               |       |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Topics                                                                                                                                                                                                                                                                                                                          | Contact Hours |       |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Introduction to isotope geochemistry. Concept of isotopes: Stable vs. Radiogenic isotopes. Atomic structure, isotopic fractionation, and mass spectrometry. Principles of radiogenic and stable isotope systems. Decay schemes, half-life, and radioactive equilibrium. Applications of isotopic systems in geochemistry        | 15            |       |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Principles of radiometric dating. Decay schemes: U-Pb, Rb-Sr, Sm-Nd, K-Ar, Ar-Ar, and Fission track dating. Closure temperature and interpretation of isotopic ages. Isochron method and error analysis. Applications of radiogenic isotopes in crustal evolution, magma genesis, and metamorphism.                             | 15            |       |

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| III                                                                                                                | Principles of stable isotope fractionation (equilibrium and kinetic effects). Oxygen (O), Hydrogen (H), Carbon (C), Nitrogen (N), and Sulfur (S) isotopes in geological processes. Applications in hydrology, paleoclimate studies, and biogeochemical cycles. Isotope geochemistry of fluids, carbonates, and organic matter. Isotopic variations in different geological reservoirs (mantle, crust, atmosphere, hydrosphere) | 15                       |
| IV                                                                                                                 | Isotopic constraints on mantle and crustal evolution. Isotopic evidence for planetary differentiation and meteorites. Biogeochemical cycling of isotopes in the Earth system. Environmental and forensic applications of isotopes. Recent advancements in isotope geochemistry                                                                                                                                                 | 15                       |
| Total Contact Hours                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                | 60                       |
| Suggested Evaluation Methods                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| Internal Assessment: 30                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                | End Term Examination: 70 |
| ➤ Theory                                                                                                           | 30                                                                                                                                                                                                                                                                                                                                                                                                                             | ➤ Theory: 70             |
| • Class Participation:                                                                                             | 5                                                                                                                                                                                                                                                                                                                                                                                                                              | Written Examination      |
| • Seminar/presentation/assignment/quiz/class test etc.:                                                            | 10                                                                                                                                                                                                                                                                                                                                                                                                                             |                          |
| • Mid-Term Exam:                                                                                                   | 15                                                                                                                                                                                                                                                                                                                                                                                                                             |                          |
| Part C-Learning Resources                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| Recommended Books/e-resources/LMS:                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 1. <i>Introduction to Geochemistry</i> , Mason, B. and Moore, C.B., 1991, Wiley Eastern.                           |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 2. <i>Introduction to Geochemistry</i> , Krauskopf, K.B., 1967, McGraw Hill.                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 3. <i>Principles of Isotope Geology</i> , Faure, G., 1986, John Wiley & Sons.                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 4. <i>Stable Isotope Geochemistry</i> , Hoefs, J., 1980, Springer-Verlag.                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 5. <i>Geochemistry</i> , Wedepohl, K.H. Holt, Rinehart and Winston Inc. USA.                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 6. <i>Geochemistry</i> , Brownlow, A.H., Prentice-Hall.                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 7. <i>Inorganic Geochemistry</i> , Henderson, P., Pergamon Press                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 8. <i>Geochemical Thermodynamic</i> , Nordstrom, D.K. and Munoz, J.L., Blackwell.                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 9. <i>Hand book of Exploration Geochemistry</i> , Govett, G.J.S., Elsevier.                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 10. <i>Encyclopedia of Geochemistry</i> , Marshal, C.P. and Fairbridge, R.W. Kluwer Academic.                      |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 11. <i>Using geochemical data</i> , Rollinson, H. Longman Scientific & Technical NY.                               |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 12. <i>Isotopes: Principles and Applications</i> , Faure, G. and Mensing, T. M., 3rd Edn. John Wiley & Sons, 2005. |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 13. <i>Radiogenic Isotope Geology</i> , Dickin, A. P., Cambridge University Press, 1995.                           |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| 14. <i>Isotope Geochemistry</i> , White, M. William, 2014, Wiley – Blackwell.                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |

| Session: 2025-26                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                         |               |       |
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| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                         |               |       |
| Name of Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                   |               |       |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III                                                                                                                                                                                                                                                                                                                     |               |       |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Sequence Stratigraphy                                                                                                                                                                                                                                                                                                   |               |       |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | M24-GGY-306                                                                                                                                                                                                                                                                                                             |               |       |
| Course Type                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DEC-1                                                                                                                                                                                                                                                                                                                   |               |       |
| Level of the course                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500-599                                                                                                                                                                                                                                                                                                                 |               |       |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                  | NIL                                                                                                                                                                                                                                                                                                                     |               |       |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                           | CLO1: Understand the basic principles and concepts of sequence stratigraphy.<br>CLO2: Understand different types of stratigraphy and interpret the various boundaries.<br>CLO3: Understand different Systems tracts and Parasequences.<br>CLO4: Use sequence stratigraphy for basin analysis and petroleum exploration. |               |       |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Theory                                                                                                                                                                                                                                                                                                                  | Practical     | Total |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4                                                                                                                                                                                                                                                                                                                       | 0             | 4     |
| Teaching Hours per week                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                                                                                                                                                                                                                                                                                                                       | 0             | 4     |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30                                                                                                                                                                                                                                                                                                                      | 0             | 30    |
| End Term Exam Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 70                                                                                                                                                                                                                                                                                                                      | 0             | 70    |
| Max. Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100                                                                                                                                                                                                                                                                                                                     | 0             | 100   |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 hours                                                                                                                                                                                                                                                                                                                 |               |       |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                         |               |       |
| <b>Instructions for Paper- Setter:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks. |                                                                                                                                                                                                                                                                                                                         |               |       |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Topics                                                                                                                                                                                                                                                                                                                  | Contact Hours |       |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Definition & overview of sequence stratigraphy. History and concepts of sequence stratigraphy. Basic stratigraphic principles. Overview of global sea-level change and its impact on sedimentation.                                                                                                                     | 15            |       |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Different types of stratigraphy: lithostratigraphy, biostratigraphy, chronostratigraphy, and seismic stratigraphy. Unconformities and sequence boundaries.                                                                                                                                                              | 15            |       |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Introduction to Sequence Boundaries (SB), Transgressive Surfaces (TS), and Maximum Flooding Surfaces (MFS). Systems tracts (lowstand systems tract, transgressive systems tract, highstand systems tract, falling-stage systems tract). Parasequences and parasequence sets.                                            | 15            |       |

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| IV                                                                                                                                                              | Depositional environments (Shorelines, deltas, shelf, deepwater). Well log correlation and interpretation in sequence stratigraphy. Paleoenvironmental reconstruction using sequence stratigraphy. Application of Sequence Stratigraphy in hydrocarbon exploration. | 15                       |
| Total Contact Hours                                                                                                                                             |                                                                                                                                                                                                                                                                     | 60                       |
| Suggested Evaluation Methods                                                                                                                                    |                                                                                                                                                                                                                                                                     |                          |
| Internal Assessment: 30                                                                                                                                         |                                                                                                                                                                                                                                                                     | End Term Examination: 70 |
| ➤ Theory                                                                                                                                                        | 30                                                                                                                                                                                                                                                                  | ➤ Theory: 70             |
| • Class Participation:                                                                                                                                          | 5                                                                                                                                                                                                                                                                   | Written Examination      |
| • Seminar/presentation/assignment/quiz/class test etc.:                                                                                                         | 10                                                                                                                                                                                                                                                                  |                          |
| • Mid-Term Exam:                                                                                                                                                | 15                                                                                                                                                                                                                                                                  |                          |
| Part C-Learning Resources                                                                                                                                       |                                                                                                                                                                                                                                                                     |                          |
| Recommended Books/e-resources/LMS:                                                                                                                              |                                                                                                                                                                                                                                                                     |                          |
| 1. Principles of Sequence Stratigraphy, Catenuanu, O., Elsevier, Amsterdam                                                                                      |                                                                                                                                                                                                                                                                     |                          |
| 2. Sequence Stratigraphy, Emery, D. and Myers, K.J., Blackwell, Oxford, U.K.                                                                                    |                                                                                                                                                                                                                                                                     |                          |
| 3. The Geology of Stratigraphic Sequences, Miall, A.D., Springer-Verlag, Berlin                                                                                 |                                                                                                                                                                                                                                                                     |                          |
| 4. Principles of Sedimentary Basin Analysis, Miall, A.D., 3rd edition, Springer-Verlag, Berlin                                                                  |                                                                                                                                                                                                                                                                     |                          |
| 5. Seismic Stratigraphy- Applications to Hydrocarbon Exploration, Payton, C.E., Memoir of the American Association of Petroleum Geologists 26, Tulsa, Oklahoma. |                                                                                                                                                                                                                                                                     |                          |
| 6. Sequence Stratigraphy: Methodology and Applications, edited by Vail, J. L. and Hardenbol S. M.                                                               |                                                                                                                                                                                                                                                                     |                          |
| 7. Sequence Stratigraphy and Facies Associations, Posamentier, H. W., Willey.                                                                                   |                                                                                                                                                                                                                                                                     |                          |
| 8. Sedimentology and Stratigraphy, Nichols, G., Willey Blackwell.                                                                                               |                                                                                                                                                                                                                                                                     |                          |

| Session: 2025-26                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |               |
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| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |               |
| Name of Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |               |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Engineering Geology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | M24- GGY-307                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |               |
| Course Type                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DEC-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |               |
| Level of the course                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500-599                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |               |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                  | NIL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                           | CLO 1: Understand Soil and rock mechanics.<br>CLO 2: Get to know about Identification and classification of soil properties and soil types.<br>CLO 3: Provide knowledge regarding Investigation and analyses of construction materials, Application of Geology in civil engineering<br>CLO 4: Learn about investigating landslides, slope stability studies, engineering geological applications in assessment of hazard zonation, earthquake, landslide and flood mitigation, engineering geological mapping. |           |               |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Theory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Practical | Total         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0         | 4             |
| Teaching Hours per week                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0         | 4             |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0         | 30            |
| End Term Exam Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0         | 70            |
| Max. Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0         | 100           |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |               |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |               |
| <b>Instructions for Paper- Setter:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course-learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |               |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           | Contact Hours |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Mechanics of rocks- compressive and shear strength, modulus of elasticity, Poisson's ratio, residual stresses, engineering properties of rocks, bearing strength of foundations, strength of discontinuities. Rock mass classification: rock quality design index, rock structure rating, rock mass ratings, rock tunnel quality index, rock mass index and geological strength index.                                                                                                                         |           | 15            |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Mechanics of soils- soil profile, soil description and classifications, Atterberg's limits, porosity, permeability and weathering, swelling and pore pressure of soils, cohesion and friction of soil, shear strength of soils, Mohr's envelope, engineering geological characteristics of sediments and problematic soils.                                                                                                                                                                                    |           | 15            |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Construction materials in practice. Dam: types and their foundations, case histories. Tunnel: classification, method of tunneling and case histories. Application of geological and geophysical methods in civil engineering projects. Role of engineering Geology in planning, designing and constructions of civil engineering projects: dam, tunnel, rail, road and highways, bridges and building.                                                                                                         |           | 15            |

|                                                                                                      |                                                                                                                                                                                                                                                                                 |                          |
|------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| IV                                                                                                   | Landslides, types of rock slope failures, slope stability assessment, Slope mass ratings, causes and consequences of earthquakes and landslides on engineering structures and preventive/mitigation measures, river improvement and flood control. Engineering geological maps. | 15                       |
| Total Contact Hours                                                                                  |                                                                                                                                                                                                                                                                                 | 60                       |
| Suggested Evaluation Methods                                                                         |                                                                                                                                                                                                                                                                                 |                          |
| Internal Assessment: 30                                                                              |                                                                                                                                                                                                                                                                                 | End Term Examination: 70 |
| ➤ Theory                                                                                             | 30                                                                                                                                                                                                                                                                              | ➤ Theory: 70             |
| • Class Participation:                                                                               | 5                                                                                                                                                                                                                                                                               | Written Examination      |
| • Seminar/presentation/assignment/quiz/class test etc.:                                              | 10                                                                                                                                                                                                                                                                              |                          |
| • Mid-Term Exam:                                                                                     | 15                                                                                                                                                                                                                                                                              |                          |
| Part C-Learning Resources                                                                            |                                                                                                                                                                                                                                                                                 |                          |
| Recommended Books/e-resources/LMS:                                                                   |                                                                                                                                                                                                                                                                                 |                          |
| 5. Engineering Geology, Krynine and Judd, CBS publishers.                                            |                                                                                                                                                                                                                                                                                 |                          |
| 6. Soil mechanics, Lambe, T.W. and Whitman, R., Wiley India Pvt Ltd.                                 |                                                                                                                                                                                                                                                                                 |                          |
| 7. Soil mechanics and foundation engineering, Bharath Singh and Shamser Prakash, Nem Chand and Bros. |                                                                                                                                                                                                                                                                                 |                          |
| 8. Soil mechanics, Tsytovich, N.A.,Central Books Ltd.                                                |                                                                                                                                                                                                                                                                                 |                          |
| 9. Design of small dams, Udall, S.L. and Dominy, F.E., United States Govt. Printing Office.          |                                                                                                                                                                                                                                                                                 |                          |
| 10. Manual of Engineering Geology, Blyth, F.G.H. and Freitas, M., CRC Press.                         |                                                                                                                                                                                                                                                                                 |                          |
| 11. Geological Engineering, Luis González de Vallejo and Ferrer, M., CRC Press.                      |                                                                                                                                                                                                                                                                                 |                          |

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| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                          |               |       |
| Name of Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                                                                                    |               |       |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III                                                                                                                                                                                                                                                                                                                                                                                      |               |       |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Computational Geology                                                                                                                                                                                                                                                                                                                                                                    |               |       |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | M24-GGY-308                                                                                                                                                                                                                                                                                                                                                                              |               |       |
| Course Type                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DEC-2                                                                                                                                                                                                                                                                                                                                                                                    |               |       |
| Level of the course                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500-599                                                                                                                                                                                                                                                                                                                                                                                  |               |       |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                  | Nil                                                                                                                                                                                                                                                                                                                                                                                      |               |       |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                           | CLO1: Know about the role of mathematical techniques in geo-sciences with a quick rewind of basic computer concepts.<br>CLO2: Gain knowledge about various methods of data handling and representation.<br>CLO3: Get knowledge of basic concepts of computer language and graphical representation of data.<br>CLO4: Know about statistical techniques and their application in geology. |               |       |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Theory                                                                                                                                                                                                                                                                                                                                                                                   | Practical     | Total |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4                                                                                                                                                                                                                                                                                                                                                                                        | 0             | 4     |
| Teaching Hours per week                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                                                                                                                                                                                                                                                                                                                                                                                        | 0             | 4     |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30                                                                                                                                                                                                                                                                                                                                                                                       | 0             | 30    |
| End Term Exam Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 70                                                                                                                                                                                                                                                                                                                                                                                       | 0             | 70    |
| Max. Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100                                                                                                                                                                                                                                                                                                                                                                                      | 0             | 100   |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 hours                                                                                                                                                                                                                                                                                                                                                                                  |               |       |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                          |               |       |
| <b>Instructions for Paper- Setter:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks. |                                                                                                                                                                                                                                                                                                                                                                                          |               |       |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Topics                                                                                                                                                                                                                                                                                                                                                                                   | Contact Hours |       |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Role of mathematical and numerical techniques in geo-sciences, qualitative and quantitative data in geology; application of computer in general database of geology. Computer system hardware: operating system, DOS and its use.                                                                                                                                                        | 15            |       |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Spreadsheets: workbook, worksheet, cell and cell reference, type of data, Functions and formulas, cell range and reference in formula; protecting worksheets; sorting and filtering data; numerical integration by Simpson's method, trapezoidal method. Utility of open source and other common softwares in calculating statistical parameters and presenting them in graphic manner.  | 15            |       |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Graphs: collection and selection of data, linear and logarithmic scale, linear graphs, 2d and 3d graphs, bar graphs, scatter plots, pie diagrams etc, use of graphs in geoscience. Data types, expressions and statements,                                                                                                                                                               | 15            |       |

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|                                                                                                                                                              | interactive statements, input/output statements subroutine and functions.<br>Utility of Google-Earth software in understanding earth features and<br>geomorphic-tectonic units, least square fit to the given data.                                                                        |                          |
| IV                                                                                                                                                           | Statistical techniques: mean, mode, median, cumulative frequency<br>distribution, skewness & kurtosis, graphical representation on histograms<br>and curves, regression analysis, linear regression, correlation and<br>correlation coefficients, application of these methods in geology. | 15                       |
| Total Contact Hours                                                                                                                                          |                                                                                                                                                                                                                                                                                            | 60                       |
| Suggested Evaluation Methods                                                                                                                                 |                                                                                                                                                                                                                                                                                            |                          |
| Internal Assessment: 30                                                                                                                                      |                                                                                                                                                                                                                                                                                            | End Term Examination: 70 |
| ➤ Theory                                                                                                                                                     | 30                                                                                                                                                                                                                                                                                         | ➤ Theory: 70             |
| • Class Participation:                                                                                                                                       | 5                                                                                                                                                                                                                                                                                          | Written Examination      |
| • Seminar/presentation/assignment/quiz/class test etc.:                                                                                                      | 10                                                                                                                                                                                                                                                                                         |                          |
| • Mid-Term Exam:                                                                                                                                             | 15                                                                                                                                                                                                                                                                                         |                          |
| Part C-Learning Resources                                                                                                                                    |                                                                                                                                                                                                                                                                                            |                          |
| Recommended Books/e-resources/LMS:                                                                                                                           |                                                                                                                                                                                                                                                                                            |                          |
| 1. <i>Statistics of Earth science Data</i> , Borradaile, G.J., Springer.                                                                                     |                                                                                                                                                                                                                                                                                            |                          |
| 2. <i>Elementary Numerical Analysis</i> , Atkinson, K., Han John, W., John Wiley & Sons.                                                                     |                                                                                                                                                                                                                                                                                            |                          |
| 3. <i>Applied Numerical Methods</i> , Yang, W.Y., Cao, W., Chung, T.S., John Wiley & Sons.                                                                   |                                                                                                                                                                                                                                                                                            |                          |
| 4. <i>Numerical Recipes: The Art of Scientific Computing</i> , Press, W.H., Teukolsky, S.A., Vellerling, W.T.,<br>Flannery,B.P., Cambridge University Press. |                                                                                                                                                                                                                                                                                            |                          |
| 5. <i>Statistics and Data Analysis in Geology</i> , Davis, J.C., 3rd Ed., John Wiley & Sons.                                                                 |                                                                                                                                                                                                                                                                                            |                          |
| 6. <i>Computer Oriented Numerical Methods</i> , Rajaraman, V., Prentice Hall of India.                                                                       |                                                                                                                                                                                                                                                                                            |                          |



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| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Name of Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                                                                      |           |               |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III                                                                                                                                                                                                                                                                                                                                                                        |           |               |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Gemology                                                                                                                                                                                                                                                                                                                                                                   |           |               |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | M24-GGY-309                                                                                                                                                                                                                                                                                                                                                                |           |               |
| Course Type                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DEC-2                                                                                                                                                                                                                                                                                                                                                                      |           |               |
| Level of the course                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500-599                                                                                                                                                                                                                                                                                                                                                                    |           |               |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                  | Nil                                                                                                                                                                                                                                                                                                                                                                        |           |               |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                           | CLO 1: Know about the basics of gemology and its significance.<br>CLO 2: Identify and classify rocks and minerals based on various physical properties required for being termed as gemstones.<br>CLO 3: Get to know regarding the distribution of gems in India and world.<br>CLO 4: Gain knowledge regarding the instruments and the techniques applicable in the field. |           |               |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Theory                                                                                                                                                                                                                                                                                                                                                                     | Practical | Total         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4                                                                                                                                                                                                                                                                                                                                                                          | 0         | 4             |
| Teaching Hours per week                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                                                                                                                                                                                                                                                                                                                                                                          | 0         | 4             |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30                                                                                                                                                                                                                                                                                                                                                                         | 0         | 30            |
| End Term Exam Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 70                                                                                                                                                                                                                                                                                                                                                                         | 0         | 70            |
| Max. Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100                                                                                                                                                                                                                                                                                                                                                                        | 0         | 100           |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 hours                                                                                                                                                                                                                                                                                                                                                                    |           |               |
| Part B-Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| <b>Instructions for Paper- Setter:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks. |                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Topics                                                                                                                                                                                                                                                                                                                                                                     |           | Contact Hours |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Physical properties of gems: hardness, color and their causes, transparency, lusture, Mohs scale, cleavage, parting, fracture, specific gravity. Magnetism, pyro-electricity, piezoelectricity and radioactivity in gems. Morphology of crystals.                                                                                                                          |           | 15            |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Basic qualities of gems and gem optics: pleochroism, interference, dispersion, reflection, refraction, strain. Sheen, chatoyancy, asterism, iridescence, adularescence, aventuryscence, opalescence.                                                                                                                                                                       |           | 15            |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Semi-precious, organic and other varieties of gemstones. Various cuts and shapes in gems. Occurrences of precious and semi-precious gemstones in India and world.                                                                                                                                                                                                          |           | 15            |
| IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Gemological instruments and their principle: jewellers lens, microscopes, spectroscope, dichroscope, polariscope, refractometer, UV lamps, Chelsea filter, thermal probes. Advanced gemological instruments: FTIR, Raman spectroscope, DiamondSURE, DiamondVIEW.                                                                                                           |           | 15            |
| Total Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                            |           | 60            |

| Suggested Evaluation Methods                                                                                     |    |                          |    |
|------------------------------------------------------------------------------------------------------------------|----|--------------------------|----|
| Internal Assessment: 30                                                                                          |    | End Term Examination: 70 |    |
| ➤ Theory                                                                                                         | 30 | ➤ Theory:                | 70 |
| •Class Participation:                                                                                            | 5  | Written Examination      |    |
| •Seminar/presentation/assignment/quiz/class test etc.:                                                           | 10 |                          |    |
| •Mid-Term Exam:                                                                                                  | 15 |                          |    |
| PartC-Learning Resources                                                                                         |    |                          |    |
| <b>Recommended Books/e-resources/LMS:</b>                                                                        |    |                          |    |
| 1. <i>Hand book of gem identification</i> , Richard, T. Liddicoat, publishers: Gemological Institute of America. |    |                          |    |
| 2. <i>Working with gemstones</i> , Anton Skuratowicz and Julie Nash, MJSA/AJM Press.                             |    |                          |    |
| 3. <i>A Students’ Guide to Spectroscopy</i> , Colin H. Winter and Hilary Taylor, OPL Press.                      |    |                          |    |

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| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |               |
| Name of Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |               |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Geoexploration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |               |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | M24-GGY-310                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |               |
| Course Type                                                                                                                                                                                                                                                                                                                                                                                                                                                            | DEC-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |               |
| Level of the course                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500-599                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |               |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                  | Nil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                           | <p>CLO1: Students will get introduced to geophysical methods of prospecting along with a detailed study of gravity methods.</p> <p>CLO2: Students will learn about principles, interpretations and applications of magnetic method of prospecting.</p> <p>CLO3: Students will get to know about reflection and refraction of seismic waves and prospecting techniques related to them.</p> <p>CLO4: Students will get acknowledged to principles and applications of electrical and electromagnetic method of prospecting.</p> |           |               |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Theory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Practical | Total         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0         | 4             |
| Teaching Hours per week                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0         | 4             |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0         | 30            |
| End Term Exam Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0         | 70            |
| Max. Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0         | 100           |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |               |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |               |
| <b>Instructions for Paper- Setter:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |               |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           | Contact Hours |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Introduction: overview and importance of various geophysical methods in geological studies, gravity method: basic principles, gravity anomalies, gravimeters, data acquisition procedures, data reduction and processing, interpretation of bouguer anomalies for basic geometrical shapes, depth rules, applications                                                                                                                                                                                                          |           | 15            |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Magnetic method: basic principles, magnetic anomalies, magnetometers, data acquisition procedures, data reduction and processing, interpretation of magnetic anomalies for basic geometrical shapes, depth rules, applications.                                                                                                                                                                                                                                                                                                |           | 15            |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Seismic methods: refraction, reflection and attenuation of seismic waves,                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | 15            |

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|                                                                                                                    | geophones and hydrophones, recording instruments, seismic refraction method, travel time curves for flat interfaces, interpretation of refraction profiles, seismic reflection method, CDP shooting, elementary ideas about processing and interpretation of seismic reflection data: application.                                                                               |                          |
| IV                                                                                                                 | Electrical method: apparent resistivity, sounding and profiling, different electrode configurations, field procedures, resistivity meters, data interpretation using curve matching method, applications. Electromagnetic methods: basic concepts, dip angle techniques, measurement of amplitude and phase, various transmitter and receiver loop configurations, applications. | 15                       |
| Total Contact Hours                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                  | 60                       |
| Suggested Evaluation Methods                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                  |                          |
| Internal Assessment: 30                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                  | End Term Examination: 70 |
| ➤ Theory                                                                                                           | 30                                                                                                                                                                                                                                                                                                                                                                               | ➤ Theory: 70             |
| •Class Participation:                                                                                              | 5                                                                                                                                                                                                                                                                                                                                                                                | Written Examination      |
| •Seminar/presentation/assignment/quiz/class test etc.:                                                             | 10                                                                                                                                                                                                                                                                                                                                                                               |                          |
| •Mid-Term Exam:                                                                                                    | 15                                                                                                                                                                                                                                                                                                                                                                               |                          |
| Part C-Learning Resources                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                  |                          |
| Recommended Books/e-resources/LMS:<br>SUGGESTED BOOKS:                                                             |                                                                                                                                                                                                                                                                                                                                                                                  |                          |
| 1. <i>Applied Geophysics</i> , Telford, W.M., Geldart, L.P. and Sheriff, R.E., Cambridge University Press.         |                                                                                                                                                                                                                                                                                                                                                                                  |                          |
| 2. <i>An Introduction to Geophysical Exploration</i> , Kearey, P. Brooks, M. and Hill, I., Blackwell.              |                                                                                                                                                                                                                                                                                                                                                                                  |                          |
| 3. <i>Principles of Applied Geophysics</i> , Parasnis, D.S., Kearey, P. Brooks, M. and Hill, I., Chapman and Hall. |                                                                                                                                                                                                                                                                                                                                                                                  |                          |
| 4. <i>Introduction to Geophysical Prospecting</i> , Dobrin, M.B. and Savit, C.H., McGraw-Hill.                     |                                                                                                                                                                                                                                                                                                                                                                                  |                          |

| Session: 2025-26                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |               |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------|
| Part A - Introduction                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |               |
| Name of the Programme                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |               |
| Semester                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |               |
| Name of the Course                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Geology Lab-V<br>(Practical based on M24-GGY-301, M24-GGY-302 & Field Work)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |               |
| Course Code                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | M24-GGY-311                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |               |
| Course Type                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | PC-5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Level of the course                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 500-599                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |               |
| Pre-requisite for the course (if any)                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NIL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |               |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | CLO 1. Gain the knowledge of geological mapping, engineering geological assessment of rock masses, slope stability analysis and structural geological studies in the field.<br>CLO 2. Gain the knowledge of working in the field in an organisation with geologists to enhance the skill.<br>CLO 3. Learn the identification and classification of igneous and metamorphic rocks, and to know the analysis of chemical data/composition to classify rocks and graphical representation and studies.<br>CLO 4. Know the graphical and numerical studies and hands-on practice on geological and geophysical equipments for hydrological studies. |           |               |
| Credits                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Theory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Practical | Total         |
|                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4         | 4             |
| Teaching Hours per week                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8         | 8             |
| Internal Assessment Marks                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 30        | 30            |
| End Term Exam Marks                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 70        | 70            |
| Max. Marks                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 100       | 100           |
| Examination Time                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4 hours   |               |
| Part B- Contents of the Course                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |               |
| Practicals                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           | Contact Hours |
|                                                                                              | <b>Compulsory Geological Field Training</b> <ul style="list-style-type: none"><li>Geological Mapping</li><li>Measurement of Attitude of planar and linear structures</li><li>Engineering rock mass classification</li><li>Identification of rocks and minerals</li><li>Stratigraphy of the rocks in the field</li><li>Identification of Structures in the field</li><li>Industrial Visit/s: Mining/Tunnel/Dam/Highway etc.</li><li>Other field aspects.</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           | 120           |
|                                                                                              | <b>Practical based on M24-GGY-301 (Advanced Igneous and Metamorphic Petrology)</b> <ul style="list-style-type: none"><li>Calculate the CIPW norm from a given chemical composition of an igneous rock.</li><li>Calculation of mineral formula by using the given geochemical data.</li></ul>                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |               |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"><li>Interpret ternary phase diagrams (Ab-An-Di, Fo-An-SiO<sub>2</sub>, and Fo-Di-SiO<sub>2</sub>) to understand</li><li>magma crystallization sequences.</li><li>Identify and describe the major igneous and metamorphic rocks in hand specimen.</li><li>Identify and classify major igneous and metamorphic rocks under a polarizing microscope.</li><li>Plot mineral assemblages of metamorphic rocks on ACF, AKF, and AFM diagrams and determine metamorphic facies.</li><li>Identify metamorphic facies from mineral assemblages and construct a petrogenetic grid.</li><li>Interpretation of geochemical data using variation diagrams.</li></ul> <p><b>Practical based on M24-GGY-302 (Geohydrology)</b></p> <ul style="list-style-type: none"><li>Preparation and interpretation of water table contour map and depth of water table maps.</li><li>Chemical quality maps, hydrographic maps.</li><li>Analytical instruments and their uses</li><li>Interpretation of hydro-geochemical data</li><li>Evaluation of hydrological parameters of aquifers, processing and interpretation of pumping test data.</li><li>Numerical and graphical exercises.</li><li>To perform resistivity survey for acquisition, processing and interpretation of groundwater data.</li></ul> |                                                                |
| <b>Suggested Evaluation Methods</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                |
| <b>Internal Assessment: 30</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>End Term Examination: 70</b>                                |
| ➤ <b>Practicum</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>30</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ➤ <b>Practicum</b> <b>70</b>                                   |
| •Class Participation:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Lab record, Viva-Voce, write-up and execution of the practical |
| •Seminar/Demonstration/Viva-voce/Lab records etc.:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                |
| •Mid-Term Exam:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                |
| <b>Part C-Learning Resources</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                |
| <ol style="list-style-type: none"><li><i>HandBook of applied Hydrology</i>, Chow, V.T., McGraw Hill.</li><li><i>Hydrology</i>, Meinzer, O.E., Dover.</li><li><i>Problem Solving in Engineering Hydrology</i>, Faris Gorashi Faris &amp; Isam Mohammed Abdel-Magid, University of Dammam Press.</li><li><i>Ground water Hydrology</i>, David K. Todd., John Wiley and sons.</li><li><i>Hydrogeology</i>, Davis, S.N., and Dewiest. R.J.M., John Wiley and Sons.</li><li><i>Ground water</i>, Toman, C.F., McGraw Hill.</li><li><i>Geohydrology</i>, Dewiest, R.J.M., John Wiley and Sons.</li><li><i>Ground water</i>, Walton, W.C., McGraw Hill.</li><li><i>Ground water</i>, Raghunath, H.M., Wiley Eastern Ltd.</li><li><i>Hydrology</i>, Joya, P. and Reddy Remi, Laxmi Publications, Delhi.</li><li><i>Basic Exploration Geophysics</i>, Robinson, E.S., Wiley.</li><li><i>A descriptive petrography of igneous rocks</i>, Johansen, A., Allied Pacific Pvt. Ltd, Bombay.</li><li><i>Petrology of metamorphic rocks</i>, Mason, R., CBS publishers.</li><li><i>The study of rocks in thin sections</i>, Moorhouse, W.W., CBS publishers.</li><li><i>Atlas of igneous rocks and their textures</i>, Mackenzie, W.S., Donaldson, C.H. and Guilford, C., ELBS/Longman</li></ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                |

| Session: 2025-26                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |               |
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| Part A - Introduction                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |               |
| Name of the Programme                                                                        | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |               |
| Semester                                                                                     | III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |               |
| Name of the Course                                                                           | Geology Lab-VI<br>(Practical based on DEC-1 & DEC-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |               |
| Course Code                                                                                  | M24-GGY-312                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |               |
| Course Type                                                                                  | PC-6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |               |
| Level of the course                                                                          | 500-599                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |               |
| Pre-requisite for the course (if any)                                                        | NIL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |               |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to: | CLO 1. Learn the identification of coal microconstituents and types of kerogens for source rock evaluation, and to identify the relationship between facies & sea level fluctuations.<br>CLO 2. Gain the knowledge about the instruments used in geosciences, and concepts and application of isotope geochemistry.<br>CLO 3. Gain knowledge about the engineering geological techniques for field and laboratory studies.<br>CLO 4. Learn to use statistical and computer knowledge in geology and to learn the identification of gems. Use of geological and geophysical techniques in geoexploration.                                                                                                                                                               |           |               |
| Credits                                                                                      | Theory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Practical | Total         |
|                                                                                              | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4         | 4             |
| Teaching Hours per week                                                                      | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8         | 8             |
| Internal Assessment Marks                                                                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 30        | 30            |
| End Term Exam Marks                                                                          | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 70        | 70            |
| Max. Marks                                                                                   | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 100       | 100           |
| Examination Time                                                                             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4 hours   |               |
| Part B- Contents of the Course                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |               |
| Practicals                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | Contact Hours |
|                                                                                              | DEC-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           | 120           |
|                                                                                              | <b>Practical Based on M24-GGY-303 (Coal and Petroleum Geology)</b> <ul style="list-style-type: none"><li>• Identification of coal in hand specimen.</li><li>• Geological and Distribution of coal in India.</li><li>• Geological and Distribution of lignite in India.</li><li>• Numerical exercises based on Proximate and ultimate analyses of coal.</li><li>• Maceral analyses of coal</li><li>• Lithotype analyses</li><li>• Distribution of oil and gas fields.</li><li>• Petroliferous Basins of India.</li><li>• Exercises based on Kerogen.</li><li>• Palynofacies analyses.</li><li>• Maturation based on visual estimation of organic matter (TAI)</li></ul> <b>Practical Based on M24-GGY-304 (Geoscientific Instrumentation and Analytical Techniques)</b> |           |               |

Analytical techniques used for:

- Microfossils slide preparation techniques.
- Rock thin section and slide preparation.
- Sample digestion procedures in geochemistry.
- Exercise on sedimentological techniques.

Hands on practice on

- Sieve shaker for grain size analysis.
- Uniaxial compressive strength machine for determination of UCS for rock specimens.
- Direct shear testing machine for determination of shear strength.
- Vane shear apparatus for determination of shear strength.
- pH meter, Eh meter, Turbidity meter, TDS meter, Moisture meter for Hydrogeological parameter evaluation.
- UV spectrophotometer.
- Fluorescent Microscope.
- Polarising microscope.
- Aqua meter CRM 500.

#### **Practical Based on M24-GGY-305 (Isotope Geochemistry)**

- Examine isotopic data and interpret stable and radiogenic isotope compositions.
- Use given isotopic data to construct isochron diagrams, calculate ages, and analyze decay curves.
- Interpret  $\delta^{18}\text{O}$ ,  $\delta^{13}\text{C}$ , and  $\delta^{34}\text{S}$  values from given datasets and assess their significance in paleoclimate, hydrology, and biogeochemistry.
- Examine isotopic data from different reservoirs and interpret their significance in planetary differentiation and geochemical cycling.
- Analyze isotopic compositions of water, soil, or organic samples and determine contamination sources or biological origins.

#### **Practical Based on M24-GGY-306 (Sequence Stratigraphy)**

- Interpret Stratigraphic Records.
- Identification and classification of sequence boundaries and systems tracts.
- Stratigraphic Interpretation from Core Data.
- Lithostratigraphic and Biostratigraphic data Interpretation in sequence Stratigraphy.
- Recognize how sedimentary facies change as a result of sea-level variations.
- Core description and classification.
- Log and Well-Data Interpretation using well logs (e.g., gamma-ray, resistivity, sonic).
- Log correlations and sequence boundary identification.
- Seismic Interpretation in Sequence Stratigraphy.
- Integration of geological data (well logs, core, seismic).
- Sequence Stratigraphy and Paleogeographic Reconstruction.
- Sea-Level Curve Construction.



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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------------------------|-----------|
| <b>DEC-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |                                 |           |
| <p><b>Practical Based on M24-GGY-307 (Engineering Geology)</b></p> <ul style="list-style-type: none"> <li>• Analysis of stress-strain diagrams of different rock types and soil.</li> <li>• Problems related to foundations and soil properties: Atterberg's Limits.</li> <li>• Identification of building materials/stones for various constructions.</li> <li>• Study of maps and models of important engineering structures/dam sites and tunnels, engineering geological maps.</li> <li>• Assessment of mode of failure of rock slopes.</li> <li>• To determine RQD through core recovery and volumetric joint count methods</li> <li>• To evaluate rock mass rating and classify rock mass.</li> <li>• To classify rock mass as per engineering rock mass classification schemes.</li> <li>• Soil/rock slope stability analysis.</li> <li>• Laboratory test for Uniaxial Compressive Strength for rocks.</li> </ul> <p><b>Practical Based on M24-GGY-308 (Computational Geology)</b></p> <ul style="list-style-type: none"> <li>• MS Excell and Spreadsheets for solving mathematical and statistical problems in earth science.</li> <li>• MS Excell and Spreadsheets used in statistical exercises based on geo-scientific data.</li> <li>• Creating graphs from tabular data: linear, 2d and 3d.</li> <li>• Trigonometry: dip, apparent dip, strike, slope and other related problems.</li> <li>• Preparation of lithologs on RockWorks and Corel Draw software.</li> </ul> <p><b>Practical Based on M24-GGY-309 (Gemology)</b></p> <ul style="list-style-type: none"> <li>• Identification of physical properties of gems.</li> <li>• Identification of optical properties of gems under microscope.</li> <li>• Identification of physical properties of organic gems.</li> <li>• Identification physical properties of other varieties of gems.</li> <li>• Hands on Jeweller's Lens.</li> <li>• Identification of gems under stereo zoom microscope.</li> </ul> <p><b>Practical Based on M24-GGY-310 (Geoexploration)</b></p> <ul style="list-style-type: none"> <li>• Numerical, logs and other exercises based upon gravity method</li> <li>• Numerical, logs and other exercises based upon magnetic method</li> <li>• Exercises based upon magnetic method Seismic methods: refraction, reflection like; numerical, logs etc.</li> <li>• Field based survey, numerical and other exercises based on apparent resistivity</li> </ul> |           |                                 |           |
| <b>Suggested Evaluation Methods</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |                                 |           |
| <b>Internal Assessment: 30</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           | <b>End Term Examination: 70</b> |           |
| ➤ <b>Practicum</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>30</b> | ➤ <b>Practicum</b>              | <b>70</b> |

|                                                     |    |                                                                |
|-----------------------------------------------------|----|----------------------------------------------------------------|
| • Class Participation:                              | 5  | Lab record, Viva-Voce, write-up and execution of the practical |
| • Seminar/Demonstration/Viva-voce/Lab records etc.: | 10 |                                                                |
| • Mid-Term Exam:                                    | 15 |                                                                |

### Part C-Learning Resources

1. *Engineering Geology*, Krynine and Judd, CBS publishers.
2. *Soil mechanics*, Lambe, T.W. and Whitman, R., Wiley India Pvt Ltd.
3. *Soil mechanics and foundation engineering*, Bharath Singh and Shamser Prakash, Nem Chand and Bros.
4. *Design of small dams*, Udall, S.L. and Dominy, F.E., United States Govt. Printing Office.
5. *Manual of Engineering Geology*, Blyth, F.G.H. and Freitas, M., CRC Press.
6. *Geological Engineering*, Luis González de Vallejo and Ferrer, M., CRC Press.
7. *Applied Geophysics*, Telford, W.M., Geldart, L.P. and Sheriff, R.E., Cambridge University Press.
8. *An Introduction to Geophysical Exploration*, Kearey, P. Brooks, M. and Hill, I., Blackwell.
9. *Textbook of coal (Indian Context)*, Chandra, D., Singh, R.M. and Singh, M.P., Tata Book Agency, Varanasi.
10. *Text book of Coal Petrology*, Stach, E., Mackowsky, M.T.H., Taylor, G.H., Chandra, D., Teichmuller, M., and Teichmuller, R. 1982, Gebruder Borntraeger, Stuttgart.
11. *Petroleum formation and occurrence*, Tissot, B.P. and Welte, D.H. 1984, Springer-Verlag
12. *Geology of Petroleum*, Levenson, A.I., CBS.
13. *Principles of Sequence Stratigraphy*, Catenuanu, O., Elsevier, Amsterdam
14. *The Geology of Stratigraphic Sequences*, Miall, A.D., Springer-Verlag, Berlin
15. *Principles of Sedimentary Basin Analysis*, Miall, A.D., 3rd edition, Springer-Verlag, Berlin
16. *Seismic Stratigraphy- Applications to Hydrocarbon Exploration*, Payton, C.E., Memoir of the American Association of Petroleum Geologists 26, Tulsa, Oklahoma.
17. *Sequence Stratigraphy and Facies Associations*, Posamentier, H. W., Wiley.
18. *Laboratory handbook of petrographic techniques*, Hutchinson, C. S., John Wiley.
19. *Using geochemical data*, Hugh Rollinson, Routledge.
20. *Modern geotechnical engineering*, Alam Singh, IBI Publisher.
21. *Geophysical practice in mineral exploration and mapping*, T.S. Ramakrishna, Geological Society of India.
22. *Hand book of Exploration Geochemistry*, Govett, G.J.S., Elsevier.
23. *Using geochemical data*, Rollinson, H. Longman Scientific & Technical NY.
24. *Isotopes: Principles and Applications*, Faure, G. and Mensing, T. M., 3rd Edn. John Wiley & Sons, 2005.
25. *Isotope Geochemistry*, White, M. William, 2014, Wiley – Blackwell.
26. *Statistics of Earth science Data*, Borradaile, G.J., Springer.
27. *Elementary Numerical Analysis*, Atkinson, K., Han John, W., John Wiley & Sons.
28. *Applied Numerical Methods*, Yang, W.Y., Cao, W., Chung, T.S., John Wiley & Sons.
29. *Numerical Recipes: The Art of Scientific Computing*, Press, W.H., Teukolsky, S.A., Vetterling, W.T., Flannery, B.P., Cambridge University Press.
30. *Statistics and Data Analysis in Geology*, Davis, J.C., 3rd Ed., John Wiley & Sons.
31. *Computer Oriented Numerical Methods*, Rajaraman, V., Prentice Hall of India.
32. *Hand book of gem identification*, Richard, T. Liddicoat, publishers: Gemological Institute of America.
33. *Working with gemstones*, Anton Skuratowicz and Julie Nash, MJSA/AJM Press.
34. *A Students' Guide to Spectroscopy*, Colin H. Winter and Hilary Taylor, OPL Press.

| Session: 2025-26                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                            |                          |               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------|
| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                            |                          |               |
| Name of Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M.Sc. Applied Geology                                                                                                                                                                                                                                                                                                                                                                                      |                          |               |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III                                                                                                                                                                                                                                                                                                                                                                                                        |                          |               |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                     | GEOSCIENCE AND SOCIETY                                                                                                                                                                                                                                                                                                                                                                                     |                          |               |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | M24-OEC-318                                                                                                                                                                                                                                                                                                                                                                                                |                          |               |
| Course Type                                                                                                                                                                                                                                                                                                                                                                                                                                                            | OEC                                                                                                                                                                                                                                                                                                                                                                                                        |                          |               |
| Level of the course                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 500-599                                                                                                                                                                                                                                                                                                                                                                                                    |                          |               |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                  | Nil                                                                                                                                                                                                                                                                                                                                                                                                        |                          |               |
| Course Learning Outcomes (CLO)<br>After completing this course, the learner will be able to:                                                                                                                                                                                                                                                                                                                                                                           | CLO1: Students will get introduced to geosciences and know about Earth’s history; natural processes related etc.<br>CLO2: Students will learn about natural resources and their significance, like water, mineral resources etc.                                                                                                                                                                           |                          |               |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Theory                                                                                                                                                                                                                                                                                                                                                                                                     | Practical                | Total         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2                                                                                                                                                                                                                                                                                                                                                                                                          | 0                        | 2             |
| Teaching Hours per week                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2                                                                                                                                                                                                                                                                                                                                                                                                          | 0                        | 2             |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                              | 15                                                                                                                                                                                                                                                                                                                                                                                                         | 0                        | 15            |
| End Term Exam Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 35                                                                                                                                                                                                                                                                                                                                                                                                         | 0                        | 35            |
| Max. Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50                                                                                                                                                                                                                                                                                                                                                                                                         | 0                        | 50            |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 hours                                                                                                                                                                                                                                                                                                                                                                                                    |                          |               |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                            |                          |               |
| <b>Instructions for Paper- Setter:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks. |                                                                                                                                                                                                                                                                                                                                                                                                            |                          |               |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Topics                                                                                                                                                                                                                                                                                                                                                                                                     |                          | Contact Hours |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Introduction to Geo-science and its various branches, Earth and its place in the solar system. Origin and structure of Earth. Geological time scale. Origin and evolution of life through Earth history. Elementary idea of rocks, their types, rock cycle, minerals and gemstones. Elementary idea of various Earth processes, continental drift and plate tectonics. Orogenic and epeirogenic movements. |                          | 15            |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Elementary idea of geological considerations in site evaluation of engineering, construction, mining and other geological works. Environmental changes through the Earth history. Significance of earth resources to mankind and society. Hydrological cycle and water budget of an Earth.                                                                                                                 |                          | 15            |
| Total Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                            |                          | 30            |
| Suggested Evaluation Methods                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                            |                          |               |
| Internal Assessment: 15                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                            | End Term Examination: 35 |               |
| ➤ Theory                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 15                                                                                                                                                                                                                                                                                                                                                                                                         | ➤ Theory:                | 35            |
| • Class Participation:                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4                                                                                                                                                                                                                                                                                                                                                                                                          | Written Examination      |               |
| • Seminar/Demonstration/Viva-voce/Lab records etc.:                                                                                                                                                                                                                                                                                                                                                                                                                    | 4                                                                                                                                                                                                                                                                                                                                                                                                          |                          |               |

• Mid-Term Exam:

7

### **Part C-Learning Resources**

#### **Recommended Books/e-resources/LMS:**

##### **SUGGESTED BOOKS:**

1. *Understanding the Earth*, Press, F. and Siever, R., W.H. Freeman & Co.
2. *Palaeontology*, Jain, P.C. and Anantharaman, M.S., Vishal Publishing Co.
3. *An Introduction to Physical Geology, Eleventh Edition*, Tarbuck, Lutgens and Tasa, Pearson Publication.
4. *Principles of engineering Geology and Geotechnics*, Krynine/Judd., Jain Book Agency.
5. *Ground water Hydrology*, Todd David K., PHI Learning.