

Institute of Hydrocarbon, Energy and Geo-Resources, ONGC Centre of Advanced Studies, University of Lucknow, is running a M.Sc. Course in Applied Geology (with specialization in Petroleum Geosciences) and a Post-Graduate Diploma in Exploration, Resources and Mining Technology. It is also planning to start a Ph. D. Course, Diploma Modules in different branches of earth science, training and expert guidance to Governmental and Non-Governmental Organisations. The details of the M.Sc. Applied Geology (with specialization in Petroleum Geosciences) Course from the Session 2019-2020 are as follows:

**M. SC. IN APPLIED GEOLOGY**  
**(With Specialization in Petroleum Geosciences)**

The revised syllabus for M.Sc. in Applied Geology (with specialization in Petroleum Geosciences), will be applicable for students enrolled in July 2019 and onwards.

**Eligibility of Candidates for admission to M.Sc. Programme in Applied Geology:**

Candidates who have passed the **three years** B.Sc. examination of the University of Lucknow or any other equivalent examination of other universities (considered as equivalent by the University of Lucknow) with at least aggregate 45% marks or equivalent CGPA with **Geology** at graduate level and/or 50% marks or equivalent CGPA with any two of the following subjects: (a) Chemistry, (b) Physics, (c) Mathematics and (d) Life Sciences (*Zoology and/ or Botany*), (e) B.Tech./ B.E. at the U.G. level, will be considered eligible for the Entrance Test.

This is a **Self-Financing Course** with an intake of **25 seats** per annum. The fee structure will be **Rs.30,000 per Semester**.

Admission to the Four Semester M.Sc. Programme in Applied Geology (with specialization in Petroleum Geosciences), for the eligible candidates, will be based on performance in the Entrance Test and as per Lucknow University rules. The Test Paper, will be in English only and will be of U.G. level of the University of Lucknow in Geology, mainly Physical Geology, Physiography of India, Natural Hazards, Economic Geology, Remote Sensing and Environmental Geology.

**Syllabus and Evaluation for M.Sc. Programme in Applied Geology:**

The M.Sc. Programme in Applied Geology shall be imparted to the selected students for two academic sessions consisting of four semesters as given below. Candidates will be examined through **Continuous Internal Assessment** and evaluated at the end of each semester in the different courses of **Theory, Practical, Field Work and Project work**, as per the details and marks given against each course of study. The papers will be set in English, and the students will be required to answer the questions in English only.

The attendance in the Fieldwork/ Industrial Visit/ Industrial Training will be compulsory for all the students, after which the students will be required to submit a detailed report to the concerned teacher(s) for evaluation. The field work will be conducted during the second and fourth semesters. The semester breaks/ holidays/recess can also be utilized for the theory and practical classes as well for the geological field work etc.

The different courses as detailed below shall be taught in the Four Semesters, and there shall be Written Papers, a Practical Examination, Project work/ Field work/ Industrial Study/ Industrial Training, Semester Assignment Evaluation in each Semester. Viva-Voce examination will be held along with the Practical Examinations. Field Reports/ Semester Assignments will be evaluated as a part of the examination.

**INSTITUTE OF HYDROCARBON, ENERGY AND GEO-RESOURCES**  
**ONGC CENTRE OF ADVANCED STUDIES,**  
**UNIVERSITY OF LUCKNOW, LUCKNOW- 226007**

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**Students are required to have a minimum of 75% attendance to be eligible to appear in the examination.**

**Evaluation in the Four Semesters:**

For the **Continuous Internal Assessment** of the candidates, 30 marks shall be awarded by the teacher(s), teaching that Paper, for which the breakup of the marks will be as follows:

Class Test(s) /Assignment(s)/ Presentation(s)/ Class Participation **30 marks**

For the **Semester End Examination**, the question paper for each course will be of 70 marks and consist of TWO Units. Unit- I shall be COMPULSORY, and have five short answer type questions. Unit II will have multiple questions (descriptive type) out of which the candidates will be required to attempt any three or four questions. The duration of the examination shall be of three hours. Non-programmable scientific calculators or simple calculators will be allowed in the Semester examinations.

**Course-wise details of the Four Semesters:**

<u>COURSES</u>		Internal Assessment Marks	Semester End Examination Marks	Total	
				Credits	Marks
<b>SEMESTER I*</b>					
<b>AG-11</b>	Basics of Earth Sciences	30	70	<b>4</b>	<b>100</b>
<b>AG-12</b>	Sedimentology	30	70	<b>4</b>	<b>100</b>
<b>AG-13</b>	Stratigraphy	30	70	<b>4</b>	<b>100</b>
<b>AG-14</b>	Mineralogy, Crystallography & Igneous Petrology	30	70	<b>4</b>	<b>100</b>
<b>AG-15</b>	<b>Practical:</b> Laboratory Work & Viva-voce			<b>4</b>	<b>100</b>
<b>AG-16</b>	<b>Project work</b>			<b>4</b>	<b>100</b>
	<b>CBCS Elective</b>	30	70	<b>4</b>	<b>100</b>
<b>SEMESTER II *</b>					
<b>AG-21</b>	Structural Geology and Tectonics	30	70	<b>4</b>	<b>100</b>
<b>AG-22</b>	Palaeontology	30	70	<b>4</b>	<b>100</b>
<b>AG-23</b>	Metamorphic Petrology & Economic Geology	30	70	<b>4</b>	<b>100</b>
<b>AG-24</b>	Petroleum Geology	30	70	<b>4</b>	<b>100</b>
<b>AG-25</b>	<b>Practical:</b> Laboratory Work & Viva-voce			<b>4</b>	<b>100</b>
<b>AG-26</b>	<b>Field Work:</b> Practical Training Including Case Study, Tutorials and Report Writing			<b>4</b>	<b>100</b>
	<b>CBCS Elective</b>	30	70	<b>4</b>	<b>100</b>
<b>SEMESTER III *</b>					
<b>AG-31</b>	Geophysics and Seismic Interpretation	30	70	<b>4</b>	<b>100</b>
<b>AG-32</b>	Sedimentary Basins	30	70	<b>4</b>	<b>100</b>
<b>AG-33</b>	Exploration, Drilling, Production and Reservoir Engineering	30	70	<b>4</b>	<b>100</b>
<b>AG-34</b>	Remote Sensing and Groundwater	30	70	<b>4</b>	<b>100</b>
<b>AG-35</b>	<b>Practical:</b>			<b>4</b>	<b>100</b>

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	Laboratory Work & Viva-voce				
<b>AG-36</b>	<b>Project work</b>			<b>4</b>	<b>100</b>
	<b>CBCS Elective</b>	30	70	<b>4</b>	<b>100</b>
<b>SEMESTER IV *</b>					
<b>AG-41</b>	Well Logging and Techno- Economics	30	70	<b>4</b>	<b>100</b>
<b>AG-42</b>	Sequence Stratigraphy	30	70	<b>4</b>	<b>100</b>
<b>AG-43</b>	Indian Petroliferous Basins	30	70	<b>4</b>	<b>100</b>
<b>AG-44</b>	Energy Resources and Geochemistry	30	70	<b>4</b>	<b>100</b>
<b>AG-45</b>	<b>Practical:</b> Laboratory Work & Viva-voce			<b>4</b>	<b>100</b>
<b>AG-46</b>	<b>Field Work/ Project Work / Industry visit/ Industrial Training/Dissertation</b> Practical Training Including Case Study, Tutorials and Report/ Dissertation Writing & Presentation.			<b>4</b>	<b>100</b>
	<b>CBCS Elective</b>	30	70	<b>4</b>	<b>100</b>

\* The Courses in Semester - I, II, III and IV may be revised if required.

**Besides the above syllabus the students shall opt for a compulsory CBCS elective course offered by any of the departments of the Faculty of Science, University of Lucknow. The marks and credits of these courses will be added in the results.**

**M.SC. APPLIED GEOLOGY**  
**(With Specialization In Petroleum Geosciences)**

**FIRST SEMESTER**

**AG-11 Basics of Earth Science**

Introduction to Geology; Origin of Earth; Age of Earth, Interior of Earth, Radiometric dating methods of rocks; Geological time scale; Weathering and Erosion

Basic concept of Landform evolution; Exogenic processes: Fluvial, Aeolian, Glacial, Karst and Coastal; River basin and drainage network; Waves and Currents;

Earthquakes and Volcanoes; Forms of igneous bodies., Coral reefs; Active tectonics and associated landforms.

Quaternary time; Climatic cycles during Quaternary; Milankovitch cycles; Geomorphology and Quaternary climate studies of Thar Desert, Ganga Plain, Himalaya, and Peninsular India; Use of Oxygen Isotopes in palaeoclimate studies.

**AG-12 Sedimentology**

Introduction to sedimentary rocks and their origin; Classification of Sedimentary Rocks Concept of flow regime and bedforms; Diagenesis.

Texture of sedimentary rocks; Sedimentary structures. Depositional Sedimentary Environments

Terrigenous clastics, and chemically precipitated rocks and their classification.

Concept of facies; General idea about shallow marine environments; Fluvial system; Delta system; Deep sea systems. Walther's Law of facies.

**AG-13 Stratigraphy**

Principles of stratigraphy: Lithostratigraphic, Magnetostratigraphic, Chronostratigraphic and Biostratigraphic units; Stratigraphic correlation; Physical and structural subdivisions of the Indian subcontinent and their characters.

Precambrian time and important events. Precambrian stratigraphy of India with special reference to Vindhyan and Dharwar Supergroups.

Palaeozoic time and important events. Palaeozoic stratigraphy of Himalayas with special reference to

Spiti valley, H.P., Mesozoic time and important events; Triassic stratigraphy of Himalaya with special reference to Spiti valley, H.P.. Jurassic stratigraphy of western India with special reference to Kutchch.

Marine and non-marine Cretaceous formations of India. Siwalik Group of India with special reference to Lithostratigraphy, Vertebrate Palaeontology and Magnetostratigraphy. Boundary problems – Cretaceous-tertiary boundary, Neogene-Quaternary boundary, Palaeogene and Neogene global events.

#### **AG-14 Mineralogy, Crystallography and Igneous Petrology**

Polarising microscope; Physical and optical properties of minerals; Solid solution, polymorphism, isomorphism and pseudomorphism; Pauling's rules and coordination polyhedral.

Crystal forms; Twinning in crystals; Zoning; Crystal defects; Silicate structures; Study of normal class of cubic, tetragonal, hexagonal, orthorhombic, monoclinic and triclinic systems.

Detailed study of following mineral groups with reference to their general formula, classification, atomic structure, paragenesis and uses: Garnet group, Olivine group, Pyroxene group, Amphibole group, Mica group, Zeolite group, Silica group, Feldspar group and Feldspathoid group; Introduction to structures of clay minerals.

Magma: definition, composition and origin; Bowen's reaction series; Classification of igneous rocks; Textures and structures of igneous rocks; Magmatic evolution (differentiation, assimilation, mixing, mingling); Types of magma melting; Phase equilibria studies; Classification and composition of meteorites; Petrology and petrogenesis of igneous rocks.

#### **AG-15 Laboratory work and Viva -Voce**

Laboratory exercises related to Structural Geology, Sedimentology, Mineralogy, Crystallography, Optical Mineralogy and Igneous Petrology.

*Every student shall be required to keep and maintain up-to-date record of practical work during the session, properly signed by the teachers concerned and submit it at the time of their Practical Examination.*

#### **AG-16 Project work**

For the project work, students would be required to prepare and submit a write-up and give a Power Point Presentation on a topic/ project assigned to them.

*The marks awarded for the Project work shall be on the basis of the write-up and presentation.*

## **SECOND SEMESTER**

### **AG-21 Structural Geology and Tectonics**

Introduction to structural geology; Crustal processes, behaviour of the crust during deformation; Sea-floor spreading; Concepts of plate-tectonics; Causes of Plate motion; Mantle Plumes and Plume mechanics; Mechanical properties of rocks; Concepts of stress and strain; Mohr diagrams; Estimation of strain in naturally deformed rocks.

Outliers and Inliers; Unconformities: their classification, recognition and geological significance, onlap and offlap; Morphology, Geometric and genetic classification of Folds and Faults their Recognition in the field and their effects on beds.

Joints; Foliation and Lineation; Recognition of top and bottom of beds; Time relationships between crystallisation and deformation. Neotectonics.

Shear zones; Geometry and rock types of shear zones; Types of Tectonites; Structure and tectonic evolution of the Himalaya; Anatomy of Mountain belts.

### **AG-22 Palaeontology**

Introduction to palaeontology; processes of fossilisation; Origin of life and Precambrian fossil records; Basic idea of trace fossils and their uses.

Morphology and mode of life in brief of Bivalvia, Gastropoda, Brachiopoda, Cephalopoda, Echinoidea and Anthozoa.

Morphology of Trilobita and Graptolithina; Micropalaeontology and its use in hydrocarbon Exploration. Introduction to various microfossil groups.

Evolution of important vertebrates and their fossils localities in India; Siwalik Vertebrate fauna. Devonian flora, Gondwana flora, and Deccan Inter-trappean flora.

### **AG-23 Metamorphic Petrology and Economic Geology**

Metamorphism: controlling factors and types of metamorphism; metamorphic grades; textures and structures of metamorphic rocks; Mineralogical phase rule for closed and open systems; Nature of metamorphic reactions; Phase diagrams and graphic representation of mineral assemblages (ACF, A'KF and AFM projections); Concept of P-T-t paths; Geothermobarometry.

Concept of metamorphic zones, index minerals, Isograds and reaction isograds; Concept and classification of metamorphic facies and facies series; Metamorphism of pelitic rocks.

Regional metamorphism and its relation to plate tectonics; Paired metamorphic belts; Metasomatism and metamorphic differentiation; Introduction to ultrahigh temperature and ultrahigh pressure metamorphism; Petrogenesis of Charnockite; Anatexis; Origin and structure of migmatites.

Processes of formation of ores; Occurrence, origin and distribution of the important metallic and non-metallic mineral deposits of India; Industrial minerals; Concepts of mineral exploration; Concepts of surface and subsurface mining; Strategic, Critical and Essential minerals; National Mineral Policy; Mineral Concession Rules.

#### **AG-24 Petroleum Geology**

Basics of Hydrocarbon Geology; Crude oils and Petrochemical raw materials; Physical and Chemical characteristics of Hydrocarbons

Generation of Hydrocarbon, Kerogen, Reservoir characteristics, Primary and Secondary Migration of Hydrocarbons

Structural, Stratigraphic and Combination traps; Exploration of Petroleum; Introduction to well-logging;

Oil production methods; New Resources of Hydrocarbons: Gas Hydrates, Coal Bed Methane, Shale Gas.

#### **AG-25 Laboratory work and Viva -Voce**

Laboratory exercises related to Structural Geology, Palaeontology, Metamorphic Petrology, Economic Geology and Petroleum Geology.

#### **AG-26 Field work**

*Every student shall be required to attend the field training and submit a record of field observations and specimens collected, properly labelled after returning from the field.*

*Viva-Voce examination based on the field work shall also be conducted at the time of the Practical Examination.*

*The marks assigned to the fieldwork shall be on the basis of the field records and collections, and performance in the field.*

### **SEMESTER III**

#### **AG-31 Geophysics and Seismic Interpretation**

Introduction of Geophysics and Geophysical methods in exploration and mining; Earth shape: Geoid; Internal structure of Earth and seismic Discontinuities.

Gravity and magnetic methods: Fundamental of Gravity, Gravity anomalies, Magnetism and magnetic fields, Magnetic properties of rocks, Palaeomagnetism, Magnetic anomalies.

Electrical Resistivity Methods: Basic principles of resistivity, Spontaneous (Self) Potential Methods and Induced Polarisation; Electrode configurations and geometric factors, Modes of deployment: VES, ERT, and CST and Electromagnetic Method.

Seismic Method: fundamental of Seismic waves, Stress-Strain and Seismic energy sources, Loss of seismic energy, Detection and recording of seismic waves; Seismic Refraction Surveying and Seismic Reflection Surveying, Velocity Measurements: in boreholes, by surface- to surface refraction

#### **AG-32 Sedimentary Basins**

Introduction to Sedimentary Basins, Concepts, Scope and Importance of Sedimentary Basins, Genesis of Sedimentary Basins

Classification of Sedimentary Basins; Types of basins related to lithospheric extension; Basins formed by subduction of plates

Basins formed by strike-slip movement, Complex, hybrid and Miscellaneous basins,

Analysis of Sedimentary basins; Basin Stratigraphy, Basin Modelling.

#### **AG-33 Exploration, Drilling, Production and Reservoir Engineering**

Drilling Rigs, types and components. Drilling fluid types and uses. Types of wells. Drilling Engineering – observation and interpretation.

Well prognosis and Drilling program; General drilling information; Tools and techniques used in Drilling.

Mudlogging and various drilling operations; Pressure evaluation while drilling; Well Site Geological techniques.

Basics of Reservoir Engineering; Concept of Enhanced Oil Recovery; Techniques of Enhanced Oil Recovery (EOR); Planning of Enhanced Oil Recovery, Case Studies.



#### **AG-34 Remote Sensing and Groundwater**

Basics of Remote Sensing; Physics of Remote Sensing, Sensor types and their characteristics; types of resolution; Remote Sensing satellites and data products; Satellite orbits and characteristics; EMR characteristics and interaction in atmosphere and with ground objects; Interpretation elements.

Application of remote sensing in natural resources management / Geo-Sciences; Basics of GIS and GPS.

Origin, occurrence and distribution of water; Types of water; Hydrological cycle; Water bearing properties of rocks – porosity and permeability; Vertical distribution of ground water; aquifer, aquifer parameters and types of aquifers; Darcy's Law; Piezometric surface.

Artificial recharging of aquifers, saline water intrusion; geological and geomorphic controls on groundwater; Groundwater exploration; Role of remote sensing in groundwater exploration; Groundwater Quality-physical and chemical; Groundwater management.

#### **AG-35 Laboratory work and Viva -Voce**

Laboratory exercises related to Geophysics and Seismic Interpretation, Sedimentary Basins, Sequence Stratigraphy, Remote Sensing and Groundwater.

*Every student shall be required to keep and maintain up-to-date record of practical work during the session, properly signed by the teachers concerned and submit it at the time of their Practical Examination.*

#### **AG-36 Project work**

For the project work, students would be required to prepare and submit a write-up and give a Power Point Presentation on a topic/ project assigned to them.

*The marks awarded for the Project work shall be on the basis of the write-up and presentation.*

### Semester IV

#### **AG-41 Well Logging and Techno-economics**

MWD: Introduction and benefits, tool quality control. MWD Telemetry systems and Sensor types. Special Hydraulic considerations, Comparison with Wireline logging.

Theoretical Basis of well logging logging, Methods and Apparatus used in well logging, Factors affecting results of well logging, Interpretation of Well logs.

Horizontal wells and multilaterals, Geosteering: Application and uses, Well placement, case studies.

Techno-Economic Evaluation of Exploration Ventures; Introduction to Exploration & Business Development Process. Cash Flow Analysis, Economic Indicators: NPV, IRR, Payback Period & CPI; Risk & Uncertainty: Probabilities of Geological Success, Expected Monetary Value (EMV). Decision Tree Analysis; Overview of Fiscal Terms: Structure & Fiscal Flow diagram of Royalty / Tax Regime, Structure & Fiscal Flow diagram of Production Sharing Agreement, Elements in PSC, JV etc.

#### **AG-42 Sequence Stratigraphy**

Introduction and concepts of Sequence Stratigraphy; Walther's law; Sea-level in geological history.

Types of stratigraphical cycles; Long Term Eustacy; Transgression; Regression: Normal and Forced Regression.

Para-sequences: Aggradational, Progradational, Retrogradational and Degradational Shoreline Shift and facies variation with the rise and fall in sea-level.

Modern Sequence Stratigraphy; Low System Tract, High System Tract, Transgressive System Tract; Sequence Boundaries; Maximum Flooding Surfaces.

#### **AG-43 Indian Petroliferous Basins**

Basics of Petroliferous Basins; History of petroleum geology in India; Petroleum products.

Assam Basin, Cambay Basin, Cauvery Basin, Tripura-Cachar Basin.

Mahanadi Basin, Mumbai Offshore Basin, Rajasthan Basin, Krishna- Godavari Basin.

Prospects of new petroleum basins in India; Case Study of Indian Sedimentary Basins.

**AG-44 Energy Resources and Geochemistry**

Sustainable Environmental studies; Fossil fuels; Solar Energy, Hydro Energy, Ocean Energy, Wind Energy, Geothermal Energy, Biomass, Nuclear Energy; Storage of Energy; Energy Scenario in India; Energy Audit; Global pricing and Geopolitics and its importance on economics.

Introduction of Geochemistry; Geochemistry of the atmosphere, hydrosphere, lithosphere; Geochemistry of sedimentary rocks; Geochemical cycle, Geochemical cycle of Carbon and Oxygen.

Isotopic fractionation, Stable Isotopes with special reference to oxygen and carbon isotopes; Radiogenic Isotopes.

Goldschmidt's Geochemical classification, Geochemical differentiation; Major, minor, trace and Rare Earth Elements.

**AG-45 Laboratory work and Viva -Voce**

Laboratory exercises related to Well-logging and Techno-economics, Exploration, Drilling, Production and Reservoir Engineering, Indian Petroliferous Basins, Energy Resources and Geochemistry.

*Every student shall be required to keep and maintain up-to-date record of practical work during the session, properly signed by the teachers concerned and submit it at the time of their Practical Examination.*

**AG-46 Field Work/ Project Work / Industry visit/ Industrial Training/Dissertation**

Practical Training Including Case Study, Tutorials and Report/ Dissertation Writing & Presentation.

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Institute of Hydrocarbon, Energy and Geo-Resources, ONGC Centre of Advanced Studies, University of Lucknow, is running a M.Sc. Course in Applied Geology (with specialization in Petroleum Geosciences) and a Post-Graduate Diploma in Exploration, Resources and Mining Technology. It is also planning to start a Ph. D. Course, Diploma Modules in different branches of earth science, training and expert guidance to Governmental and Non-Governmental Organisations. The details of the Post-Graduate Diploma in Exploration, Resources and Mining Technology Course from the Session 2019-20 are as follows:

### **PG DIPLOMA IN EXPLORATION, RESOURCES AND MINING TECHNOLOGY**

**Syllabus:** The revised syllabus for Post-Graduate Diploma in Exploration, Resources and Mining Technology will be applicable for the students enrolled in July 2019 and onwards.

#### **Eligibility of Candidates for admission to P.G. Diploma in Exploration, Resources and Mining Technology:**

Candidates who have passed the M.Sc. in Geology examination of the University of Lucknow or any other equivalent examination of other universities (considered as equivalent by the University of Lucknow) with an aggregate of at least **45 % marks** or equivalent CGPA will be considered eligible for admission.

Admission to the Two Semester P.G. Diploma in Exploration, Resources and Mining Technology programme for the eligible candidates, will be based on their past academic record and performance in the Interview.

The P.G. Diploma in Exploration, Resources and Mining Technology programme shall be imparted to the selected students for one academic session consisting of two semesters.

Candidates will be examined through Continuous Internal Assessment and evaluated at the end of each semester in the different courses of Theory, Practical, and Project work/ Field Work, etc. **The papers will be set in English, and the students will be required to answer the questions in English only. Students are required to have a minimum of 75% attendance to be eligible to appear in the examination.** The attendance in the Industrial Visit/ Industrial Training/ Fieldwork will also be compulsory for all the students, after which the students will be required to submit a detailed report to the concerned teacher(s) for evaluation. This is a **Self-Financing Course** with an intake of **10 seats** per annum. The fee structure will be **Rs. 25,000 per Semester**.

The different courses, as detailed below, shall be taught in the Two Semesters, and there shall be Written Papers, a Practical Examination, Project work/ Fieldwork/ Industrial Study/ Industrial Training. Viva-Voce examination will be held along with the Practical Examinations and presentation of Project Reports/Field Reports, etc.

For the **Semester End Examination**, the question paper for each course will be of 100 marks and consist of TWO Units. Unit- I shall be **COMPULSORY**, of 25 marks, and have five short answer type questions. Unit- II will be of 75 marks and have five questions (descriptive type) out of which the candidates will be required to attempt any three questions. The duration of the examination shall be of three hours. Non-programmable scientific calculators or simple calculators will be allowed in the Semester examinations.

**PG Diploma in Exploration, Resources and Mining Technology**

Course – wise details of the Two Semesters:

<u><b>COURSES</b></u>		<b>Total</b>	
		<b>Credits</b>	<b>Marks</b>
<b>SEMESTER- I</b>			
<b>PGD-11</b>	Mining Operation	<b>4</b>	<b>100</b>
<b>PGD-12</b>	Exploration Technology	<b>4</b>	<b>100</b>
<b>PGD-13</b>	Exploratory Data Assessment	<b>4</b>	<b>100</b>
<b>PGD-14</b>	Introduction to Mineral Resource Estimation	<b>4</b>	<b>100</b>
<b>PGD-15</b>	<b>Practical:</b>	<b>4</b>	<b>100</b>
<b>SEMESTER- II</b>			
<b>PGD-21</b>	Mining Methods	<b>4</b>	<b>100</b>
<b>PGD-22</b>	Introduction to Mine Planning and Financial Modelling	<b>4</b>	<b>100</b>
<b>PGD-23</b>	International Standards and Compliance	<b>4</b>	<b>100</b>
<b>PGD-24</b>	Mining Studies	<b>4</b>	<b>100</b>
<b>PGD-25</b>	<b>Practical/ Dissertation Report</b>	<b>4</b>	<b>100</b>

\*The Courses may be revised if required.

**PG DIPLOMA IN EXPLORATION, RESOURCES AND MINING TECHNOLOGY**

**SYLLABUS (Session 2019-20 onwards)**

**FIRST SEMESTER**

<b>PGD- 11</b>	<b>Mining Operation</b>	Life Cycle of a Mine: An Overview; Role of the Geologist in Mining; Role of the Geologist in Resource Estimation; Safety – Mines; Environment Management - Mines; Role of the Geologist in Geotechnical Requirement in Mines; Role of the Geologist in Hydro-geological Requirement in Mines
<b>PGD- 12</b>	<b>Exploration Technology</b>	<b>History of Exploration Techniques - Surface:</b> Planning of Exploration; Management of Exploration Program; Application of Remote Sensing Technique and a case study; Application of Geophysical Technique and a case study; Application of Geo-Chemical Technique and a case study <b>History of Exploration Technique - Subsurface</b> <b>Exploration:</b> Conventional Diamond Core Drilling; Advanced Diamond Core Drilling; Reverse Circulation Drilling <b>Exploration Data:</b> Geological Logging and sampling; Format of Geochemical and Drill hole Data capture
<b>PGD- 13</b>	<b>Exploratory Data Assessment</b>	<b>Statistical and Spatial Interpretation:</b> Univariate, Bi-Variate, Multivariate statistics; Classical Statistical analysis; Interpretation of Statistical Parameters; Graphical presentation and interpretation <b>Quality Assurance and Quality Control (QA/QC):</b> Accuracy, Precision, Bias, contamination detection in analytical lab; QA chart preparation and interpretation
<b>PGD- 14</b>	<b>Introduction to Mineral Resource Estimation</b>	<b>Interpretation of data:</b> 2D Interpretation; 3D Interpretation; Block Modelling <b>Geostatistical Techniques:</b> Estimation Methods; Variography; Mineral Resource Estimation Process, Validation and Reporting
<b>PGD- 15</b>	<b>PRACTICAL</b>	Exploration Database Creation and Management; Introduction to Geographical Information System (GIS) and its Application; Datamine software & its Application in Exploration; Mineral Resource and Mine Design.

**SECOND SEMESTER**

<b>PGD- 21</b>	<b>Mining Methods</b>	<b>Surface Mining Methods:</b> Applicability and its limitation; Drilling & Blasting; Stripping ratios and their significance; Objectives, types of box cut; Parameters for production benches <b>Underground Mining Methods:</b> Modes of entry, Mine development -drifting, raising and winzing; Classification of underground metal mining methods; Operations involved in underground mining operations; Different methods of stoping <b>Impact of Mining on Environment:</b> An overview of impact of Open cast and underground mining methods on environment; An overview of mitigation methods in Open cast and underground mining methods on environment
<b>PGD- 22</b>	<b>Introduction to Mine Planning and Financial Modelling</b>	<b>Concepts of Mine Planning:</b> The need and necessity for mine planning <b>Open Cast Mine Planning:</b> Elements of Mine Planning; Significance of Short term /Medium term/Long term planning <b>Mineral Project Economics:</b> Capex, Opex, financial modelling concept for project evaluation; Cut-off grade estimation
<b>PGD- 23</b>	<b>International Standards and Compliance</b>	<b>Public reporting of mineral resource/reserves:</b> Introduction to JORC and its significance in classification of Resource and Reserves; Introduction to NI 43-101 and its significance in classification of Resource and Reserves; UNFC classification- Indian regulatory requirement
<b>PGD- 24</b>	<b>Mining Studies</b>	<b>Role of Mining Studies:</b> Preliminary economic assessment studies and its limitation; Pre-feasibility studies and its limitation; Feasibility studies; Importance and preparation of bulk samples in testwork/beneficiation tests; Introduction to mineral beneficiation study
<b>PGD- 25</b>	<b>Practical/ Dissertation Report</b>	Live project and preparation of technical report based on mineral resource, mine design, reserve on sample data set in Datamine

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