

DEPARTMENT OF GEOLOGY

GOVT. N.P.G. COLLEGE OF SCIENCE, RAIPUR

SCHEME OF EXAMINATION (2018-19)

- ❖ It is proposed that M.Sc. Geology shall consist of four semesters as given in the table named scheme of examination attached herewith (page nos 02 to 05).
- ❖ Semester first and second and accordingly third and fourth shall have four theory papers of 80 marks each with for marks of sessionals, resultantly it will be of each 100 marks. An as per UGC guidelines all these four papers will of four credits. These four papers of four hundred marks and sixteen credits in total will have two practical's namely lab course-I and lab course-II of hundred marks each and three credits each thereof which comes as six credits for practicals in total. This configuration is proposed for all the four semesters.
- ❖ In the semester second lab course-II and semester four lab course-II student will have to submit a project report and project report/dissertation respectively on the topic allotted to him by the supervisor.
- ❖ The sessional will be allotted on the basis of seminar, sessionals, field work or other assignment given.

SCHEME OF EXAMINATION

M. Sc. Ist Semester

S. No.	Name of the Paper	Marks Allotted				Practical	Credit
		Theory	Sessional	Total	Credit		
1	Mineralogy, Mineral Optics & Crystallography	80	20	100	04	Lab Course I	03
2	Structural Geology	80	20	100	04	100 Marks	
3	Principles of Stratigraphy and Indian Geology	80	20	100	04	Lab Course II	03
4	Palaeontology	80	20	100	04	100 Marks	
Total Marks with total credits				400	16	200	06

SCHEME OF EXAMINATION

M. Sc. IInd Semester

S. No.	Name of the Paper	Marks Allotted				Practical	Credit
		Theory	Sessional	Total	Credit		
1	Igneous and Metamorphic Petrology	80	20	100	04	Lab Course I	03
2	Sedimentary Petrology and Crustal Evolution	80	20	100	04	100 Marks	
3	Geodynamics and Geomorphology	80	20	100	04	Lab Course II	03
4	Photogeology, Remote Sensing and GIS	80	20	100	04	100 Marks	
Total Marks with total credits				400	16	200	06

Note: -Lab course II will consist of submission of a project report on the topic allotted to student by the supervisor.

SCHEME OF EXAMINATION

M. Sc. IIIrd Semester

S. No.	Name of the Paper	Marks Allotted				Practical	Credit
		Theory	Sessional	Total	Credit		
1	Hydrogeology	80	20	100	04	Lab Course I 100 Marks	03
2	Engineering Geology and Geotechnical Investigation	80	20	100	04		
3	Mining Geology and Environmental Geology	80	20	100	04	Lab Course II 100 Marks	03
4	Mineral Exploration	80	20	100	04		
Total Marks with total credits				400	16	200	06

SCHEME OF EXAMINATION

M. Sc. IVth Semester

S. No.	Name of the Paper	Marks Allotted				Practical	Credit
		Theory	Sessional	Total	Credit		
1	Economic Geology – I (Processes)	80	20	100	04	Lab Course I	03
2	Economic Geology – II (Deposits)	80	20	100	04	100 Marks	
3	Chhattisgarh : Geology, mineral resources and their industrial application	80	20	100	04	Lab Course II	03
4	Mining Legislation and Mineral Resources Development	80	20	100	04	100 Marks	
Total Marks with total credits				400	16	200	06

Note: -Lab course II will consist of submission of a project report/dissertation on the topic allotted to student by the supervisor.

M.Sc.GEOLOGY

SEMESTER-I PAPER-I

MINERALOGY, MINERAL OPTICS AND CRYSTALLOGRAPHY

UNIT-I

- 1.1 Minerals-Definition and classification, Physical Properties of minerals.
- 1.2 Structures of Silicates, Electrical, Magnetic Properties of minerals.
- 1.3 Luminescence, Thermal & Radioactive Properties of minerals.
- 1.4 Polymorphism, Psuedomorphism.

UNIT-II

Study of the following rock forming silicate mineral groups covering Structure, chemistry, physical properties, optical properties & Para genesis of

- 2.1 Feldspars, Feldspathoid,
- 2.1 Quartz & Garnet.
- 2.1 Pyroxenes, Amphiboles,
- 2.1 Micas, Olivines.

UNIT-III

Study of the following rock forming minerals groups covering structure, chemistry, Physical & optical properties & Para genesis of

- 3.1 Epidote, chlorite, Alumino silicates.
- 3.2 Staurolite, Cordierite, Talc & chloritoides.
- 3.3 Study of common oxides, carbonates & Sulphate mineral groups.
- 3.4 Study of common phosphate, Sulphide & Halide mineral groups.

UNIT-IV

- 4.1 General principles of optics, Polarization of light, double refraction.
- 4.2 Interference phenomenon, Isotropic & Anisotropic minerals.
- 4.3 Petrological microscope, important optical properties of minerals.
- 4.4 Optical accessory & their use. Uniaxial & biaxial indicatrix & interference figures.

UNIT-V

- 5.1 Definition of Crystal, Crystal elements, Symmetry, laws of crystallography.
- 5.2 Common holohedral, hemihedral & hemimorphic form. Parameter & indices.
- 5.3 Symmetry characters & forms of normal classes of –Cubic, Tetragonal, hexagonal, Orthorhombic, monoclinic & triclinic systems. Twinning in crystals, Spherical, Gnomonic & stereographic projections.

M.Sc.GEOLOGY

SEMESTER-I PAPER-II

STRUCTURAL GEOLOGY

UNIT-I

- 1.1 Rock deformation, concept of Stress & Strain, their relationship.
- 1.2 Factors controlling deformation Type of Stress & Strain, Stress & Strain ellipsoid.
- 1.3 Homogeneous & inhomogeneous strain, Finite & Infinitesimal Strain, Strain markers (Measurement of Strain in deformed rocks) Progressive deformation, Top & bottom Criteria.
- 1.4 Unconformity-types & recognition in field & on geological map .Outlier and Inlier.

UNIT-II

- 2.1 Fold: definition, elements, classification (Geometric & Genetic),
- 2.2 Mechanics of development of folds, Super imposed folds
- 2.3 Recognition of folds in field and on geological map.
- 2.4 Effects of folds on outcrops, causes of folding.

UNIT-III

- 3.1 Definition, elements, classification of faults,
- 3.2 Recognition of faults, causes & mechanism of faulting (with reference to principal stress orientation)
- 3.3 Effects of faulting on the outcrops, Nappe, klippe, and tectonic windows.
- 3.4 Difference between fault and unconformity.

UNIT-IV

- 4.1 Geometric & Genetic classification and importance of Joints,
- 4.2 Lineation:- definition, types, and their relation to major structures,
- 4.3 Foliation:- definition & types, and their relation to major structures
- 4.4 Rock cleavage and schistosity, their relation to major structures.

UNIT-V

- 5.1 Stereographic projection and their use in structural analysis.
- 5.2 Signification and limitation of pie and Beta diagram.
- 5.3 Tectonite:- definition and types. Concept of petrofabric analysis,
- 5.4 Types of fabric, fabric elements and interpretation of petrofabric data.

Lab Course-I
(Paper I and II M.Sc. Semester I)

(A)

- Megascopic and microscopic study of common rock forming minerals.
- Determination of paleochroic scheme, anorthite content of plagioclase feldspar, estimation of birefringence.
- Determination of order of interference colour and sign of elongation.
- Study of interference figures and determination of optic sign.
- Study of holohedral and hemihedral, hemimorphic and alitriomorphic forms of all crystal system.
- Stereographic projection.

(B)

- Concept on line & plane, altitude of line & plane, dip & strike their measurements.
- Stereographic projection: problems in angular relationship- True dip, apparent dip, Plunge & Rock of the intersection of plane, Beta and Pi diagrams.
- Study of minor structure in Hand specimens.
- Preparation and interpretation of Geological maps- for inclined strata, folds, faults & unconformity.
- Three point problems.
- Application of software- altimeter, Geoclino, my GPS coordinate and other available.

M.Sc.GEOLOGY

SEMESTER-I

PAPER-III

STRATIGRAPHY AND INDIAN GEOLOGY

UNIT-I

- 1.1 Stratigraphic principles and Scales for Classification.
- 1.2 Units of Stratigraphy-Litho Bio and Chrono Stratigraphic units.
- 1.3 Correlation.
- 1.4 Correlation in Indian Subcontinent.
- 1.5 Correlation of rock units of Chhattisgarh with other units of Country

UNIT-II

- 2.1 Evolution of Lithosphere.
- 2.2 Chief Divisions of Indian Subcontinent and Their economic Character and Physiographic Character.
- 2.3 Correlation and Economic Importance of Archeans of Peninsular and Extra Peninsular India.
- 2.4 Geological Time Scale.

UNIT-III

- 3.1 Stratigraphy and Correlation of mobile belts and Proterozoic Sedimentary basins of India.
- 3.2 Classification, Correlation and economic importance of Dharwar Super Group.
- 3.3 Cuddapah Super Group and Correlation with its other equivalent.
- 3.4 Vindhayan Super Group and Correlation with other equivalents.
- 3.5 Chhattisgarh, Indravati and Khairagarh Group of rocks and Study of their Correlation and economic Importance.

UNIT-IV

- 4.1 Palaeozoic formation of extra peninsular region, its Correlation and Classification.
- 4.2 Detail Study of Mesozoic of India.
- 4.3 Gondwana Super group detail study on their Classification, Correlation and Economic Importance.
- 4.4 Jurassic rocks in extra peninsular India.
- 4.5 Detail Study of Deccan traps, Intratrappean and Infratrappeans.

UNIT-V

- 5.1 Evolution of Man, Plant and Animal Life.
- 5.2 Stratigraphic units in India and their Economic Importance.
- 5.3 Stratigraphic units of Chhattisgarh and their economic Importance.
- 5.4 Importance and other studies of Palaeoclimate and Palaeogeography in Stratigraphy.
- 5.5 Boundary Problem with Special reference to Indian Stratigraphy.

M.Sc.GEOLOGY

SEMESTER-I

PAPER-IV

PALAEONTOLOGY

UNIT-I

- 1.1 Definition of fossils and mode of preservation, their application in age determination, Correlation, Palaeoclimatology, Palaeobiogeography and Palaeoecology.
- 1.2 Modes and theories of organic evolution, concept of bathymetric distribution of animals, migration. Mass Extinction and their causes.
- 1.3 Outline classification of organisms.
- 1.4 Morphology, Classification, evolutionary trends and geologic and geographic distribution of Brachiopods.

UNIT-II

- 2.1 Morphology, Classification , evolutionary trends and geologic, geographic distribution of
- 2.2 Pelecypoda(Lamellibranchia)
- 2.3 Gastropoda
- 2.4 Cephalopoda.
- 2.5 Trilobites.

UNIT-III

- 3.1 Morphology, Classification, evolutionary trends and geologic history of Echinoids, Graptolites and Rugose Corals.
- 3.2 Elementary idea about Vertebrates origin & evolution.
- 3.3 Evolutionary history of Horse & Elephant.
- 3.4 Evolutionary history of Man.

UNIT-IV

- 4.1 Siwalik mammalian fauna.
- 4.2 General idea about plant evolution through geologic ages.
- 4.3 Fossil flora of Gondwana Group and Tertiary formation of India.
- 4.4 Definition and Scope of micropalaeontology, types of microfossils.

UNIT-V

- 5.1 Techniques in micropalaeontology.
- 5.2 Use of microfossils in Stratigraphic correlation and age determination.
- 5.3 Use of microfossils in interpretation of sea floor tectonism, hydrocarbon exploration.
- 5.4 Oxygen and Carbon isotope Studies of microfossils and their use in palaeoenvironmental and palaeoceanographic Studies.

Lab Course-II
(Paper III and IV M.Sc. Semester I)

(A)

- Study of stratigraphic rocks from important geological formation of India.
- Plotting of important stratigraphic formation of world and India.
- Exercise related to stratigraphic correlation.

(B)

- Study of typical vertebrate and invertebrate fossils from different Indian stratigraphic horizons.
- Study of plant fossils of Gondwana formation

M.Sc.GEOLOGY

SEMESTER-II

PAPER-I

IGNEOUS & METAMORPHIC PETROLOGY

UNIT-I

- 1.1 Principles and general concept of petrology, petrography & petrogenesis.
- 1.2 Various forms, structures and textures of igneous rocks & their significance in petrogenesis.
- 1.3 Phase equilibria of unicomponent, Binary (mixed & Eutectic), Ternary (Ab-An-Dio, for Diopside-Silica) Silicate system.
- 1.4 Petrographic Province.

UNIT-II

- 2.1 Magma, Definition, Composition, Characteristics, Factors causing diversity in igneous rocks-Differentiation, Assimilation.
- 2.2 Origin & evolution of magma, magmatism related to plate tectonics.
- 2.3 Classification of Igneous rocks important chemical, mineralogical, textural CIPW & IUGS classification.
- 2.4 Reaction Principles and Bowen's reaction Series.

UNIT-III

- 3.1 Petrography, Petrogenesis & Indian occurrences of Granite, alkaline rocks.
- 3.2 Monomineralic rocks (Dunite, Auriferite)
- 3.3 Basalt, Andesite, Spillite, Lamprophyre.
- 3.4 Ultramafic rocks, carbonatite, pegmatite, Kimberlite.

UNIT-IV

- 4.1 Metamorphism: Definition, Agents, Types of metamorphism.
- 4.2 Structure & texture of metamorphic rocks, metamorphic grades, Zones.
- 4.3 Metamorphic Facies, classification of metamorphic rocks.
- 4.4 Retrograde metamorphism. Metasomatism and their types.

UNIT-V

- 5.1 Regional and Thermal metamorphism of mafic, ultramafic rocks, pelitic sediments, and impure calcareous rocks.
- 5.2 Graphic representation of metamorphic mineral assemblages, ACF, AKF, and AFM, diagrams.
- 5.3 Paired metamorphic Belts.
- 5.4 Study of important metamorphic rocks- Granulite, Charnockite, Eclogite, migmatites, Khondalite, Gondites.

M.Sc.GEOLOGY

SEMESTER-II

PAPER-II

SEDIMENTARY PETROLOGY AND CRUSTAL EVOLUTION

UNIT-I

- 1.1 Sedimentary Rock, Processes of sedimentation. Mineral stability, Quartz, Felspar and heavy mineral as Province indicator.
- 1.2 Classification of Sedimentary Rocks; Rudaceous rocks Conglomerate and Breccia and their classification.
- 1.3 Arenaceous rock, Dot's Classification of Sandstone, Argillaceous Sedimentary rocks (lutaceous), their composition and environment of deposition.
- 1.4 Folks and Dunhams Classification of Limestone.

UNIT-II

- 2.1 Textural analysis of sediments, Grain size measurements Udden-Wentworth and Krumbin Phi scale.
- 2.2 rain Porosity and Permeability. Graphical representation statistical treatment and geological significance.
- 2.3 Petrogenesis of arkoses, greywacke and quartz arenites.
- 2.4 Evaporite and Volcanoclastic sediments. Dolomite and Process of Dolomitisation.

UNIT-III

- 3.1 Sedimentary structures: Mechanical, Chemical and Organosedimentary structures and their significance in top and bottom criteria.
- 3.2 Paleocurrents and basin analysis.

3.3 Diagenesis of sandstone and carbonate rocks changes in mineralogy, fabric and chemistry.

3.4 Application of Trace, REE and stable isotope geochemistry in sedimentological interpretations.

UNIT-IV

4.1 Sedimentary facies, Depositional environments, Marine, Transitional, Continental,

4.2 Types of delta, Recognition of ancient Delta. Stratigraphy and Sedimentation, Walther's law, Sequence stratigraphy,

4.3 Basin analysis, sedimentary chemistry, Basin evolution and tectonics.

4.4 Introduction to clay mineralogy. Classification, Origin and economic importance.

UNIT-V

5.1 Development of Proterozoic sedimentary basins of India within the Cratons.

5.2 Anatomy of Orogenic belts and formation of mountain roots.

5.3 Life in Pre Cambrians, Pre Cambrian- Cambrian boundary with special reference to India. Relation of sedimentary basins with Plate tectonic.

5.4 Greater Indian continental plate during Proterozoic and Palaeozoic.

Lab Course-I

(A)

- Megascopic identification & description of Igneous & Metamorphic rocks.
- Study of textures & Structures of Igneous & Metamorphic rocks.
- Microscopic Identification of igneous & metamorphic rocks.
- Plotting the geographic distribution of igneous & metamorphic rock types in outline map of India.
- C.I.P.W. norm calculation.
- Construction of variation diagram.
- Construction of ACF & AKF diagram.
- Application of MVPM software

(B)

- Megascopy of clastic sedimentary rocks (conglomerates, breccias, sandstones and shales) and non clastic sedimentary rocks (limestones, fossiliferous limestones including stromatolitic limestones and dolomites).
- Microscopy of clastic and non- clastic rocks as given above.
- Estimation of sphericity and roundness of grains.
- Identification of sedimentary structures and interpretation of depositional environments.
- Construction and interpretation of rose diagrams using palaeocurrent data.
- Interpretation of texture, structures, based on line drawing.

(C)

- Study of geomorphological models
- Identifications of various types of drainage pattern
- Morphometric analysis : bifurcation ratio, number of stream,length of stream, stream frequency , drainage density, basin area etc.
- Earthquake belt of India and world
- Volcanic belt of world

(D)

- Study of areal photograph (stereo pair) with the help of stereoscope
- Study of land set imageries, identification of forest, water bodies, lineament and other geological structure
- Various notation of imageries

Books Recommended:

1. Introduction to Sedimentology- S.M. Sengupta.
2. Origin of Sedimentary Rocks, Blatt, H., Middleton, G.V. and Murray, R.C.
3. Sedimentary Structures, Collins, J.D., and Thompson, D.B.
4. Palaeocurrents and Basin analysis By Potter, P.E., & Pettijohn, F. J.
5. A Practical Approach to Sedimentology, George Allen and Unwin, London.
6. Practical Manual of Sedimentology By Lindholm., R.
7. Principles of Basin Analysis, Mail Springer-Verlag.
8. Sedimentary Rocks (3rd Ed.), Pettijohn; F.J. (1975).
9. Carbonate Sedimentology by M.E. Tucker,
10. Principles of Sedimentology by Friedman and Sanders.

M.Sc.GEOLOGY

SEMESTER-II

PAPER-III

GEODYNAMICS AND GEOMORPHOLOGY

UNIT-I

- 1.1 Earth and Solar System, Origin of the earth.
- 1.2 Interior of the earth. Age of the earth.
- 1.3 Palaeomagnetism, Continental drift,
- 1.4 Polar wandering, sea floor spreading.

UNIT-II

- 2.1 Plate Tectonics- Characteristics of Boundaries- Concordant, Discordant.
- 2.2 Island Arc, Subduction Zone, oceanic Trenches.
- 2.3 Mid Oceanic Ridge, Triple Junction. Transform fault.
- 2.4 Convection current, continent-continent collision. Continent -ocean collision.

UNIT-III

- 3.1 Volcanoes- Their form & structure,Types,Volcanic products, volcanic belts of the world.
- 3.2 Earthquake- Types of earthquake waves,its measurement.
- 3.3 Richter and Marcali scale, earthquake zones of India and Major Earthquake belts of theworld.
- 3.4 Geosynclines- Classification and evolution.

UNIT-IV

- 4.1 Principles of Geomorphology, Theories of Geomorphology.
- 4.2 Landforms in relation to climate, rock type, structure & tectonics.
- 4.3 Weathering & cycle of erosion, upliftment, mass movement.
- 4.4 Fluvial Geomorphology, drainage pattern, fluvial land forms, Karst topography.

UNIT-V

- 5.1 Glacial features, type of glacier & Land forms.
- 5.2 Major landforms of arid region, effect of wind erosion.
- 5.3 Morphometric analysis of drainage basins & its significance.
- 5.4 Applied Geomorphology- Application of mineral prospecting, Civil engineering, Hydrology &environmental studies.

M.Sc.GEOLOGY

SEMESTER-II

PAPER-IV

PHOTOGEOLOGY, REMOTE SENSING AND GIS

UNIT-I

- 1.1 Introduction to Photogeology and Remote Sensing, Types of Aerial photographs.
- 1.2 Vertical, Low-oblique, High-oblique with their geometry. Nadir Point, Photogrammetry.
- 1.3 Photo-Scale variation and its causes. Flight Procedure, Tip and Tilt, Mosaic.
- 1.4 Stereoscopic vision, Stereoscope types, Pocket and Mirror stereoscope and their uses, Parallax, Vertical Exaggeration.

UNIT-II

- 2.1 Satellite Remote sensing, Types of sensors, Electromagnetic radiation (EMR) Interaction of EMR with earth objects.
- 2.2 Types of Images, MSS, Thermal Image, Qualitative interpretation of thermal image.
- 2.3 Multispectral Thermal data, Radar Image, Interaction between Radar and surface material.

2.4 Geological features on Radar Images.

UNIT-III

3.1 Interpretation of Aerial photographs, Tone, Texture and patterns, Landforms and Drainage, 3.2 Glacial landforms, Recognition of Rock Types Igneous, Extrusive and Intrusive rocks.

3.2 Sedimentary rock- coarse clastic sediments, fine clastic sediments and chemically precipitated sedimentary rocks.

3.3 Metamorphic rocks in Stereo pair, Structural and stratigraphic relationships, Dip and strike, Unconformity, Structural relations.

UNIT-IV

4.1 Introduction to Digital Image Processing, Image Histogram, Contrast stretching, spatial frequency filtering.

4.2 Principal component Analysis, Band Rationing, Pattern recognition, Change detection.

4.3 Global Positioning system, GIS, its principle, Significance of GIS in Geology. Handling digital Geographical Information System data.

4.4 Analysis and use of multiple data planes, and Topographic Data in raster format. Synergistic interpretation of Geographic Information System.

UNIT-V

5.1 Application and significance of Remote Sensing studies in identification of lineaments folds, faults.

5.2 Groundwater targeting, Drainage pattern and its relation to rock types and structural features.

5.3 Use of remote sensing data in Mineral Exploration, Groundwater targeting, Petroleum exploration.

5.4 Use of remote sensing data in Engineering geology and environmental geology, Urban Land use.

Books Recommended:

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|---|----------------------|
| 1. Remote Sensing : Principles and Application- | B.C. Panda |
| 2. Remote Sensing and GIS | Bhatia B |
| 3. Remote and GIS | M. Anjali Reddy. |
| 4. Remote Sensing & Image Interpretation | Lilesand and Kiefer. |
| 5. Fundamentals of Remote Sensing | George Joseph. |
| 6. Remote Sensing and Geology | S. M. Ramasamy. |
| 7. Image Interpretation in Geology | S. Drury. |
| 8. Remote Sensing Principles and Interpretation | Sabins |
| 9. Remote Sensing | Pandey,S.N |
| 10. Photogeology | Miller & Miller |

**Lab Course-II
(M.Sc. Semester II)**

Lab course II will consist of submission of a project report on the topic allotted to student by the supervisor.

M.Sc.GEOLOGY

SEMESTER-III

PAPER-I

HYDROGEOLOGY

UNIT -I

- 1.1 Introduction to hydrogeology and its relation with hydrology, meteorology, water balance, significance of hydrometeorological data in ground water geology.
- 1.2 Hydrologic cycle, occurrence and distribution of sub surface water.
- 1.3 Water bearing formation- aquifers, aquitard, aquiclude & aquifer. Aquifer types-perched, unconfined, semi confined & confined. Isotropic, Anisotropic aquifer.
- 1.4 Hydrological properties of water bearing formations, porosity, types of opening in rocks(Primary &secondary)Darcy's law and its application, specific yield and specific retention, storativity and transmissivity and hydraulic conductivity.

UNIT-II

- 2.1 Water table, definition and location of water table free unconfined water, water table in porous, fractured and cavernous media, perched

water table, lowering of water table due to pumping, area of influence upon pumping and drawdown and pressure surface.

- 2.2 Water table maps, construction and interpretations of fluctuations of water table and influencing factors.
- 2.3 Ground water mounds, trenches, divide, cascades, influent and effluent seepage artesian wells.
- 2.4 Ground water flow & permeability, steady & unsteady flow, G.W. flows near aquifer boundaries. Darcy's law and its application, leaky aquifer.

Unit-III

- 3.1 Ground water wells, types of wells and methods of their construction- dug wells, driven wells and drilled wells, Inverted wells, recharge wells, tube wells, dug cum tube wells, function of well screen, gravel treatment.
- 3.2 Well development and completion, principle and various methods of developing wells, testing of wells for yield, specific capacity of wells.
- 3.3 Course of well failures, maintenance and well repair.
- 3.4 Methods of pumping test for aquifer analysis of test data.

Unit-IV

- 4.1 Geomorphic and geologic control of ground water, surface method (geological, hydrological and geophysical) of Exploration. Electrical resistivity method.
- 4.2 Sub surface methods of exploration- bore hole logging, geological, geophysical and other logging.
- 4.3 Application of remote sensing in ground water exploration, use of radioisotopes in hydrogeological studies.
- 4.4 Ground water provinces of India, Basin wise development of ground water with special reference to Chhattisgarh region.

Unit-V

- 5.1 Quality of ground water- Chemical and Physical Characteristics of ground water for domestic, agricultural& industrial use.
- 5.2 Quality criteria for ground water use.
- 5.3 Ground water pollution, ground water recharge- natural and artificial.
- 5.4 Ground water development & management, conjunctive use of surface & ground water resources. Waterlogging, safe yield, overdraft and spacing of wells.

M.Sc.GEOLOGY

SEMESTER-III

PAPER-II

ENGINEERING GEOLOGY & GEOTECHNICAL INVESTIGATIONS

UNIT-I

- 1.1 Importance of Engineering Geology in Civil Engineering.
- 1.2 Work activities of engineering geologist.
- 1.3 Guidelines for writing an engineering Geology report.
- 1.4 Engineering properties of rock material : specific gravity, density, porosity , permeability, absorption , compressive strength, tensile strength , shear strength, deformation moduli-Poisson's ratio.

UNIT-II

- 2.1 Engineering behavior of rock mass, description of rock mass. Rock mass classification of Terzaghi and NGI, RQD.
- 2.2 Metal & concrete aggregate, desirable properties for aggregate.
- 2.3 Important properties and test for rocks used as foundation sites, test and important properties desirable for building stone.
- 2.4 Grouting: Ground improvement techniques for rocks, Geotechnical consideration, and different types of grouting. Grouting for various

engineering structures, efficacy of grouting .Rock bolting and anchoring, dental filling.

UNIT-III

- 3.1 Dam: Terminology & appurtenance, types of dam, types of spill ways with their parts.
- 3.2 Forces acting on dam, foundation and abutment problem, dam failure.
- 3.3 Geotechnical consideration for selection of dam sites.
- 3.4 Reservoirs: consideration for successful reservoirs, erosion of catchments area and siltation, reservoir capacity & life, environmental impact of creation of a reservoir.

UNIT-IV

- 4.1 Tunnels: components and types of tunnels, different stages of geotechnical investigation for tunnel.
- 4.2 Tunneling through rocks and soft ground: geological consideration.
- 4.3 Geological hazards in tunneling, effect of tunneling on the ground.
- 4.4 Methods of tunneling and support system.

UNIT-V

- 5.1 Bridge: Major types and acting force, supports and foundations of bridges.
- 5.2 Geological investigation of a bridge site, some case studies on bridges including Collapse Bridge.
- 5.3 Earthquakes magnitude & scale, Seismic zoning map of India and code for earthquake resistance.Seismotectonic frame work of India, geological consideration in seismic design.
- 5.4 Landslides:Types, description, causes, landslide hazard zonation mapping, landslide hazard mitigation& Prevention.

Lab Course-I
(Paper I and II M.Sc. Semester III)

(A)

- Water table contour maps: study and construction, analysis of hydrographs and estimation of infiltration capacity.
- Chemical analysis of water in practical and study.
- Pumping test, time-draw down test and evolution of aquifer parameters.
- Study of electrical resistivity sampling data.
- Exercise on ground water exploration.

(B)

- Study of engineering properties of rocks.
- Study of maps and models of important engineering structures on dam sites tunnels etc.

- Study of the important ongoing engineering projects (Dams, Tunnels, building constructions, town planning (special reference to Naya Raipur and river front projects).

M.Sc.GEOLOGY

SEMESTER-III

PAPER-III

MINING GEOLOGY & ENVIRONMENTAL GEOLOGY

UNIT-I

- 1.1 Introduction to mining terminologies like open cast mining, underground mining, pit, audit, tunnel, stoss, raise, etc.
- 1.2 Mining methods: Surface mining- alluvial, mineral sand, open pit, quarrying and open cast mining.
- 1.3 Mining methods: Sub surface mining- classification of stopping, underground development, different types of stopping.
- 1.4 Mining equipments: Drilling, shovel, dumpers, excavators etc.

UNIT-II

- 2.1 Mine supports, Ventilation, Drainage, Roofing.
- 2.2 Methods of breaking of rocks.
- 2.3 Role of geologist before the commencement of mining and during the mining activity.
- 2.4 Choice of mining methods depending upon
(a) Geological structures (b) Deposits

UNIT-III

- 3.1 Mine valuation methods, Use of computers in mining.
- 3.2 Coal mining methods.
- 3.3 Study of important mining methods and operations at Malanjkhand Copper mine, Ironore mining at Bailadila and Kirandul.
- 3.4 Tin ore mining in Bastar, Limestone mining in Chhattisgarh.

UNIT-IV

- 4.1 Concept of environmental geology.
- 4.2 Necessity and application of studying environmental geology.
- 4.3 Role of geologist in environmental studies in mining activities, preventive and curative measures.
- 4.4 Deforestation, land degradation and calamities, afforestation, pollution due to mining and other geological activities.

UNIT-V

- 5.1 Impact assessment of anthropogenic activities such as urbanization, open cast mining and quarrying, river valley projects, disposal of industrial and radioactive waste.
- 5.2 Concept of EIA and EMP.
- 5.3 Preliminary rules for environmental clearance.
- 5.4 Environmental Impact of mining and role of geologist in preventive and curative measures.

M.Sc.GEOLOGY

SEMESTER-III

PAPER-IV

MINERAL EXPLORATION

UNIT-I

- 1.1 Meaning and scope of prospecting and exploration.
- 1.2 Planning a prospecting program.
- 1.3 Different stages of prospecting activities.
- 1.4 Methods of prospecting: surface and sub surface.

UNIT-II

- 2.1 Opting a proper prospecting method depending upon the type of ore search.
- 2.2 Enlisting general prospecting methods depending upon type of ore search.
- 2.3 Concept of geochemical, geophysical, geological, stratigraphic, lithological prospecting methods.
- 2.4 Geophysical methods of prospecting ; their principles, applications and limitation in general.

UNIT-III

- 3.1 Gravity, magnetic, seismic and electrical methods of geophysical prospecting.
- 3.2 Sub surface methods of prospecting.
- 3.3 Subsurface geophysical methods of prospecting, different types of logging etc.
- 3.4 Prospecting plans and use of computers and modern computer based software in prospecting.

UNIT-IV

- 4.1 Sampling: Methods of sampling, choice of sampling method depending upon type of ore, precaution during the sampling and reduction of bulk samples.
- 4.2 Ore reserve estimation: Principle of ore reserve estimation in general, choosing the reserve estimation method depending upon type of ore.
- 4.3 Calculation & interpretation of assay, average assay, grade, tonnage factor and reserve calculations there from.
- 4.4 Use of computers and computer based software's in reserve estimation.

UNIT-V

- 5.1 Drilling in exploration activities.
- 5.2 Types of drilling, various components.
- 5.3 Coring and lithological logging.
- 5.4 Holistic approach for prospecting (conjunctive approach of aerial survey, satellite Imageries, geochemical analysis, lithological studies, geophysical surveys).

Lab Course-II
(Paper III and IV M.Sc. Semester III)

(A)

- Calculation of ore reserves and assay values.
- Diagrammatic representation of opencast and underground mining.
- Study of approved or otherwise mine planning.

(B)

- Viva voce on exploration plans for different types of ores.
- Exercise on various types of exploration strategies like geochemical and geophysical.

- Exercise on exploratory drilling and techniques of borehole logging.
- Exercise on geological mapping.

M.Sc.GEOLOGY

SEMESTER-IV

PAPER-I

ECONOMIC GEOLOGY – I (ORE FORMING PROCESSES)

UNIT – I

- 1.1 Modern concepts of ore genesis.
- 1.2 Classification of ore forming processes in general, genetically associated with igneous, sedimentary and metamorphic activities.
- 1.3 Ore bearing fluids, their origin and migration.
- 1.4 Textures, paragenesis and zoning in ores.

UNIT-II

- 2.1 Ore localization: structural, physico-chemical and stratigraphic controls of ore localization.
- 2.2 Wall rock alteration and Skarn deposits.
- 2.3 Sedimentary processes: precipitation, residual and mechanical concentration, placer, evaporates.
- 2.4 Oxidation and supergene enrichment processes.

UNIT – III

- 3.1 Magmatic deposits: Early and late magmatic processes, assimilation, filter pressing, gravity accumulation, dissemination.
- 3.2 Pegmatites and migmatitic processes of pneumatolitic deposits.
- 3.3 Hydrothermal processes of ore formation.
- 3.4 Introductory study and applications of fluid inclusion studies.

UNIT – IV

- 4.1 Metamorphic and metasomatic processes of ore deposition.
- 4.2 Study of geothermobarometry.
- 4.3 Stratiform and stratabound deposits.

UNIT – V

- 5.1 Plate tectonics and mineral deposition- global and Indian perspective.
- 5.2 Basic concepts of origin of coal.
- 5.3 Origin of petroleum.
- 5.4 Metallogenetic epoch and provinces in global as well as Indian context.

M.Sc.GEOLOGY

SEMESTER-IV

PAPER-II

ECONOMIC GEOLOGY – II

(INDIAN MINERAL DEPOSITS: METALLIC, NON-METALLIC AND FOSSIL FUEL)

UNIT – I

Mineralogical characteristics, geological setting, genesis (in short), distribution and uses of following ore deposits in India:

- 1.1 Iron and Manganese
- 1.2 Lead and Zinc
- 1.3 Chromium and Nickel
- 1.4 Alluminium

UNIT – II

Mineralogical characteristics, geological setting, genesis (in short), distribution and uses of following ore deposits in India:

- 2.1 Platinum and Cobalt
- 2.2 Gold and Silver
- 2.3 Tin, Tungsten and Molybdenum
- 2.4 Copper

UNIT – III

Characteristics, geological setting, genesis (in short), distribution and application of following non-metallic deposits of India:

- 3.1 Limestone and Dolomite
- 3.2 Gypsum and various Clays
- 3.3 Phosphorite and Feldspars
- 3.4 Sillimanite, kyanite, Andalusite

UNIT – IV

Characteristics, geological setting, genesis (in short), distribution and application of following non-metallic deposits of india:

- 4.1 Baryte (heavy spar), Micas
- 4.2 Asbestos, Graphite, Talc
- 4.3 Diamond, Garnet, Corundum
- 4.4 Gem mineral deposits

UNIT – V

- 5.1 Petroleum system: Concepts and definitions
- 5.2 Migration and accumulation of Petroleum. Structural, stratigraphic and Mixed Traps.
- 5.3 Petroleum deposits of India
- 5.4 Characteristics, grades, origin, geological setting, distribution and uses of Indian coal deposits with special reference to Chhattisgarh.
- 5.5 Study of coal and petroleum economics in global perspective.

Lab Course-I

- Megascopic study of ore minerals in hand specimens.
- Identification of ore minerals in polished sections.
- Study of ore textures and structures.
- Practical related to application of ores in various industries.
- Plotting of famous ore deposits of world as well India on the maps.
- Mineral map of chhattisgarh (metallic and non mettalic)
- Mineral based industry of Chhattisgarh(location map)
- Coal deposit & gem minerals of Chhattisgarh
- List of major and minor minerals of Chhattisgarh
- Royalty rate of minor minerals of Chhattisgarh
- Make a chart of minerals used in :1 Cement industry
2 ferroallowa industry 3 alluminium based industry 4
ceremic and fertilizer industry 5 paints and pigments
6 refractory 7 building and decorative stone 8 road metal

M.Sc.GEOLOGY

SEMESTER-IV

PAPER-III

CHHATTISGARH: GEOLOGY, MINERAL RESOURCES AND THEIR INDUSTRIAL APPLICATION

UNIT-I

- 1.1 General geological setup of Chhattisgarh state.
- 1.2 Study and preparation of Geological map of Chhattisgarh.
- 1.3 Geological formation with the short outline of their paleogeography, palaeohistory and palaeoclimate.
- 1.4 Geological set up of Chhattisgarh state and its correlation with other equivalent formation of Indian subcontinent.

UNIT-II

- 2.1 Metallic deposits and mineral resources of Chhattisgarh state as data available with state and central govt. agencies.
- 2.2 Genetic Correlation of these (2.1) deposits and mineral resources with Geology of Chhattisgarh.
- 2.3 Metallic mineral deposits of Chhattisgarh like Bauxite, Iron Ore, Tin ore, gold and other reported resources.
- 2.4 Study of Grade and Quality of above given metallic mineral deposits and reported resources.

UNIT-III

- 3.1 Non metallic deposits and reported mineral resources of Chhattisgarh state as per data available with state and central govt. agencies.
- 3.2 Genetic correlation of these (3.1) deposits and mineral resources with the geology of Chhattisgarh.
- 3.3 Non-metallic deposits of Chhattisgarh like Coal, Limestone, Gypsum, Fluorite, Clay, Flagstone Silica and gem minerals like Corundum and Garnet.
- 3.4 Study of Grade and quality of above given non-metallic mineral deposits and reported resources.

UNIT-IV

- 4.1 An overview of minerals based industries of Chhattisgarh.
- 4.2 Minerals used in Iron & Steel industry with their specification.
- 4.3 Mineral used in Cement industries with their specification.
- 4.4 Mineral with their specification used in ferro-alloy and aluminium based industries.

UNIT-V

- 5.1 Other possible mineral based industries on the basis of study in unit 2.4
- 5.2 Other possible mineral based industries on the basis of study in Unit 3.4
- 5.3 Study of ongoing mineral based industries in other part of the country and abroad with similar mineral resources of Chhattisgarh.
- 5.4 Possible use of mineral resources of Chhattisgarh in ceramic, fertilizer, Paint and pigment, abrasive, building and decorative stone, pavement and road metal, refractory, chemical industries.

M.Sc.GEOLOGY

SEMESTER-IV

PAPER-IV

MINING LAGISLATION AND MINERAL RESOURCES DEVELOPMENT

UNIT-I

- 1.1 Concept of act, rules & restriction of rules.
- 1.2 General concepts of RP (Reconnaissance Permit), PL (Prospecting License) and ML (Mining Lease)
- 1.3 MMDR-Mines & Minerals (Development & Regulation) act-1957 and amendments therein.
- 1.4 General restriction on undertaking prospecting and mining operations.

UNIT-II

- 2.1 Definition and scope of “ mineral development” as per act
- 2.2 Procedure of obtaining prospecting license or mining lease in which the mineral vest in the government and other than government.
- 2.3 Section 5 to 13 of the above act for central government jurisdiction for mineral concession, power of state government under section 15 of

the act for minor minerals, minor minerals as per list of government of Chhattisgarh.

- 2.4 Understanding of royalty, dead rent and others fees.

UNIT-III

- 3.1 Salient features of Mineral concession & Development Rule 1988 and amendments therein.
- 3.2 Understanding of reconnaissance, prospecting and mining operations in context of a geologist in them.
- 3.3 Salient features of mineral concession rule- 1960 and amendments therein.
- 3.4 Chhattisgarh minor mineral Rules, 2015.

UNIT-IV

- 4.1 Mining Plan, understanding the components of mining plans, understanding about its approval by appropriate authorities.
- 4.2 Progressive and final mine closure plans.
- 4.3 Mine planning for major and minor minerals, studies on geologists aspects therein.
- 4.4 Study of measures indicated in MCDR about protection of environment.

UNIT-V

- 5.1 Guidelines under MCDR for united nation framework classification (UNFC classification) of mineral resource/reserve.
- 5.2 Understanding of economic axis, feasibility axis and geological axis of classification.
- 5.3 Detailed account of mining plan in context of different ore reserves & geological conditions.
- 5.4 Study of any of the approved mining plan.

Lab Course-II
(M.Sc. Semester IV)

In lab course II of semester IV each student has to undergo a practical training or choose a dissertation and submit a report. Topic for the dissertation would be allotted to the student by the supervisor.

**CERTIFICATE COURSES FOR THE
STUDENTS/PROFESSIONALS**

CERTIFICATE COURSES FOR THE STUDENTS

Fundamental certificate courses for the students (FCCS)

- Seeing toward the practical approach and providing training based educational courses those applied in nature the department of Geology, Govt. N.P.G. college of Science, Raipur is of view that the certificate courses on the topics given below will be of vital importance. This proposal also is in accordance with the directives of Department of Higher Education Govt. of Chhattisgarh for providing the practical training based courses to the students.
- Hence it is proposed that such courses should be run by the department and the proposal is placed forward before the honorable board of studies. Other important points regarding these courses are as follows. :-
 - i. It is proposed that the fees for these certificate courses would be Rs 5000 (Rupees five thousands only).
 - ii. The essential educational qualification for doing these certificate courses is 10+2
 - iii. There would be one theory paper and submission of project report on practical case study on the topic concerned allotted to the

student by the supervisor after successful completion of three weeks training.

- iv. Theory and project would be of four credits and hundred marks each. Student has to pass both theory and project with minimum 50% of marks separately.
- v. One student may undergo one certificate course in an academic year.
- vi. The proposed syllabus for these courses would not be in unit pattern unlike the other regular courses keeping in view the facts that these are practical based courses and flexible in nature.
- vii. Evaluation would be done on the basis of theory as well as project report submitted by the student.
- viii. The project report is to be submitted by the student after successful completion of three weeks practical training at any ongoing project of repute.
- ix. The students those who are perusing regular courses like M.Sc. and B.Sc. may also undergo this certificate course.

Name of the certificate course for the students:-

1. Fundamental certificate course on GIS and Remote Sensing.
2. Fundamental certificate course on Rain Water Harvesting.
3. Fundamental certificate course on project based environmental studies.

Syllabus for

Fundamental certificate course on GIS and Remote Sensing

Credits 04

Marks 100

Remote Sensing:-

- Elementary idea of remote sensing and its application.
- Satellite remote sensing, types of satellites and their uses.
- Satellite remote sensing and Indian scenario.
- Types of satellite imageries and their uses.
- Use satellite imageries in Land use planning, Infrastructure, e-governance, climate, environment, disaster management.

Geographical Information System (GIS):-

- Concept of GIS.
- Principles and significance of GIS in developmental activities.
- Introduction to Global Positioning System (GPS).
- Introduction to important GIS softwares.

Lab Course

Credits 04

Marks 100

Student has to submit a project report based on the practical training of three weeks done by him on the topic allotted by the supervisor from points above. It is proposed seeing the practical usability of the study that the topic preferably would be on the mega projects like planning and settlement of New Raipur, River front projects, mining activities, surface and ground water studies.

Syllabus for

Fundamental certificate course on Rain Water Harvesting.

Credits 04

Marks 100

- Concept & scope of rain water harvesting.
- Hydro geological cycle.
- Understanding of groundwater and surface water.
- Groundwater table
- Over exploitation of groundwater: Need for artificial recharge and rain water harvesting.
- Various artificial recharge structures: Recharge ponds, recharge pits, percolation pond, basin spreading, surface and subsurface dykes.
- Recharge well, recharge borewells,
- Rain water harvesting in urban areas: implementation of new rules by the various agencies for having RWH structures.
- RWH structure design and construction.
- Maintenance and monitoring of RWH structures
- Estimation of probable runoff from an area including rooftop.
- Study of benefit-effect on local ground water environment.
- Recycling of domestic water
- Source of water for recharging urban areas.

Lab Course

Credits 04

Marks 100

Student has to submit a project report based on the practical training of three weeks done by him on the topic allotted by the supervisor from points above. It is proposed seeing the practical usability of the study that the topic preferably would be given on case study from the area in and around Raipur. Possibly it will also be preferred that the student is attached to the place for the practical training in consultation with authorities of NRDA, Town and Country Planning, and Municipal Corporation of Raipur.

Syllabus for**Fundamental certificate course on project based environmental studies.**

Credits 04

Marks 100

- Multidisciplinary nature of environmental studies Definition, scope and importance need for public awareness.
- Natural resources and associated problems.
 - (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
 - (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
 - (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
 - (d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
- Concept of an ecosystem, structure and function of an ecosystem.
- Environmental Pollution
 - Definition, Causes, effects and control measures of
 - (a) Air pollution
 - (b) Water pollution
 - (c) Soil pollution
 - (d) Marine pollution
 - (e) Noise pollution
 - (f) Thermal pollution

(g) Nuclear hazards

Lab Course

Credits 04

Marks 100

Student has to submit a project report based on the practical training of three weeks done by him on the topic allotted by the supervisor. It is proposed seeing the practical usability of the study that the topic preferably would be given on case study from the area in and around Raipur. Possibly it will also be preferred that the student is attached to the place for the practical training from the topic given by the supervisor.

Advance post graduate certificate courses for professionals (APGCCP)

- These courses are designed keeping in view the idea of academia-industry interaction an important need of the present time as the educational institutes are partly unaware of the advances in the field while the industry is lacking behind because of unavailability of findings of new researches in academic domain. Seeing toward the practical approach and providing training based educational courses those applied in nature. The department of Geology, Govt. N.P.G. college of Science, Raipur is of view that the advance post graduate certificate courses on the topics given below will be of vital importance. This proposal is also in accordance with the directives of University Grant Commission.
- Hence it is proposed that such courses should be run by the department and the proposal is placed forward before the honorable board of studies. Other important points regarding these courses are as follows. :-
 - i. It is proposed that the fees for these certificate courses would be Rs 5000 (Rupees five thousands only).
 - ii. The essential educational qualification for doing these certificate courses is graduate in science/engineering.
 - iii. There would be one theory paper and submission of project report on practical case study on the topic concerned allotted to the student/professionals by the supervisor.

- iv. Theory and project would be of four credits and hundred marks each. Student has to pass both theory and project with minimum 50% of marks separately.
- v. One student may undergo one certificate course in an academic year.
- vi. The proposed syllabus for these courses would not be in unit pattern unlike the other regular courses keeping in view the facts that these are practical based courses and flexible in nature.
- vii. Evaluation would be done on the basis of theory as well as project report submitted by the student.
- viii. The project report is to be submitted by the student after successful completion of four weeks practical training at any ongoing project of repute.
- ix. Since this course is designed for professionals teaching hours in the regular time table will be assigned in the time slot apart from the periods allotted to the regular courses or if, needed extra classes would be arranged for covering the four credits.

Name of Advance post graduate certificate courses for professionals:-

1. Advance post graduate certificate course on ground water exploration techniques.
2. Advance post graduate certificate course on mineral exploration techniques.
3. Advance post graduate certificate course on mine planning.

Syllabus for

Advance post graduate certificate course on ground water exploration techniques.

Credits 04

Marks 100

- Origin, occurrence and distribution of groundwater: Introduction, history, distribution of water in the earth's crust, hydrologic cycle, evaporation, precipitation, effective depth of precipitation, runoff and stream flow, measurements of stream flow, vertical distribution of groundwater.
- Hydrogeological properties of rocks: Aquifer, Aquiclude, Aquitard, Acquifuge, water table fluctuations.
- Groundwater exploration: Surface and subsurface geophysical methods.
Surface geophysical methods. Electrical Methods: Resistivity Methods, Instruments, Field procedures, Data collection, Interpretation and Applications. Self-potential method.
Subsurface geophysical methods: Electrical logging methods- SelfPotential logging, Resistivity logging and other miscellaneous logging methods; Interpretations and Application of well logging methods.
- An elementary idea and understanding other geophysical methods like Seismic Methods, Magnetic Methods, Gravity Methods.

- Application of modern tools like remote sensing and GIS in groundwater exploration.

Lab Course

Credits 04

Marks 100

Student has to submit a project report based on the practical training of four weeks done by him on the topic allotted by the supervisor. It is proposed seeing the practical usability of the study that the topic preferably would be given on case study from the area in and around Raipur. Possibly it will also be preferred that the student is attached to the place for the practical training from the topic given by the supervisor.

Syllabus for

Advance post graduate certificate course on mineral exploration techniques.

Credits 04

Marks 100

- Meaning and scope of prospecting and exploration, planning a prospecting program, Different stages of prospecting activities, Methods of prospecting: surface and sub surface.
- Concept of geochemical, geophysical, geological, stratigraphic, lithological prospecting methods, Geophysical methods of prospecting; their principles, applications and limitation in general.
- Geological Exploration :Lithological and Structural guides. Regional exploration –Different stages. Planning and operation. Documentation and analysis of exploration data. Prospecting criteria and selection of target areas for exploration during reconnaissance and initial follow-up. Geological setting and prospecting criteria for important mineral deposits.
- Geophysical Exploration :choosing the geophysical method of prospecting depending on geological condition and type of ore search.

Principal, technique, instruments and procedure, for Gravity, magnetic, seismic and electrical methods of geophysical prospecting and exploration. Sub surface methods of prospecting and exploration.

- Geochemical Exploration. Geochemical cycle, mobility and association of elements, primary and secondary dispersion patterns and their classification. Geochemical surveys, sampling media – Geo chemical Exploration methods: lithochemical, hydrogeochemical, pedochemical, Biogeochemical and Radon emanometric techniques.
- An elementary idea of application of remote sensing and GIS in prospecting and exploration.
- Understanding of an integrated approach for proper prospecting and exploration method.

Lab Course

Credits 04

Marks 100

Student has to submit a project report based on the practical training of four weeks done by him on the topic allotted by the supervisor. It is proposed seeing the practical usability of the study that the topic preferably would be given on the exploration projects carried out by the agencies of national repute for different mineral search or in a mining activity where extension exploration work is being carried out.

Syllabus for

Advance post graduate certificate course on mine planning

Credits 04

Marks 100

- Introduction to MMDR (1957), MCR (1960) & MCDR (1988)
- Mining Plan, understanding the components of mining plans, understanding about its approval by appropriate authorities, role of planning in mining ventures; technical information for mine planning, reserve estimation.
- Mineral inventory and ore reserves, the basis difference cut off grade, its determination. Grade Tonnage curves and their computation.
- Bench geometry and mine layouts, planning steps; determination of mine size and Taylor's mine life rule; ultimate pit configuration; mining program; haul road design.
- Determination of optimum Size of mine, life of mine, rate of production and mining losses, Optimization of mine design on economic

considerations. Its functions and preparation of feasibility report for metallic and nonmetallic minerals

Lab Course

Credits 04

Marks 100

Student has to submit a project report based on the practical training of four weeks done by him on the topic allotted by the supervisor. It is proposed seeing the practical usability of the study that the topic preferably would be given on the ongoing mine planning projects being prepared by Recognized Qualified Person (RQP) with Indian Bureau of Mines, (Ministry of Mines) Govt. of India. The apex agency appointed for approval of mine plan.