


**COURSE OF STUDY AND SCHEME OF EXAMINATION OF
B.TECH/B.ARCH/M.TECH/M.C.A.
NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR**

Branch - Applied Geology

Course - M.TECH.

Semester - FIRST SEMESTER

S. No.	Board of Study	Subject Code	Subject Name	Periods per Week			Scheme of Examination			Total Marks	Credits
				L	T	P	ESE	CT	TA		
1	AG	A G 4 1 1 1 1 (A G)	Geomorphology	4	0	0	100	30	20	150	4
2	AG	A G 4 1 1 1 2 (A G)	Crystallography & Physical Mineralogy	4	0	0	100	30	20	150	4
3	AG	A G 4 1 1 1 3 (A G)	Structural Geology - I	4	0	0	100	30	20	150	4
4	AG	A G 4 1 1 1 4 (A G)	Principles of Stratigraphy & Palaeontology	4	0	0	100	30	20	150	4
5	AG	A G 4 1 1 1 5 (A G)	Pre-Cambrian Stratigraphy	4	0	0	100	30	20	150	4
6	AG	A G 4 1 1 2 1 (A G)	Lab.-I Crystallography & Physical Mineralogy	0	0	6	75	-	20	95	3
7	AG	A G 4 1 1 2 2 (A G)	Lab.- II Structural Geology	0	0	6	75	-	20	95	3
8	CI	C I 4 1 1 2 3 (A G)	Lab.- III Topographic Survey	0	0	6	75	-	20	95	3
9	AG	A G 4 1 1 2 4 (A G)	Library + Computer Lab.	-	-	2	-	-	15	15	1
TOTAL				20	0	20	725	150	175	1050	30


 12/11/2010
 Head of the Department
 DR. P. DIWAN
 Associate Prof. & Head
 Dept. of Applied Geology
 NIT, Raipur-492 010 (C. G.)


 Dean Academics

**COURSE OF STUDY AND SCHEME OF EXAMINATION OF
B.TECH/B.ARCH/M.TECH/M.C.A.**

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

**Branch - Applied Geology
Semester - SECOND SEMESTER**

Course - M.TECH.

S. No.	Board of Study	Subject Code	Subject Name	Periods per Week				Scheme of Examination			Total Marks	Credits
				L	T	P	ESE	CT	TA			
1	AG	AG 4 1 2 1 1 (A G)	Geodynamics	4	0	0	100	30	20	150	4	
2	AG	AG 4 1 2 1 2 (A G)	Optical Mineralogy	4	0	0	100	30	20	150	4	
3	AG	AG 4 1 2 1 3 (A G)	Descriptive Mineralogy	4	0	0	100	30	20	150	4	
4	AG	AG 4 1 2 1 4 (A G)	Structural Geology - II	4	0	0	100	30	20	150	4	
5	AG	AG 4 1 2 1 5 (A G)	Phanerozoic Stratigraphy	4	0	0	100	30	20	150	4	
6	AG	AG 4 1 2 2 1 (A G)	Lab. - I Optical Mineralogy	0	0	6	75	-	20	95	3	
7	AG	AG 4 1 2 2 2 (A G)	Lab.-II Stratigraphy & Palaeontology	0	0	6	75	-	20	95	3	
8	AG	AG 4 1 2 2 3 (A G)	Geological Field Training Camp & Report	0	0	8	100	-	45	145	4	
9	AG	AG 4 1 2 2 4 (A G)	Library + Computer Lab.	-	-	2	-	-	15	15	1	
TOTAL				20	0	22	750	150	200	1100	31	

Dr. P. Diwan
Head of the Department
(Dr. P. Diwan)

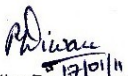
Dr. Y. B. Katpatal
External Expert - I
Dr. Y. B. Katpatal,
Professor in Geology,
Dept. of Civil Engg.,
V. N. I. T. Nagpur (M.S.)


Mr. U. P. Singh
External Expert - II
Mr. U. P. Singh,
Sr. General Manager (Geology),
Jindal Steel & Ispat Ltd.,
Mandir Hasaud,
Raipur (C.G.)


Prof. K. D. Parnar
Dean Academics
(Prof. K. D. Parnar)

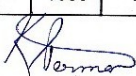
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B.TECH/B.ARCH/M.TECH/M.C.A.
NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
Branch - Applied Geology
Semester - THIRD SEMESTER**

S. No.	Board of Study	Subject Code	Subject Name	Periods per Week			Scheme of Examination			Total Marks	Credits
				L	T	P	ESE	CT	TA		
1	AG	A G 4 1 3 1 1 (A G)	Igneous Petrology	4	0	0	100	30	20	150	4
2	AG	A G 4 1 3 1 2 (A G)	Sedimentary Petrology - I	4	0	0	100	30	20	150	4
3	AG	A G 4 1 3 1 3 (A G)	Ore Forming Processes	4	0	0	100	30	20	150	4
4	AG	A G 4 1 3 1 4 (A G)	Geology of Fuel	4	0	0	100	30	20	150	4
5	AG	A G 4 1 3 1 5 (A G)	Geochemistry	4	0	0	100	30	20	150	4
6	AG	A G 4 1 3 2 1 (A G)	Lab.- I Igneous Petrology	0	0	6	75	-	20	95	3
7	CH	C H 4 1 3 2 2 (A G)	Lab.- II Geochemistry	0	0	6	75	-	20	95	3
8	AG	A G 4 1 3 2 3 (A G)	Lab. - III Ores & Ore Microscopy	0	0	6	75	-	20	95	3
9	AG	A G 4 1 3 2 4 (A G)	Library + Computer Lab.	-	-	2	-	-	15	15	1
TOTAL				20	0	20	725	150	175	1050	30


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**COURSE OF STUDY AND SCHEME OF EXAMINATION OF
B.TECH/B.ARCH/M.TECH/M.C.A.**

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

Branch - Applied Geology

Course - M.TECH.

Semester - FOURTH SEMESTER

S. No.	Board of Study	Subject Code	Subject Name	Periods per Week				Scheme of Examination			Total Marks	Credits
				L	T	P	ESE	CT	TA			
1	AG	AG 41411 (A G)	Metamorphic Petrology	4	0	0	100	30	20	150	4	
2	AG	AG 41412 (A G)	Sedimentary Petrology - II	4	0	0	100	30	20	150	4	
3	AG	AG 41413 (A G)	Indian Mineral Deposits: Metallic	4	0	0	100	30	20	150	4	
4	AG	AG 41414 (A G)	Indian Mineral Deposits: Non Metallic	4	0	0	100	30	20	150	4	
5	AG	AG 41415 (A G)	Nuclear Geology	4	0	0	100	30	20	150	4	
6	AG	AG 41421 (A G)	Lab. I Metamorphic Petrology	0	0	6	75	-	20	95	3	
7	AG	AG 41422 (A G)	Lab. II Sedimentary Petrology	0	0	6	75	-	20	95	3	
8	AG	AG 41423 (A G)	Geological Excursion Tour & Report	0	0	8	100	-	45	145	4	
9	AG	AG 41424 (A G)	Library + Computer Lab.	-	-	2	-	-	15	15	1	
TOTAL				20	0	22	750	150	200	1100	31	

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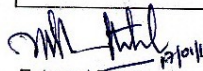
U. P. Singh
External Expert - II
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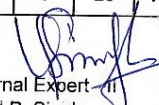
K. D. Permar
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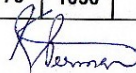
**COURSE OF STUDY AND SCHEME OF EXAMINATION OF
B.TECH/B.ARCH/M.TECH/M.C.A.
NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
Branch - Applied Geology
Semester - FIFTH SEMESTER**

S. No.	Board of Study	Subject Code	Subject Name	Periods per Week			Scheme of Examination			Total Marks	Credits
				L	T	P	ESE	CT	TA		
1	AG	A G 4 1 5 1 1 (A G)	Photogeology	4	0	0	100	30	20	150	4
2	AG	A G 4 1 5 1 2 (A G)	Mining Geology	4	0	0	100	30	20	150	4
3	AG	A G 4 1 5 1 3 (A G)	Mineral Exploration	4	0	0	100	30	20	150	4
4	AG	A G 4 1 5 1 4 (A G)	Engineering Geology	4	0	0	100	30	20	150	4
5	AG	A G 4 1 5 1 5 (A G)	Hydrogeology - I	4	0	0	100	30	20	150	4
6	AG	A G 4 1 5 2 1 (A G)	Lab. I Photogeology	0	0	6	75	-	20	95	3
7	AG	A G 4 1 5 2 2 (A G)	Lab. II Mining & Exploration	0	0	6	75	-	20	95	3
8	AG	A G 4 1 5 2 3 (A G)	Lab. III Engineering Geology	0	0	6	75	-	20	95	3
9	AG	A G 4 1 5 2 4 (A G)	Library + Computer Lab.	-	-	2	-	-	15	15	1
TOTAL				20	0	20	725	150	175	1050	30


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**COURSE OF STUDY AND SCHEME OF EXAMINATION OF
B.TECH/B.ARCH/M.TECH/M.C.A.**

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

Branch - Applied Geology

Semester - SIXTH SEMESTER

Course - M.TECH.

S. No.	Board of Study	Subject Code	Subject Name	Periods per Week				Scheme of Examination				Total Marks	Credits
				L	T	P		ESE	CT	TA			
1	AG	AG 41611 (A G)	Remote Sensing & GIS	4	0	0		100	30	20	150	4	
2	AG	AG 41612 (A G)	Hydrogeology – II	4	0	0		100	30	20	150	4	
3	AG	AG 41613 (A G)	Geotechnical Investigations	4	0	0		100	30	20	150	4	
4	AG	AG 41614 (A G)	Environmental Geology	4	0	0		100	30	20	150	4	
5	AG	AG 41615 (A G)	Mineral Economics	4	0	0		100	30	20	150	4	
6	AG	AG 41621 (A G)	Lab. I Hydrogeology	0	0	6		75	-	20	95	3	
7	AG	AG 41622 (A G)	Lab. II Geotechnical Investigations	0	0	6		75	-	20	95	3	
8	AG	AG 41623 (A G)	Dissertation & Thesis	0	0	8		100	-	45	145	4	
9	AG	AG 41624 (A G)	Library + Computer Lab.	-	-	2		-	-	15	15	1	
TOTAL				20	0	22		750	150	200	1100	31	

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Raipur (C.G.)

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M.TECH. SEMESTER - I
THEORY
PAPER – I GEOMORPHOLOGY

Unit 1

Principles of Geomorphology, Landforms in relation to climate, rock type, structure and tectonics. Weathering and Soil processes, Cycle of Erosion and Modification by climates, Upliftment and Erosion, Mass Movement. Theories in Geomorphology.

Unit 2

Fluvio-Geomorphic Cycle: Fundamental concepts, Streams and valleys, Drainage pattern and their significance, Drainage texture, Stream meandering and lateral erosion, an idealized fluvial cycle and fluvial features. Karst topography: Introduction, Factors, Types and Landforms.

Unit 3

Arid cycle and climate: Major landforms of arid regions, the arid erosion cycle, Topographic effects of wind erosion. Glacial features, Type of glaciers and landforms.

Unit 4

Techniques of geomorphology: Morphometric analysis, Drainage basin analysis, Slope analysis and Geomorphological mapping. Topographical maps.

Unit 5

Applied geomorphology: Application to mineral prospecting, civil engineering, hydrology and environmental studies. Problems of land use and development, Geomorphological methods. Geomorphology of India.

M.TECH. SEMESTER – I
THEORY
PAPER – II CRYSTALLOGRAPHY AND PHYSICAL MINERALOGY

Unit 1

Crystal elements, symmetry, the law of crystallography, the common holohedral hemihedral and hemimorphic forms in crystallography, simple mathematical relationships. Crystal parameters and indices. Classification of crystals into six systems and 32 point groups.

Unit 2

Symmetry characters and forms of the normal classes of the following systems: Cubic, Tetragonal, Hexagonal, Orthorhombic, Monoclinic and Triclinic. Stereographic Projections of symmetry elements and forms.

Unit 3

Twinning in crystals, their laws, composition plane, twin plane and twin axis. Imperfections and irregularities of crystals: Lattice defects (point, line and planar).

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Elementary principles of X-ray and their applications.

Unit 4

Solid solutions, Principles governing solid solution phenomena.

Effects of temperature on solid solutions, Ex-solution, Ionic radii, Coordination number, Radius ratio, Bonding and Pauling's principle.

Structural classification of silicate mineral.

Unit 5

Minerals: definition and classification, physical properties and chemical composition of common rock-forming minerals (oxides, silicates, sulphides, carbonates, phosphates, and halide groups).

Transformation of minerals – polymorphism, polytypism.

M.TECH. SEMESTER – I THEORY PAPER – III STRUCTURAL GEOLOGY – I

Unit 1

Principles of geological mapping and map reading, Field techniques of structural mapping and structural annotations. Scale of map.

Structural behaviour of igneous rocks, diapirs and salt domes.

Top and bottom criteria of sedimentary, metamorphic and igneous rocks, Differentiation of sedimentary and tectonic structures.

Unit 2

Theory of stress and strain. Stress-strain relationships of elastic, plastic and viscous materials.

Behaviour of minerals and rocks under deformation conditions. Different types of failure and sliding criteria.

Role of fluids in deformation processes.

Time-relationship between crystallization and deformation.

Unit 3

Stress analysis: Compressive and shear stresses, Mohr's circle, mean and deviatoric stress. Stress ellipsoid.

Paleostress analyses

Unit 4

Strain analysis: kinds of strain, strain ellipsoid, strain markers. Techniques of strain analysis. Strain measurements.

Progressive strain history and methods for its determination.

Unit 5

Stereographic projections and their use in structural analysis.

Concept of Orogeny. Important Orogenic belts of the world.

Neotectonics and its importance. Indian examples.

Structure and major tectonic features of the Indian subcontinent.

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M.TECH. SEMSTER – I
THEORY
PAPER – IV PRINCIPLES OF STRATIGRAPHY AND PALAEOLOGY

Unit 1

Components of Stratigraphy, Stratigraphic columns, Historical evolution of stratigraphic classification.
 Principles of Stratigraphy, Geological Time Scale, Stratigraphic units and their modern classification.
 Physical and tectonic subdivisions of Indian subcontinent and their characteristics.

Unit 2

Methods of Stratigraphic correlations, Code of Stratigraphic Nomenclature and Age of the Earth's Strata.
 Lithostratigraphic, chronostratigraphic and biostratigraphic units, stratigraphic classification and correlation.
 Identification of stratigraphic contacts. Facies concept in stratigraphy.

Unit 3

Basic principles of magnetostratigraphy, sequence stratigraphy and high resolution biostratigraphy.
 Changes in the environment on the Earth surface through geological time.
 Basic idea of paleogeographic reconstruction, position of the Indian subcontinent in different geological periods and the paleoclimatic implications.

Unit 4

Morphology, classification, distribution and geological history of Corals, Echinoderms, Graptolites, Trilobites, Brachiopods, Lamellibranchs, Gastropods, Ammonoites and Cephalopods.
 Micropalaeontology and its importance: A preliminary study of Foraminifera, Ostracods and Nannofossils.

Unit 5

Elementary ideas about vertebrate evolutions.
 Evolutionary history of man, elephant and horse.
 General idea about of plant evolution with emphasis on Gondwana flora.

M.TECH. SEMSTER – I
THEORY
PAPER – V PRE-CAMBRIAN STRATIGRAPHY

Unit 1

An outline of Paleogeography and Paleoclimate of Pre-Cambrians and Phanerozoic rocks of the World.
 Classification, geographic distribution, lithological characteristics, fossil contents and economic importance of rocks of Pre-Cambrian successions of India.

Unit 2

Precambrian Basement rocks in Dharwar, Aravalli-Bundelkhand, Bastar, Singhbhum provinces, Central India and Northeastern India.

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Lithological, geochemical, geochronological and stratigraphic characteristics of the cratonic nuclei, granite – greenstone and granulite belts.

Unit 3

Proterozoic mobile belts in northwestern, central, eastern and southern Indian peninsular regions and in the extra-peninsula.

Stratigraphy of Proterozoic sedimentary basins: Vindhyan, Cuddapah, Kurnool, Bhima, Kaladgi, Chattisgarh.

Unit 4

Detailed study of Pre-Cambrians (Archeozoics and Proterozoics) of Extra-Peninsular India.

Proterozoic events: glacial deposits, changes in atmospheric composition and organization of life.

Unit 5

Life in Precambrian: Archaeozoic and origin of life.

Concept of Proterozoic Super continents—Columbia and Rodinia. Gondwanaland, Pangea and their breakup and amalgamation through time.

Precambrian – Cambrian boundary with special reference to India.

M.TECH. SEMESTER – I

PRACTICAL

CRYSTALLOGRAPHY AND PHYSICAL MINERALOGY

- 1 Study of holohedral, hemihedral, hemimorphic and enantiomorphic forms of Cubic, Tetragonal, Hexagonal, Orthorhombic, Monoclinic and Triclinic crystal Systems.
- 2 Stereographic projections.
- 3 Calculation of zone symbols and symbol of imperfect faces occurring between known zones.
- 4 Identification and megascopic characters of the important rock forming minerals.
- 5 Study of Twin crystals.
- 6 Calculation of mineral formula.

M.TECH. SEMESTER – I

PRACTICAL

STRUCTURAL GEOLOGY

- 1 Stereographic Projections: Problems in Angular relationship - True dip, Apparent dip, Plunge and Rake of the Intersection of plane, β and π - Diagrams, π - pole girdle, Contouring of Stereographically plotted data.
- 2 Study of minor structures in hand specimens.

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- 3 Preparation and interpretation of advanced Geological Maps and Structural Contour Maps (Isopach, Isochore, Isolith and Isograde) for inclined strata, folds, faults and unconformities.
- 4 Three point problems: Geometric solutions and fault problems.
- 5 Analysis of Geometry and Style of folds.
- 6 Measurements of Strain in rocks.

**M.TECH. SEMESTER – I
PRACTICAL
TOPOGRAPHIC SURVEY**

- 1 Measurement of distances, Chain surveying, Prismatic compass and Chain traversing.
- 2 Leveling with Dumpy level and Contouring.
- 3 Plane Table surveying and Three Point problems.
- 4 Measurement of horizontal and vertical angles with Transit Theodolite, Triangulation, Tacheometric survey with Theodolite and Plane table with Telescopic alidade.
- 5 Use of Global Positioning System (GPS) in surveying.

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**M.TECH. SEMESTER – II
THEORY
PAPER – I GEODYNAMICS
SUBJECT CODE: A G 4 1 2 1 1 (A G)**

Unit 1

Earth and solar system. Planetary evolution of the earth and its internal structure.
Crust: Composition, crustal types, Seismic exploration, Heat flow, Gravity and Magnetic anomalies, Crustal provinces.
Mantle: Different zones, Seismic characters, Composition, gravity anomalies,
Core: Divisions and Compositions.

Unit 2

Palaeomagnetism: Normal and Reverse Magnetism, Palaeomagnetic Time Scale, Palaeomagnetism of Ocean floors.
Continental Drift: Taylor and Wegners concepts. Geological and geophysical evidence, mechanics, objections, present status. Concept of Polar Wandering.
Hot spot, Mantle plume.

Unit 3

Sea-floor spreading: Evidence and Mechanism.
Oceanic ridges and rises, Migrating oceanic volcanoes, Ocean trenches.
Subduction zones, Island arcs, Isostasy.
Orogeny: Orogenic cycles, Orogenic periods.

Unit 4

Plate tectonics: Plates and their reconstruction, Wilson cycle.
Mechanism and causes of Global Tectonic phenomenon: Contraction and Expansion Hypothesis, Thermal Convection Hypothesis.
Geological and geophysical characteristics of plate boundaries.
Geosynclines: Geosynclinal theory, Evolution of Mountains.

Unit 5

Volcanoes: Their form and structure, volcanic belts.
Earthquake: Distribution of epicenters, Intensities and Isoleismic lines, Earthquake zones and belts.
Geodynamics of the Indian plate.

**M.TECH. SEMESTER – II
THEORY
PAPER – II OPTICAL MINERALOGY
SUBJECT CODE: A G 4 1 2 1 2 (A G)**

Unit 1

General principles of optics: Color of light, Polarization of light, Refraction, Total Reflection, Refractive index, Double refraction.
Interference phenomenon: Order of interference color, Michael Levy's Chart.
Isotropic and Anisotropic Minerals.

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Unit 2

Petrological microscope: Various parts and their functions.
Principle, construction and use of optical accessories: Quartz wedge, Gypsum plate, Mica plate and Berek's Compensator.
Determination of the order of interference color in anisotropic minerals.
Isoaxial, Uniaxial and Biaxial Minerals.

Unit 3

Determination of refractive index of Isoaxial, Uniaxial and Biaxial minerals
Birefringence of minerals and their relation with mineral composition. Determination of birefringence using Berek's compensator and Michael Levy's Chart.
Optical indicatrix, uniaxial and biaxial.

Unit 4

Extinction phenomenon, Extinction angle and its determination.
Study of interference figure, uniaxial and biaxial.
Determination of optic sign in minerals.
Selective absorption, determination of dichroism and pleochroic scheme in minerals.

Unit 5

Optic axial angle and its determination.
Dispersion in minerals.
Optical anomalies in minerals and their study.
Basic elementary principle of Universal Stage and its application.

**M.TECH. SEMESTER – II
THEORY
PAPER – III DESCRIPTIVE MINERALOGY
SUBJECT CODE: A G 4 1 2 1 3 (A G)**

Unit 1

Classification of Minerals.
Study of following rock forming silicate mineral groups covering structure, chemistry, physical properties, optical properties and paragenesis of Felspars, Feldspathoids, Quartz and Garnet.

Unit 2

Study of following rock forming silicate mineral groups covering structure, chemistry, physical properties, optical properties and paragenesis of Olivines, Pyroxenes, Amphiboles and Mica.

Unit 3

Study of following rock forming silicate mineral groups covering structure, chemistry, physical properties, optical properties and paragenesis of Epidote, Chlorite, Alumino-silicates, Staurolites, Cordierites, Talc and Chloritoids.

Unit 4

Study of some common oxides, carbonate and sulphates mineral groups covering structure, chemistry, physical properties, optical properties and paragenesis.

Unit 5

Study of some common phosphate, sulphide and halide mineral groups covering structure, chemistry, physical properties, optical properties and paragenesis.



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M.TECH. SEMESTER – II
THEORY
PAPER – IV STRUCTURAL GEOLOGY – II
SUBJECT CODE: A G 4 1 2 1 4 (A G)

Unit 1

Fold morphology. Geometric and genetic classification of folds.
Mechanics and causes of folding.
Interference patterns and structural analyses in areas of superposed folding.
Sheath folds.

Unit 2.

Geometric and genetic classification of Fractures, Faults and Thrusts.
Mechanics and causes of faulting.
Effects of faulting on the outcrops.
Klippe and Tectonic windows.

Unit 3

Unconformities: their kinds. Geological significance and recognition of unconformities. Basement - cover relations. Outlier and Inlier.
Introduction to petrofabrics. L-, L-S-, and S-tectonic, S-C- tectonics fabrics.
Petrofabric Analysis.

Unit 4

Cleavage: Types, mechanics of cleavage formation and relation to major structures.
Lineation: Types, development and relation to major structures.
Joints: Geometric and Genetic Classification and joint analysis.
Schistosity: Types and relation to major structures.

Unit 5

Shear zones: Introduction, Geometry and Analyses. Shear sense indicators, Structures in shear zones.
Geometry and mechanics of development boudins.
Structural analysis of an area with single and multiple deformations.

M.TECH. SEMESTER – II
THEORY
PAPER – V PHANEROZOIC STRATIGRAPHY
SUBJECT CODE: A G 4 1 2 1 5 (A G)

Unit 1

An advanced study of the stratigraphy, paleogeography and paleoclimates, distribution and correlation of the Paleozoic rocks of India.

Unit 2

An advanced study of the stratigraphy, paleogeography and paleoclimates, distribution and correlation of the Mesozoic rocks of India.

Unit 3

Stratigraphy, paleogeography, paleoclimates, fossil content and distribution of the Gondwana rocks of India.
Comparison between Peninsular and Extra Peninsular Gondwana rocks.



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Unit 4

Detailed study of the stratigraphy, paleogeography and paleoclimates, distribution and correlation of the Tertiary rocks in India.

Deccan Traps. Stratigraphy of Bagh and Lameta beds. Infra- and Intertrappean beds.

Unit 5

Stratigraphic boundary problems in Indian Geology: Precambrian-Cambrian boundary; Permian-Triassic boundary; Cretaceous-Tertiary boundary.

Glacial events in the Earth's history.

Stratigraphic implication of the sea-level changes in the Quaternary period and their significance in Indian subcontinent.

**M.TECH. SEMESTER – II
PRACTICAL
OPTICAL MINERALOGY
SUBJECT CODE: A G 4 1 2 2 1 (A G)**

- 1 Identification and microscopic characters of the important rock forming minerals.
- 2 Determination of the order of interference color of minerals.
- 3 Determination of pleochroic scheme of uniaxial and biaxial minerals.
- 4 Study of conoscopic figures of uniaxial and biaxial crystals using the optic axial and acute bisectrix, figures, determination of extinction angle using tint sensitive plate and by the Bio Fresnel law.
- 5 Determination of the composition of feldspars by the Michael Levy's method.

**M.TECH. SEMESTER – II
PRACTICAL
STRATIGRAPHY AND PALAEOONTOLOGY
SUBJECT CODE: A G 4 1 2 2 2 (A G)**

- 1 Megascopic study of typical stratigraphical rocks from important geological formations of India and their age.
- 2 Plotting of important Stratigraphic Formations and locations on World and Indian geographical maps.
- 3 Stratigraphic correlation of different rocks of India.
- 4 Study of the typical invertebrate fossils from different geological formations.
- 5 Study of the plant fossils of Gondwanas.

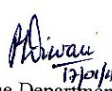
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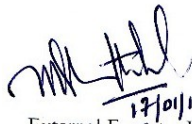
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M.TECH. SEMESTER – II
FIELD CAMP
GEOLOGICAL FIELD TRAINING REPORT AND VIVA VOCE
SUBJECT CODE: A G 4 1 2 2 3 (A G)

- 1 21 Days field training on the various aspects of geological mapping and instruments (Surveying instruments and GPS).
- 2 Topographic Map reading and positioning.
- 3 Techniques of field mapping and sampling. Collection of data from field, their plotting and interpretation.
- 4 Preparation of geological map and cross sections.
- 5 Exhaustive geological field mapping program and report writing.
- 6 Introduction to the Computer and its use in geology.


Head of the Department
(Dr. P. Diwan)


External Expert – I
Dr. Y.B. Katpatal,
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Dept. of Civil Engg.,
V. N. I. T. Nagpur (M.S.)


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Raipur (C.G.)


Dean Academics
(Prof. K.D. Permar)

M.TECH. SEMESTER – III
THEORY
PAPER – I IGNEOUS PETROLOGY
SUBJECT CODE: A G 4 1 3 1 1 (A G)

Unit 1

Principles and general concept of petrology, petrography and petrogenesis.
 Principles governing phase equilibrium and kinetics of reaction in single, binary, ternary and multi-component magma and its significance in genesis and fabric of rock. Effect of volatiles on melt equilibria.
 Various Forms, Structures and Textures of Igneous rocks and their significance in petrogenesis.

Unit 2

Magma: Composition and Characteristics. Factors controlling the ascent of magmas. Effect of water and high pressure on magma.
 Classification of Igneous rocks: Important Textural, Chemical, Mineralogical, CIPW and IUGS classification.

Unit 3

Reaction principle – Bowen's Reaction Series, its role in crystallization of magmas.
 Crystallization of magma in relation to studies of following systems and their petrogenetic significance:

- (a) Diopside – Anorthite system
- (b) Forsterite – Silica system
- (c) Albite – Anorthite system
- (d) Or – Ab system
- (e) Ab – An – Diopside system.
- (f) Fo – An – SiO₂ system.
- (g) Fo – Diopside – SiO₂ system.
- (h) Or – Ab – Silica system
- (i) Petrogeny's residua system.
- (j) Qz-Or-Ab-An-H₂O system.

Unit 4

Factors causing diversity in igneous rocks – Assimilation, Liquid Immiscibility and Differentiation.
 Origin and Evolution of Magma. Magmatism related to Plate Tectonics.
 Partial melting, magma generation and diversification.

Unit 5

Description of important igneous rocks, petrogenesis and their distribution in India: Charnockite, Granite and Granitization, Alkaline rocks, Monomineralic rocks, Spilites, Basalt, Lanprophyre, Ultramafic rocks, Carbonatite, Kimberlite and Pegmatites.

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M.TECH. SEMESTER – III
THEORY
PAPER – II SEDIMENTARY PETROLOGY – I
SUBJECT CODE: A G 4 1 3 1 2 (A G)

Unit 1

Fundamentals of sedimentation and signification of sedimentology.
 Sedimentary processes: Weathering, transportation, deposition.
 Post depositional changes: Cementation, Compaction, Diagenesis.
 Changes during Lithification.
 Diagenesis of Clastic and Non-clastic sediments.

Unit 2

Texture of sediments: Principles, size, roundness, surface, particle-orientation.
 Methods of study of grain size, shape and roundness.
 Statistical analysis of the grain size and other textural data.
 Structure of sediments: Morphological and genetic, Primary and secondary.
 Primary structures, Biogenic and chemical sedimentary structures.

Unit 3

Classification of sedimentary rocks.
 Rocks of Mechanical origin:
 Rudaceous rocks: Conlomerate and Breccia – Classification, Description and Origin.
 Arenaceous rocks: Sandstone - Classification, Description and Origin.
 Argillaceous rocks: Mudrock/Shale - Classification, Description and Origin.

Unit 4

Rocks of Chemical and Biochemical origin:
 Carbonate: Classification, Description and Origin.
 Rocks other than Carbonate – Evaporites, Siliceous sediments, Phosphorites, Iron rich rocks, Carbonaceous rocks: Classification, Description and Origin.

Unit 5

Volcanoclastic rocks: Texture and structure of volcanoclastic sediments, Classification, composition and origin.
 Orogenic sediments: Flysch and Molasse - Classification, composition and origin.

M.TECH. SEMESTER – III
THEORY
PAPER – III ORE FORMING PROCESSES
SUBJECT CODE: A G 4 1 3 1 3 (A G)

Unit 1

Historical review of theories of ore deposition. Tenor and Grade, Ore bodies and Lodes,
 Ore Bearing Fluids- Their nature and migration. Deposition of Ores.
 Physico-Chemical controls of deposition and post depositional changes.
 Metallogeny in space and time (Metallogenic provinces and epochs).

MD ML VP

Unit 2

The Nature and Morphology of mineral deposits.
 Textures and Structures of Ore and Gangue minerals.
 Wall rock alteration, Paragenesis and Zoning.
 Geothermometry and geobarometry.
 Fluid Inclusions. Dating of ore deposits.

Unit 3

Classification of Ore deposits.
 Magmatic deposits: Early and Late.
 Hydrothermal Deposits: Hypothermal, Mesothermal, Epithermal, Telethermal and Xenothermal.
 Metasomatic Deposits: Skarns deposits.
 Pegmatitic and Carbonatitic Deposits.

Unit 4

Sedimentary Deposits: Chemical precipitation, Residual and Mechanical concentration. Placer Deposits.
 Gossans: Structure, Mineral Composition, Interpretation and significance.
 Oxidation and Supergene Enrichment.
 Metamorphism of ores deposits.

Unit 5

Disseminated and Stockwork deposits associated with plutonic intrusives.
 Stratiform sulphide and oxide deposits of sedimentary and volcanic environments.
 Strata bound deposits.
 Plate tectonics related to mineral deposits.

**M.TECH. SEMESTER – III
 THEORY
 PAPER – IV GEOLOGY OF FUEL
 SUBJECT CODE: A G 4 1 3 1 4 (A G)**

Unit 1

Fuel geology: Concept of fuel minerals, their role in national productivity, conservation and exploration policy of fuel minerals like Coal, Petroleum and Radioactive Minerals.
 Petroleum: Composition and origin – Inorganic and Organic Theories.
 Petroleum system: Concept and definition.

Unit 2

Migration and Accumulation of petroleum fluids: Primary and Secondary migration.
 Factors affecting migration and accumulation of petroleum. Mathematical derivations for migration of petroleum.
 Structural, stratigraphic and mixed traps for petroleum accumulation.



Unit 3

Kerogen: Definition, Types and their significance. Oil window.
Characteristics and properties of Source, Reservoir and Cap rocks.
Geographical and geological distributions of Onshore and Offshore petroliferous basins of India and their characteristics.

Unit 4

Origin of Coal: Various Theories. Peat, Lignite, Bituminous and Anthracite.
Coalification: Definition and Process. Factors affecting coalification.
Composition and constitution of Coal, rank, bands in coal, grade of coal, chemical composition and analysis of coal.
Stratigraphy of Coal Measures.

Unit 5

Fundamentals of coal petrology. Industrial application of coal petrology.
Geographical and geological distributions of Coal field of India and their characteristics.
Elementary ideas about Coal Bed Methane and Gas Hydrate.
Mineralogy, distribution, origin and occurrence of radioactive minerals in India.

**M.TECH. SEMESTER – III
THEORY
PAPER – V GEOCHEMISTRY
SUBJECT CODE: A G 4 1 3 1 5 (A G)**

Unit 1

The subject of geochemistry history, scope and relationship with other sciences.
Composition of the universes. Cosmic abundance of the elements.
Meteorites: Classification, Composition and structure.
The structure and composition of the earth. Ringwood's model. Composition of the Crust.

Unit 2

The primary geochemical differentiation of the earth and the distribution of the elements among the geochemical spheres of the earth. Goldschmidt's geochemical classification of the elements.
Principles of crystal structure – different kinds of bonds ionic size, coordination number, structural classification of silicate minerals, Lattice energy of crystals, Isomorphism and atomic substitution, camouflage, capturing and admittance. Polymorphism.

Unit 3

The Chemical composition of magmas and their chemical differentiation. Minor, Trace and REE elements in magmatic crystallisation. The volatile components of Magma. The Reaction series.
Sedimentation as a geochemical process. Goldich's stability series, Physico-chemical factors in sedimentation - ionic potential, hydrogen ion concentration, oxidation-reduction potential, sorption and colloidal process.
Metamorphism as geochemical process. Mineral transformation and facies principle.



Unit 4

The hydrosphere: Composition of sea water and terrestrial waters. Residence time of elements. Gains and losses of ocean.

The atmosphere: Composition and evolution. Atmospheric gains and losses.

The biosphere: Composition of the biosphere. Minor elements in biogenic deposits.

The Geochemical Cycle.

Unit 5

Geochemistry in mineral exploration: Geochemical environment, dispersion, mobility, background, threshold and anomaly. Geochemical indicators and association of elements. Methods of analytical investigations used in geochemical exploration.

Primary dispersion: Syngenetic and epigenetic patterns. Gaseous dispersion patterns.

Secondary dispersion: Classification and forms of secondary dispersion patterns.

Factors affecting the development of secondary dispersion patterns. Anomalies not related to mineral deposits. Suppression of significant anomalies.

M.TECH. SEMESTER – III
PRACTICAL
IGNEOUS PETROLOGY
SUBJECT CODE: A G 4 1 3 2 1 (A G)

- 1 Identification of various Igneous rocks in hand specimen through megascopic characters.
- 2 Identification of various Igneous rocks in thin section through and microscopic characters.
- 3 Identification of various textures such as intergrowth, porphyritic, equigranular, reaction rim, panidiomorphic, perthites and antiperthites etc. of igneous rocks and their petrogenetic significance.
- 4 C.I.P.W. norm calculations, plotting of normative values on triangular diagrams.
- 5 Harker's and Niggli's variation diagrams and their interpretation.
- 6 Application of computer in petrological data analysis and use of petrological software.

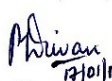
M.TECH. SEMESTER – III
PRACTICAL
GEOCHEMISTRY
SUBJECT CODE: C H 4 1 3 2 2 (A G)


- 1 Collection of field samples and methods of quick analysis as used in geochemical prospecting, specially flame photometry, colorimetry, chromatography and spot tests.
- 2 Analysis of the following: Limestone, bauxite, ores of Fe, Mn, Cu, Pb, Zn, etc.


- 3 Trace and REE plotting and their interpretation.
- 4 Acquaintance with the following instruments: Radiation meters, scientilloeters and geiger counter.
- 5 Micro chemical tests for ores.
- 6 Application of computers in geochemical data analysis and introduction to data base management.

M.TECH. SEMESTER – III
PRACTICAL
ORES AND ORE-MICROSCOPY
SUBJECT CODE: A G 4 1 3 2 3 (A G)

- 1 Megascopic study of ores, ore-minerals, gangue and host rock. Discussion of the nature of ore deposits revealed from hand specimen.
- 2 Identification of ore minerals in polished sections on the basis of their optical properties.
- 3 Study of ore textures and their geological significance.
- 4 Establishment of Paragenesis of ore minerals.
- 5 Application of microscopic study to ore dressing.


Head of the Department
(Dr. P. Diwan)


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M.TECH. SEMESTER – IV
THEORY
PAPER – I METAMORPHIC PETROLOGY
SUBJECT CODE: A G 4 1 4 1 1 (A G)

Unit 1

Metamorphism: Definition, General concept, Agents and Types of metamorphism.
Metamorphic Grade, Metamorphic Zones, Metamorphic Facies and Isogrades.
Metamorphic Pressure – Temperature regimes.
Classification of metamorphic rocks.

Unit 2

Graphical representation of metamorphic mineral assemblages. ACF, AKF, AFM diagrams, etc.
The concept of Equilibrium. Evidence of Mass transfer during metamorphism and its mechanism.
Kinetics of mineral reactions in metamorphism their use in Geothermobarometry.
Metamorphic Structures and Textures.

Unit 3

Regional and Thermal metamorphism of mafic rocks, pelitic sediments and calcareous rocks.
Thermal metamorphism of impure lime stone.

Unit 4

Anatexis, Panlingogenesis and Migmatites.
Paired Metamorphic Belts. Impact, and ocean-floor metamorphism.
Metamorphism related to Plate tectonics.
P – T – t path in regional metamorphic terrains.
Evidence of polymetamorphism.

Unit 5

Metasomatism – Chemical principles and types of metasomatism.
Metamorphic textures and structures in relation with retrograde metamorphism and metamorphic differentiation.
Fabric analysis of metamorphic rocks.
Relationship between metamorphism and deformation.

M.TECH. SEMESTER – IV
THEORY
PAPER – II SEDIMENTARY PETROLOGY – II
SUBJECT CODE: A G 4 1 4 1 2 (A G)

Unit 1

Sedimentary environment: Elements and factors, patterns and classification.
Sedimentary facies: Terminology and revised concept.
Sedimentary environment and facies.
Facies modelling for marine, non-marine and mixed sediments.

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Unit 2

Plate movement and basin formation.
Tectonics and tectonic framework of sedimentation, Rate of sedimentation, Krynine's tectonic cycle, important lithologic associations, classification of tectonic elements. Tectonics and related factors in sedimentation.
Tectonic control of sandstone composition.

Unit 3

Provenance: Definition and Concepts. Minerals and Source rocks. Mineral stability. Heavy Mineral Zone.
The Geosynclinal Cycle: Concept and relation with sedimentation.

Unit 4

Classification of sedimentary basins, Sedimentary basins of India.
Basin Analysis: Palaeoslope and Palaeocurrent analysis.
Determination of depositional environment.
Basin Evolution and Tectonics of the basin.

Unit 5

Introduction to clay mineralogy, classification and nomenclature. Detailed atomic structure of all clay mineral groups and isomorphous substitution.
Ion exchange, clay water system.
Origin and occurrence of clays.
Industrial properties of clay: X-ray, DTA patterns, electron microscopy, staining techniques, correlation of engineering behavior of clays with physicochemical properties.

M.TECH. SEMESTER – IV

THEORY

PAPER – III INDIAN MINERAL DEPOSITS: METALLIC

SUBJECT CODE: A G 4 1 4 1 3 (A G)

Unit 1

Mineralogical characteristics, Geological setting, genesis and distribution and uses of the following ore deposits in India:
Iron and Manganese.

Unit 2

Mineralogical characteristics, Geological setting, genesis and distribution and uses of the following ore deposits in India:
Chromium, Nickel, Platinum and Cobalt.

Unit 3

Mineralogical characteristics, Geological setting, genesis and distribution and uses of the following ore deposits in India:
Lead, Zinc and Copper.

Unit 4

Mineralogical characteristics, Geological setting, genesis and distribution and uses of the following ore deposits in India:
Tin, Tungsten, Molybdenum



Unit 5

Mineralogical characteristics, Geological setting, genesis and distribution and uses of the following ore deposits in India:
Gold, Silver and Aluminium.

**M.TECH. SEMESTER – IV
THEORY**

**PAPER – IV INDIAN MINERAL DEPOSITS: NON-METALLIC
SUBJECT CODE: A G 4 1 4 1 4 (A G)**

Unit 1

Specification for minerals used in industries. Economic factor, geological criteria, origin, Indian resources and statistics of production of minerals used as:
Refractory minerals, Abrasives and Ceramic.

Unit 2

Specification for minerals used in industries. Economic factor, geological criteria, origin, Indian resources and statistics of production of minerals used in following Industries:
Paints and Pigments, Cement and Chemical.

Unit 3

Specification for minerals used in industries. Economic factor, geological criteria, origin, Indian resources and statistics of production of minerals used in:
Fertilizer Industries, building stone and REE minerals.

Unit 4

Specification, economic factor, geological criteria, origin, Indian resources, mode of occurrence and distribution in India for various Gem Minerals.

Unit 5

The study of following minerals with reference to origin, mode of occurrences and distribution in India: Mica, Vermiculite, Asbestos, Barytes, Gypsum, Garnet, Corundum, Kyanite, Sillimanite, Graphite, Talc, Fluorite, and Beryl.

**M.TECH. SEMESTER – IV
THEORY**

**PAPER – V NUCLEAR GEOLOGY
SUBJECT CODE: A G 4 1 4 1 5 (A G)**

Unit 1

Introduction to Radioactivity and Radiation: Stable and unstable nuclei, Interaction of radiation with matter: Type of radioactivity and rays, their properties, qualitative discussion on the decay theories, artificial radioactivity, nuclear accelerations, nuclear reactions and nuclear energy.

Unit 2

Distribution of Potassium, Uranium and Thorium in various rock types: Radioactive methods of age determination of rocks. Isotope geochemistry

Unit 3

Detection and measurement of Radioactivity: Application and principles of portable Radiation meters, Geiger counter and Scintillometers.
Radioactive well-logging.

Unit 4

Introduction to Nuclear Geophysics: Principles of Gamma and neutron methods and their utility in geophysical exploration, Nuclear methods generally used for geophysical investigations – Gamma-gamma method, X-ray fluorescence method, gamma-neutron method and neutron-neutron method and Interpretation of these survey results.

Unit 5

Detailed study of the minerals of Uranium, Thorium, Beryllium and the rare earth's with reference to their composition, properties, origin, mode of occurrence and distributions in India.

**M.TECH. SEMESTER – IV
PRACTICAL
METAMORPHIC PETROLOGY
SUBJECT CODE: A G 4 1 4 2 1 (A G)**

- 1 Identification of various Metamorphic rocks in hand specimen through megascopic characters.
- 2 Identification of various Metamorphic rocks in hand specimen through microscopic characters.
- 3 Identification of various metamorphic structures, textures and mineral reactions. Their petrogenetic significance.
- 4 Plotting of mineral assemblages in ACF, AKF and AFM diagrams.
- 5 Pressure and Temperature calculation.

**M.TECH. SEMESTER – IV
PRACTICAL
SEDIMENTARY PETROLOGY
SUBJECT CODE: A G 4 1 4 2 2 (A G)**

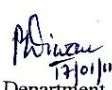
- 1 Megascopic and thin sections study of common typical clastic – nonclastic sediments, rocks and their structure.
- 2 Grain size analysis, grain size statistical parameters, and graphical analysis of sediment particle data.





- 3 Sieve Test, hydrodynamic test for size of grains, determination of shape and roundness.
- 4 Heavy mineral analysis. Insoluble residue study of carbonate rocks.
- 5 Separation of clays, identification of clays by XRD and DTA methods, patterns and staining methods.
- 6 Environmental analysis.

M.TECH. SEMESTER – IV
GEOLOGICAL TOUR
GEOLOGICAL EXCURSION REPORT AND VIVA VOCE
SUBJECT CODE: A G 4 1 4 2 3 (A G)

- 1 Candidates shall be required to under go a total of two weeks geological excursion tour and submit a detailed geological report.
- 2 Excursion tour comprises visits of various mines (open cast and underground), various geological laboratories, geological organizations, various industries and plants.
- 3 Field work at different areas of geological and petrological importance.
- 4 The viva voce examination shall be based on the report submitted by the candidate.


Head of the Department
(Dr. P. Diwan)


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22

M.TECH. SEMESTER – V
THEORY
PAPER – I PHOTOGEOLOGY
SUBJECT CODE: A G 4 1 5 1 1 (A G)

Unit 1

Aerial photographs: their type, geometry of aerial photographs, photogrammetry, factors causing scale variation, significance of scale, flight procedures, mosaic and their preparations.
Development of Aerial photography. Limitations of photogeology.
Instrumentation: Viewing instruments, stereoscopic vision. Principles of measuring and plotting instruments used in photogeology.

Unit 2

Vertical Exaggeration: Introduction, Factors affecting Vertical Exaggeration and its determination.
Basic concept of stereoscopic parallax.
Photogeological elements: Photo-reading, photo-interpretation, gray tones, and factors affecting them, recognition elements – photographic tones, colors, textures, patterns, shape and size of objects and pattern.

Unit 3

Photogeology in geological mapping, types of photogeological studies, annotation procedures, compilation of photogeological data and correlation of field & photogeological studies.
Photogeological characters of different land forms, surface drainage patterns and their significance.

Unit 4

Photogeological characters of different rock types, soils, interpretations of structures from aerial photographs and their significance.

Unit 5

Application of aerial photographs in petroleum geology, mining geology, exploration geology, engineering geology, hydrological and environmental studies.

M.TECH. SEMESTER – V
THEORY
PAPER – II MINING GEOLOGY
SUBJECT CODE: A G 4 1 5 1 2 (A G)

Unit 1

Introduction to mining terminology. Stages of exploration, preliminary and detailed mining. Tracing and outlining of mineral deposit, classification of reserves. Elements of geotectonics.

Unit 2

Mining methods: Surface mining - alluvial, mineral sand, open pit and open cast mining.



Unit 3

Mining methods: Subsurface mining - classification of stopping methods, underground development (shafts and inclined drifts) different types of stopping (open, shrinkage, cut and fill, stull, square set, block caving, top slicing, long wall).

Unit 4

Mine supports, subsidence, methods of breaking rock, mine atmosphere, ventilation, drainage, pumping, haulage and winding.
Introduction to machinery used in surface and subsurface mines.

Unit 5

Mine Valuation methods.
Mine Planning: Introduction and preparation of mine plan.
Computer application in mining.

M.TECH. SEMESTER – V
THEORY
PAPER – III MINERAL EXPLORATION
SUBJECT CODE: A G 4 1 5 1 3 (A G)

Unit 1

Planning a prospecting programs. Different stages of Prospecting activities Methods of Prospecting (surface/subsurface). Selection of potential ore bearing region.
Geology prospecting & exploration criterias and Guides, detailed study of physiographical, stratigraphical, lithological structural and mineralogical guides.

Unit 2

General Principles and scope. Various methods of geophysical prospecting Gravity, Magnetic, Seismic and Electrical. Instruments used their principles of construction, field procedure. Reduction of field data and their applications.
Structural control of ore localization along fractures, fissures, folds, faults, and joints.
Mineralization related to granitization.

Unit 3

Methods of sampling, procedure of sampling, recording of samples, reducing the bulk of samples, errors in sampling, precautions during sampling, underground sampling.
Classification of ore reserves, assay value, average assay value, tonnage of ore, tonnage factor. Different methods of reserve calculation, calculation from data obtained from bore holes, prospecting pits, trenches, ore blocks, geological maps and sections.

Unit 4

Geochemical cycle and mobility of elements. Pathfinder and indicator elements.
Accumulation and dispersion of metals. Dispersion and Dispersion patterns.
Geochemical survey.
Geochemical sampling and analytical techniques.
Preparation of geochemical maps.

Unit 5

Types of drilling, various component of drilling. Core and sludge samples. Combining core and sludge assay. Problems during drilling and their solutions. Records and logs.

Planning a drilling programs. Bore hole logging.

Choice of drilling methods.

M.TECH. SEMESTER – V**THEORY****PAPER – IV ENGINEERING GEOLOGY**

SUBJECT CODE: A G 4 1 5 1 4 (A G)

Unit 1

Development of soil profile, genesis of soil. Intrinsic properties of soil and engineering classification of soil.

Physical and engineering properties of soil: Size, shape and gradation of soil particles, specific gravity, bulk density, porosity, void ratio, degree of saturation, permeability, unit weight, liquid – plastic – shrinkage – consistency limits, swelling pressure, consolidation, compressibility, compaction, shearing strength, Mohr's envelop. Role of pore pressure. Shear stress parameters, peak and residual, total and effective, drained and undrained strength.

Unit 2

Engineering properties of rock material: Specific gravity, porosity, void ratio, permeability, slake durability, electrical resistivity, compressive strength, tensile strength and shear strength, deformability, deformation moduli. Poisson's ratio.

Engineering properties of weathered and anisotropic rocks, instrumentation in rock engineering.

Engineering behavior of rock mass. Description of rock mass.

Unit 3

Rock Mass Classification: RQD, Terzaghi's Rock Load Theory, RSR, RMR, Q-system. Empirical design criteria.

Testing of Rocks and Soil: Insitu Field tests and Laboratory tests. Construction of Mohr's diagram.

Engineering and Physical properties of rocks used as Aggregate and Building stone.

Unit 4

Dam: Classification of dams, parts of dam, types of spillways with their parts, other appurtenance. Forces acting on dams. Foundation and Abutment problems. Reservoir area problem.

Earthwork and Earth dam: Earth dam types and their design criteria, problems, stability and failure of earth dams and rock fill dams.

Barrage, Cofferdams and Caissons.

Unit 5

Tunnel: Classification and terminology, tunnel support, influence of rock-structure and rock-mass properties on stability of tunnels, roof support system in tunnels, stress around tunnels, different ground for tunnel, ground problems, techniques to stabilize the tunnel and instrumentation.

Bridges: Classification and types, abutments and piers of a bridge, bridge foundation and some design features. River valley crossing.

Highway: Location, materials of construction Classification of excavated material.

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M.TECH. SEMESTER – V
THEORY
PAPER – V HYDROGEOLOGY – I
SUBJECT CODE: A G 4 1 5 1 5 (A G)

Unit 1

Introduction to the hydrology, and geohydrology.
Hydrological cycle and groundwater occurrence: Hydrologic cycle, precipitation, water balance. Significance of hydrometeorological data in groundwater geology.
Occurrence and distribution of subsurface water.

Unit 2

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.
Water table maps – construction and interpretations, fluctuations of water table and influencing factors.
Ground water mounds, trenches, divides, cascades, influent and effluent seepage and artesian wells.

Unit 3

Hydrological properties of water bearing geomaterials: types of openings of rocks (primary and secondary), development of openings, porosity, factors affecting porosity, role of grain size parameters in porosity, effective size, uniformity coefficient, permeability, transmissibility, specific yield, specific retention and rate of percolation.
Field and laboratory determinations of permeability and hydraulic conductivity, average and effective velocity of groundwater and their determinations.

Unit 4

Groundwater flow and permeability: Definition of permeability, factors affecting permeability, Darcy's Law,
Different type of flows in aquifers, transition from artesian to water table conditions.
Aquifer Tests.
Use of tracer in groundwater flow and storage equation.

Unit 5

Evaluation of aquifer properties and well hydraulics: Types of aquifers – confined, semiconfined, unconfined, semiunconfined and leaky aquifers.
Difference between groundwater hydraulics and well hydraulics. Fundamental principles of well performance, relation of drawdown to yield, relation of well diameter to yield.
Specific Capacity of wells and Safe Yield.

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M.TECH. SEMESTER – V
PRACTICAL
PHOTOGEOLOGY
SUBJECT CODE: A G 4 1 5 2 1 (A G)

- 1 Photo-reading and interpretation, study and interpretation of structures, stratigraphy, drainage pattern and soils from aerial photographs.
- 2 Determination of scale of the aerial photographs.
- 3 Measurements of parallax differential, determination of heights, measurements of dips of beds, plotting of correct planimetric position of points.
- 4 Preparation of geological maps from aerial photographs.
- 5 Visual interpretation of satellite imageries, recognition of surface features.
- 6 Introductory use of computers and GIS in satellite data analysis.

M.TECH. SEMESTER – V
PRACTICAL
MINING AND EXPLORATION GEOLOGY
SUBJECT CODE: A G 4 1 5 2 2 (A G)


- 1 Problems on averaging grade and tonnage calculation from given data: Planes, sections, bore holes. Combining core and sludge assays.
- 2 Preparation of various plans: Iso-ash, isogrades, isopachs, floor contours, fence diagram etc.
- 3 Study of assay plans, determination pitch of the ores shoot and other problems of mining geology.
- 4 Interpretation of geophysical data, Geostatistical and computational methods.
- 5 Preparation of Section Plan.





M.TECH. SEMESTER – V
PRACTICAL
ENGINEERING GEOLOGY
SUBJECT CODE: A G 4 1 5 2 3 (A G)


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- 1 Determination and evaluation of physical and mechanical properties of rocks and soils in material scale.
- 2 Determination of quick field physical and strength indices through rapid field tests.
- 3 Evaluation of engineering parameters of the rock mass in field through different rock mass classification system, basic geotechnical descriptions of rock mass, strength and deformability estimation and prediction of rock mass in field.
- 4 Exercise related to Rock Mass Classification.
- 5 Computer application in engineering geology.


Head of the Department
(Dr. P. Diwan)


External Expert – I
Dr. Y.B. Katpatal,
Professor in Geology,
Dept. of Civil Engg.,
V. N. I. T. Nagpur (M.S.)


External Expert – II
Mr. U.P. Singh,
Sr. General Manager (Geology),
Jindal Steel & Ispat Ltd.,
Mandir Hasaud,
Raipur (C.G.)


Dean Academics
(Prof. K.D. Permar)

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M.TECH. SEMESTER – VI
THEORY
PAPER – I REMOTE SENSING AND GIS
SUBJECT CODE: A G 4 1 6 1 1 (A G)

Unit 1

Scope of Remote Sensing in Earth Sciences.
Fundamental concepts of Remote Sensing; Electromagnetic Energy and its interactions in the atmosphere and with terrain features.
Indian Remote Sensing Satellite mission.

Unit 2

Fundamental considerations of remote sensing satellites, platforms and sensors.
Multispectral images, visual interpretations, introduction and principles of image processing.
Introduction to digital image processing.

Unit 3

Fundamentals and history of GIS, significance and tasks of GIS in geology, map making, map scales and projections, cartographic techniques, map interpretation, computational methods in spatial analysis. Procedure in GIS.

Unit 4

Use of GIS software in spatial analysis.
Geographic Information System (GIS): Spatial data models and data structures, visualization and query of spatial data, overlay analysis.

Unit 5

Remote Sensing and GIS application to Geological investigation – Geological and Structural Mapping, Mineral Exploration, Groundwater, Petroleum, Engineering Geology and Environmental Geology.

M.TECH. SEMESTER – VI
THEORY
PAPER – II HYDROGEOLOGY –II
SUBJECT CODE: A G 4 1 6 1 2 (A G)

Unit 1

Groundwater wells: Construction, completion and development. Types of wells and methods of their construction, dug wells, driven wells & drilled wells, inverted wells recharge wells, tube well design (depth, diameter and screens), functions of well screens, gravel treatment, hydraulics of gravel treated wells.
Well development, principles and various methods of developing wells, testing of wells for yield.
Causes of well failures, maintenance and well repair.

Unit 2

Groundwater Exploration: Geomorphic and geologic controls on groundwater, stage wise groundwater exploration, surface methods (geological, hydrological and geophysical), subsurface exploration methods (bore hole logging – geological, geophysical and other loggings), test wells and well testing.

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Unit 3

Quality of groundwater: Chemical and physical characteristics of groundwater for domestic, municipal, agricultural & industrial purposes. Quality criteria for groundwater use.

Groundwater pollution, bacteriological quality of groundwater and treatment of groundwater for different purposes.

Unit 4

Groundwater recharge, Groundwater development and management: Groundwater balance, groundwater inventories, estimation of recharge components, groundwater recharge methods, groundwater development, conjunctive use of surface and groundwater resources. Water logging, Desalination.

Unit 5

Groundwater modeling: Use of computers in groundwater modeling, groundwater legislation and modeling techniques in groundwater management.

Groundwater provinces of India.

Sea water intrusion in coastal aquifers.

M.TECH. SEMESTER – VI**THEORY****PAPER – III GEOTECHNICAL INVESTIGATIONS**

SUBJECT CODE: A G 4 1 6 1 3 (A G)

Unit 1

Role of geologist in Engineering Geology.

Paradigm of Geotechnical Investigations, Various phases of Investigation: Preliminary stage, Feasibility stage, Design stage, Confirmatory study, Construction stage investigation and Operation monitoring.

Use of Remote sensing techniques for geological survey and investigation.

Unit 2

Geological Mapping: Lithological and Structural mapping on different scales. Foundation grade mapping.

Various Geophysical methods for exploring the geology of the Underground rock strata.

Drilling Bore Holes through the strata and carrying out water tests in the bore hole. Bore hole logging and their presentation.

Unit 3

Drift: Definition, Shape and Size, Construction, Methods of 3D logging of drift and their presentation.

Effect of various geological structures on suitability of engineering projects.

Stage wise geotechnical investigation for Dam site, Reservoir, Tunnel, Power House, Bridge, Highway etc.

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Unit 4

Ground Improvement Techniques for Soil: Compaction, Use of Admixture, Chemical Stabilization, Grouting.
Ground Improvement Techniques for Rocks: Cement Grouting, Chemical Grouting, Shotcreting, Rock Anchoring and Bolting, Dental Filling etc.
Geotechnical investigations of Landslides.
Slope stability analysis and their remedial measures.

Unit 5

Legal aspects of geotechniques: Basic legal principles, contracts, specification and owner responsibility, contractor's responsibility, negligence, adjoining landowners, lateral support of land, notice of excavation, general advice.
Geotechnical case studies of major projects in India.

**M.TECH. SEMESTER – VI
THEORY
PAPER – IV ENVIRONMENTAL GEOLOGY
SUBJECT CODE: A G 4 1 6 1 4 (A G)**

Unit 1

Environmental Geology: Definition, Concept, Objective, Principles and Scope.
Concepts of natural ecosystems on the Earth and their mutual inter-relations and interactions (atmosphere, hydrosphere, lithosphere and biosphere).
Environmental changes due to influence of human-dominated environment over nature-dominated system.

Unit 2

Introduction to Natural hazards: earthquakes, tsunamis, volcanoes, landslides, avalanches, floods, cyclones, mine fire and blow out.
Causes, prediction and forecasting, risk and mitigation of natural hazards.

Unit 3

Impact assessment of anthropogenic activities such as urbanization, open cast mining and quarrying, river-valley projects, disposal of industrial and radio-active waste, excess withdrawal of ground water, use of fertilizers, dumping of ores, mine waste and fly-ash.
Deforestation and land degradation.
Impact of Mining Activities on environment.

Unit 4

Processes of soil formation, types of soils, soil degradation and changing land use pattern. Soil contamination due to urbanization, industrialization and mining. Mobility of elements.
Impact assessment of water availability and quality. Organic and inorganic contamination of surface water and groundwater their remedial measures.
Atmosphere and Air pollution.

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Unit 5

Environment protection and legislative measures in India.
Basic tenets of environmental laws.
Watershed Management, Global Warming, Energy Crisis.
Conservation of Mineral Resources.

**M.TECH. SEMESTER – VI
THEORY
PAPER – V MINERAL ECONOMICS
SUBJECT CODE: A G 4 1 6 1 5 (A G)**

Unit 1

Definition: Importance of minerals in national economy, pattern of mineral relationships, geographic and political factors in mineral use, Features peculiar to mineral industries, Economic factors, common to mineral and manufacturing industries.
Demand, supply, cartels, substitutes, market speculations and production cost, changing mineral requirements, international nature and movement of minerals.

Unit 2

Mineral production and economics of Indian minerals and metals: Diamond, coal, petroleum, uranium, thorium, iron, manganese, chromium, nickel, tungsten, molybdenum, vanadium, titanium, copper, lead, zinc, tin, zirconium, gold, silver, sulphur, fertilizer minerals, insulating minerals and mica.

Unit 3

Trade restrictions, tariff, quotas, and embargoes, stock-piling, production incentives, foreign development and exploitation of mineral raw materials. Marketing of Minerals.
Total Indian resources, reserves and production of important minerals.

Unit 4

Strategic, critical and essential minerals, national mineral policy, mineral concession rules of India, importance of steel and fuels in modern economy and impact of atomic energy minerals on conventional fuels. Non-renewable energy resources of India.

Unit 5

Importance of ore dressing, outline and principles of ore dressing, dressing of metallic ores, sulfide ores, non-sulfide ores and native metals: gold, silver, lead, zinc, manganese, tin, titanium and chromium, dressing of non-metallic ores: graphite, barite, gypsum, steatite, clays and coal and coal washing.

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M.TECH. SEMESTER – VI
PRACTICAL
HYDROGEOLOGY
SUBJECT CODE: A G 4 1 6 2 1 (A G)

- 1 Determination of hydrological properties of rocks and soils: porosity and permeability.
- 2 Calculation of coefficient of transmissivity, storage, specific yield, groundwater velocity etc.
- 3 Demarcation of water-shed boundaries, Preparation of water table maps from given data and interpretation of water table maps, identification of groundwater features in given hydrogeological maps.
- 4 Geophysical exploration for groundwater through electrical resistivity method using Schlumbereger and Wenner electrode configurations.
- 5 Tube well testing through different methods using available instruments.
- 6 Geochemical plotting of data and their interpretation.

M.TECH. SEMESTER – VI
PRACTICAL
GEOTECHNICAL INVESTIGATION
SUBJECT CODE: A G 4 1 6 2 2 (A G)


- 1 Site investigation and discussion on suitability of site on various geological maps and locations (in field) for different engineering projects.
- 2 Bore hole logging, their presentation and interpretations.
- 3 Slope stability analysis.
- 4 Study of 3D logs of drift and tunnel.
- 5 Study of various wooden models for different engineering structures.


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**M.TECH. SEMESTER – VI
GEOLOGICAL FIELD TRAINING
DISSERTATION AND VIVA VOCE
SUBJECT CODE: A G 4 1 6 2 3 (A G)**

- 1 Every candidate shall be required to under go training in a branch of Applied Geology or carry out an independent investigation in a branch of Applied Geology as approved by the Department for a period of at least Four (4) weeks.
- 2 Viva voce examination shall be based on the dissertation submitted by the candidate.


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