# B.Sc. CREDIT-BASED SEMESTER SCHEME

## GEOLOGY

### SCHEME OF EXAMINATION AND CREDITS

#### I SEMESTER

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Title of the Paper</th>
<th>Paper</th>
<th>Hours/Week</th>
<th>Exam Duration(hrs)</th>
<th>IA</th>
<th>Exam</th>
<th>Total Marks</th>
<th>Credits</th>
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<tbody>
<tr>
<td>GT 101</td>
<td>PHYSICAL GEOLOGY AND CRYSTALLOGRAPHY</td>
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<td>4</td>
<td>3</td>
<td>30</td>
<td>70</td>
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<tr>
<td>GP 101</td>
<td>CRYSTALLOGRAPHY AND GEOMORPHOLOGY</td>
<td>P</td>
<td>3</td>
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<td>15</td>
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**TOTAL MARKS AND CREDITS FOR I SEMESTER**  
150  3

#### II SEMESTER

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<th>Paper No.</th>
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<tr>
<td>GT 201</td>
<td>GEODYNAMICS AND MINEROLOGY</td>
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<td>4</td>
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<tr>
<td>GP 201</td>
<td>MINEROLOGY AND OPTICAL MINEROLOGY</td>
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**TOTAL MARKS AND CREDITS FOR II SEMESTER**  
150  3

#### III SEMESTER

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<th>Hours/Week</th>
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#### IV SEMESTER

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<tr>
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<td>HYDROGEOLOGY AND MINING GEOLOGY</td>
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Total Marks = 1200 and Total Credits = 24

* NOT: T – Theory and P – Practical
SEMESTER I

GT-101. Physical Geology and Crystallography 70 Marks
2 Credits/Week = 4hrs/Week, 52 hrs/Semester

Unit 1
Physical Geology
Introduction: Definition, Aim and Scope of geology, relationship with other branches of science, branches of Geology. 2 hrs
Planet Earth: Forms and Dimensions of the Earth and its position in solar system. 1 hr
Origin of Earth: Nebular, Planetesimal, tidal, twin star & meteoritic hypothesis, Age of the Earth, Radiometric methods (Rb-Sr, U-Pb, Tm-Nd, Pb-Pb). 3 hrs
Interior of the Earth: Crust, Mantle and Core, their composition based on Seismic evidences. 3 hrs
Concept of Isostasy. 1 hr

Unit 2
Epigenic Processes: Weathering, Definition, Types: Mechanical, Chemical and Biological, weathering products. 2 hrs
Soil and soil profile. 1 hr
Rivers: Definition, stages of rivers (youth, mature and old) Geological action of rivers – Erosion – Hydraulic action, Abrasion, Attrition, Corrosion, Erosional features-Pot holes, ‘V’ shaped valleys, waterfalls, meanders, Ox-bow lakes, Canyons & Gorges, Transportation – Suspension, saltation, solution, Depositional features – Alluvial fans and cones, Deltas, Flood plains, Natural Levees. 4 hrs

Unit 3
Oceans: Definition, topography of seafloor, Zones – Littoral, continental shelf, slope and Abyssal, Movement of Sea water Tides, waves, and currents. Geological work of Ocean-Erosions, transportation and deposition. Features of Marine erosion and deposition. Coral reefs - Definition, formation & origin, Types - Fringing reef, barrier reef and Atolls. 4 hrs
Groundwater: Geological action of Groundwater, Erosional features – sinks, caverns, solution valleys, Transportation – solution Depositional features – Concretions, Stalactites and Stalagmites. 3 hrs

Unit 4
Hypogenic Processes: Volcanoes: Definition, description of typical volcano classification – central, fissure, active, dormant, extinct. Products of volcanoes-solid, liquid, gases; hot springs, Geysers, fumaroles. Distribution and causes of volcanoes. 3 hrs
Earthquakes: Definition, focus, epicenter, distribution, causes and effects, classification, seismic waves – P, S and L. Seismograph and seismogram, Richter scales, recent earth quakes in India. 4 hrs

Crystallography: Introduction, Formation – Crystals, Crystalline and Amorphous. Definition of crystal and crystal elements, law of Constancy of interfacial angle, contact Goniometer, Measurement of interfacial angle Crystallographic axes – Definition, Axial characters (Constants). Classification of crystals into 6 systems. Symmetry elements – Center, Plane, Axis and Composite symmetry. 4 hrs

Unit 5
Classification of crystals based on Symmetry elements, Nomenclature of Symmetry classes, Dana, Ford, Weiss notation, Miller’s indices. 2 hrs
Forms – Unit, fixed, variable, closed, open, and general. 1 hr
Study of the following symmetry classes with their forms.
i) 4/m – 3 2/m, Galena Type, ii) 4/m 2/m 2/m – Zircon type, iii) 6/m 2/m 2/m – Beryl type, iv) 2/m 2/m 2/m – Barite type, v) 2/m – Gypsum type, vi) 1- Wollastonite type. 5hr
Twins – Definition, parts, types and twin laws. 1 hr

GP-101. PRACTICALS 35 Marks
Crystallography and Geomorphology
Verification of Euler’s formula, Interfacial angle & its measurements. Notations: Miller’s Indices, Weiss notation. Classification of Crystals into systems based on their axial characters.
Study of symmetry elements and forms of Isometric, Tetragonal, Hexagonal, Orthohombic, Monoclinic and Triclinic systems. Twins.
Geomorphology: Study of important Geomorphological models.

REFERENCES

SEMESTER II
GT-201. Geodynamics and Mineralogy 70 Marks
2 Credits/Week= 4hrs/Week, 52 hrs/Semester

Unit 1
Geodynamics: Introduction, Continental Drift, evidences, and sea floor spreading, hot spots. 2 hrs
Plate Tectonics: Evolution of plate-tectonics theory, plates and their margins, constructive and destructive margins, Plate boundaries – Divergent, Convergent and Transform fault, Causes of movements of plats, origin, distribution and significance of mid oceanic ridges, trenches and island arcs. Paleo-magnetism, relation between orogeny, magnetism, metamorphism and metallogeny. Evolution of oceans and continents. 10 hrs
Unit 2

**Mineralogy:** Introduction, definition, relationship with other branches of science.

Physical mineralogy – Mineral definition, formation and broader classification on minerals. 1 hr

Properties of minerals. 2 hrs

Characters depending upon the state of aggregation – habit, form.

Properties depending upon Cohesion, elasticity, cleavage, fracture, hardness and tenacity.

Characters depending upon light – color, streak, luster, diaphaneity, play of colors, opalescence, luminescence, fluorescence, phosphorescence, tarnish and iridescence. 6 hrs

Characters depending upon electricity – conductivity, pyro, piezo.

Magnetism: para, dia and ferro-magnetism, thermo-electricity.

Specific gravity and methods of determining specific gravity. 4 hrs

Unit 3

**Optical Mineralogy:** Introduction, nature, transmission, reflection, refraction, refractive index, critical angle, total reflection, double refraction.

Polarization of light, Polaroids, Nicols prism. 2 hrs

Optical classification of Crystals. 2 hrs

Birefringence by Michael Levy’s chart. 2 hrs

Pleochroism. 2 hrs

Interference colors. 2 hrs

Unit 4

Extinction Angle, Twinning. 2 hrs

Optical Accessories - Mica plate, Gypsum plate and quartz wedge. 2 hrs

Chemical Mineralogy: Isomorphism, polymorphism, pseudomorphism, Chemical Bonding-Ionic, covalent, metallic, Vander-Waals bonding. 4 hrs

Descriptive Mineralogy:

Classification of minerals based on chemical composition and structure. 1 hr

Silicates – Classification of silicates based on their structure – nesosilicates, sorosilicates, cyclosilicates, ionosilicates, phyllosilicates and tectosilicates. 3 hrs

Unit 5

**Descriptive Mineralogy**

Study of the following groups of minerals: Olivine, Garnet, Pyroxene, Amphiboles, Mica, Quartz and Feldspar groups. 8 hrs

**GP-201. PRACTICALS** 35 Marks

Mineralogy

Identification of following minerals based on their physical properties.


Sorosilicates – Epidote, Cyclosilicates – Barite, Tourmaline

Inosilicates:

a) Pyroxenes – Hypersthene, Augite
b) Amphibole – Actinolite, Tremolite and Hornblende.
Osilicates – Talc, Myscovite, buotite, lepidolite.
Tectosilicates:
a) Quartz & its varieties
b) Feldspars – Micrcocline, orthoclase and plagioclase
c) Zeolites – Natrolite, stilbite

**Optical Mineralogy:**
Petrological Microscope.
Determination of refraction and double refraction.
Determination of reflective refringence by Becke’s method and Kolk’s method
Determination of vibration direction and sign of elongation.
Determination of Interference colors.
Determination of Pleochroism – Dichroism – Pleochroism
Measurement of Extinction Angle.

**REFERENCES**

**SEMESTER III**

**GT-301. Petrology**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
<th>Hours</th>
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<tbody>
<tr>
<td>1</td>
<td><strong>Pertology</strong>: Introduction, definition of rock, relationship with other branches of Geology.</td>
<td>1 hr</td>
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<td>Classification of rocks – Igneous, sedimentary &amp; Metamorphic.</td>
<td>2 hrs</td>
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<td>Igneous Rocks – Introduction, forms of igneous rocks – Extrusive and Intrusive.</td>
<td>4 hrs</td>
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<td>Concordant: - Sill, Laccoliths and Phacolith and Discordant: - Dyke, Ring Dyke, cone sheets, volcanic neck, batholiths, stock and boss.</td>
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<td>Structures: - Vesicular, Amygdaloidal, blocky, ropy, pillow, columnar.</td>
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<td>2</td>
<td><strong>Textures</strong>: Significance of textures, factors determining textures, types of textures equigranular: - Paniidiomorphic, hypidiomorphic and allotriomorphic, Inequigranular: - Porphyritic, poikilitic, ophitic, basaltic, intergrowth, flow textures.</td>
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<td>Classification: Basis of classification – Chemical, Mineralogical, Textural and Tabular classification of Tyrrel.</td>
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<td>Important rock types: Granite, Granodiorite, Diorite, Gabbro, Peridotite, Dunite, Syenite, Dolerite, Porphyries, Pegmatite, Basalt, Andesite, Rhyolite and Kimberlites.</td>
<td>3 hrs</td>
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<td>3</td>
<td><strong>Petrogenesis</strong>: Introduction, Concept of system, Chemical potential and phase rule. Magma, generation of magma in mantle and crust, physical properties of magma temperature, pressure and viscosity, composition of magma and lava.</td>
<td>4 hrs</td>
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**Unit 4**

**Sedimentary Petrology:** Structures of sedimentary rocks – Stratification, lamination, ripple marks, current bedding, graded bedding, sun cracks, rain prints.  
Textures of sedimentary rocks: - size and shape of the grains and cementing material.  
Classification based on mode of formation – residual, mechanical, chemical and organic. Based on grain size: Rudaceous, Arenaceous, argillaceous.  
Important rock types: Clastic sediments – conglomerate, Breccia, Sandstone, Graywake, Shales.  
Metamorphic rocks: Metamorphism, agents of metamorphism – temperature, pressure and chemically active fluids, process of Metamorphism.  

**Unit 5**

**Metamorphic rocks:** Kinds of metamorphism – Cataclastic, thermal, dynamo – thermal metamorphism.  
Concept of grades, Facies and zones.  
Fabric of metamorphic rocks – Cataclastic, maculose, schistose, granulose, gneissose, Granoblastic, porphyroblastic, relict.  
Thermal metamorphism, metamorphic aureole, effects of thermal metamorphism on argillaceous rocks and calcareous rocks.  
Important rock types: Gneiss, Schist, Slate, Marble, Quartzite, Amphibolite and Charnokites.  

**GP-301. PRACTICALS**

**Petrology**

**Microscopic Identification of Minerals**

Study of optical properties of the following rocks forming minerals – quartz, orthoclase, plagioclase, microcline, biotite mica, hornblende, augite, hypersthene, Calcite, olivine, garnet, actinolite, sillimanite, kyanite, tourmaline.  

**Megaoscopic Identification of rocks**

**Igneous rocks** - Granite, syenite, diorite, gabbro, peridotite, dunite. Porphyries, Pegmatites, Dolorites, rhyolites, trachite, andesite, and basalt.  
**Sedimentary rocks:** Sand stone, shale, grit, conglomerate, breccia, limestone.  
**Metamorphic rocks:** Quartzite, Marble. Schist, gneiss, slate, charnockites  
**Microscopic identification of rocks:** Igneous, sedimentary and metamorphic rocks as listed above.  

**REFERENCES**

Igneous Petrology – T.F.W. Barth – 1962, John Wiley and Sons  
Metamorphic Petrology – BashkarRao, 1985, Oxford and IBH  
SEMESTER IV

GT-401. Paleontology and Stratigraphy 70 Marks
2 Credits/Week= 4hrs/Week, 52 hrs/Semester

Unit 1
Paleaeontology

Definition of Fossil, Fossilization – Factors (conditions) for the preservation of fossils, Mode of fossilization-unaltered soft parts (Mummification)-unaltered hard parts, altered hard parts – Carbonization, petrification, Traces of fossils-cast, mould, tracks and trails, coprolites.

Types of fossils: Index fossils, Zone fossils, Remine fossils, Derived fossils, Synthetic fossils, Persisant fossils, Extinct fossils and Living fossils – utility of fossils.

General classification, morphological characters, distribution and geological history of the following groups.
1. Graptolozoa – Graptolites, Mono graptus and Diplograptus.
2. Foraminifera
4. Brachiopoda – Description of a typical shell of a Brachiopod types of hinge line, Classification – Inarticulata and articulata.
6. Pelecypoda – Dentition
7. Arthropoda – Trilobites
8. Echinodermata.

General methods of fossilization of plant fossils - Morphological characters, description and range in time of the following fossils – Lepidodendron, calamites, sigillaria, glossopteries, gangamopteris, ptilophyllum cardaites, Alithoptris.

Biological evolution through time.

Unit 2
Stratigraphy

Principles of Stratigraphy
Introduction, law of catastrophism, law of uniformitarianism, law of order of superposition.1hr
Nature of geological record, imperfection geological record, geological clock, homotaxis contemporaneity.

Correlation – types of correlation, criteria for Stratigraphic correlation-lithological, structural, metamorphic, paleontological and geochronological.

Standard geological time scale.

Classification of geological record in to six eras, a general account of individual era with regard to their nomenclature, distribution, lithology, classification, climate and fossil records.

Unit 3
Indian Stratigraphy:
Physiographic divisions of India and its relationship with geological distributions. 1 hr
Archaean and Proterozoic formations of Peninsular India – distribution and classification with reference to Karnataka, Sargur Group, Dharwarsupergroup. 2 hrs
Proterozoic: distribution, classification and economic importance of Cuddapah System and Kaladgis, Vindhyan System and Bhima Series, Kurnool System. 2 hrs
Paleozoic Group: Paleozoic rocks of the Spiti. 1 hr
Gondwana Group: Classification, lithostratigraphy, biostratigraphy and economic importance. 2 hrs

Unit 4
Mesozoic: i) Triassic of Spiti ii) Jurassic of Kuchch iii) Cretaceous of Trichinapoly 2 hrs
Deccan traps: Distribution, lithology and biostratigraphy, classification, Intertrappeans, Intratrappeans, Bhag beds and Lameta beds, Age of Deccan traps, Economic importance of Deccan traps. 3 hrs
Siwaliks-lithology, distribution, classification, life and age. 2 hrs

GP-401. PRACTICALS 35 Marks
Palaeontology and Stratigraphy
Drawing, labeling, description, identification, classification with geological age of the following invertebrate and plant fossil Graptolite, monograptus, diplograptus.
Corals Favosites, Halysites, Lithostrotion, Calceola, Montlivotia and Zaphrantis.
Brachiopoda – Terebratula, Productus, Lingulla, Orthis, Atripa, Spirifer, Rhynchonella.
Pelecypoda Lima, Trigonia, Pecten, Hippuritis, Graphea, Cardita
Cephalopoda – Ammonite, Orthoceras, Nautilus, Goniatites, Ceratites, Accenthoceras, Hamites, Baculite, Scaphites, Belemnites
Gastropoda Natica, Turritella, Voluta, Conus, Cerithium and Physa
Echinoderamata – Cidaris, Micraster, Hemiaster, Encrinus and Pentrimites
Trilobites – Calymene, Paradoxide, Trinucleus, Olinellus and Phacops
Plant fossils Lepidodendron, Calamites, Sigillaria, Glassopteris, Gangamgoteis, Ptilophyllum, Cardates, Alethopteris.
Preparation & study of stratigraphic maps.

REFERENCES
Paleontology invertebrate – H. Woods, 8th edition CBS Publication
Geology of India and Burma – M.S.Krishnan, 1982, CBS Publications
SEMESTER V

GT-501. Mineral Resources and Structural Geology 70 Marks
2 Credits/Week= 4hrs/Week, 42 hrs/Semester

Unit 1
Mineral Resources:
1. Ore genesis:Introduction Economic geology in relation to industry, commerce and national economy. 1 hr
Principles of mineral economies essential, strategic and critical minerals, ore minerals, gangue minerals, tenor of ore. Principles and process of ore formation: 2 hrs
Magmatic process
1) Sublimation 1 hr
2) Contact metasomatism 1 hr
3) Hydrothermal process a) Cavity filling deposits and b) Replacement deposits 2 hrs
4) Weathering: a) Residual and b) mechanical concentrations 1 hr
5) Sedimentation 2 hrs
6) Evaporation 1 hr
7) Oxidation and supergene sulphide enrichment 1 hr
8) Metamorphism 1 hr
9) Pegmatitic deposits 1 hr
10) Classifications of ore deposits – Niggli 1 hr
11) Metallogenic epochs and provinces 1 hr

Unit 2
Economic mineral deposits: Study of the following mineral deposits of India with special reference to Karnataka, in regard to their mineralogy, origin, occurrence and distribution.
I. Metallic deposits: - gold, copper, iron, manganese, chromium, aluminum, lead and zinc. 5 hrs
II. Non-metallic deposits: mica, abrasives, refractories ceramics, building and ornamental stones, fertilizers and cement. 5 hrs
III. Energy resources: i) fossil fuels, coal & petroleum ii) atomic minerals. 4 hrs

Unit 3
Structural Geology: Introduction-relationship with other branches of geology, Forces – Tensional, shearing and compressional, stress and strain. 1 hr
Concept of rock deformation, Classification of structures, conformity, unconformity. Types of unconformity – disconformity, non-conformity, angular unconformity, recognition and significance of unconformities. 2 hrs
Attitudes of beds definition of dip and strike, description of compass clinometer and determination of dip and strike of beds. 2 hrs
Out crop: Definition, width of outcrop, thickness of bed, factors controlling the width of bed. Denudational structures: i) Outlier and ii) Inlier 2 hrs
Secondary structures: Folds definition, parts of fold, types of fold, symmetrical, asymmetrical, anticline, syncline, anticlinorium, synclinorium, over turned fold recumbent fold, fan fold, isoclinal fold, chevron fold, monocline and drag fold. 3 hrs
Joints: definition, terminology, dip and strike, joint plane, joint set, joint system, block joint, master joint. 2 hrs
Classification: 1) Geometrical – dip, strike, oblique and bedding joints 2) Genetic classification – columnar, mural, sheet joints; significance of joints. 2 hrs
Faults: definitions, elements of faults, genetic classification of faults-thrust fault, Overthrust, under thrust. Gravity faults-step fault, ridge fault, trough fault, Recognition of faults in field. 1 hr

GP-501. PRACTICALS 35 Marks
Mineral Resources and Structural Geology
Economic Geology: study and identification of the following minerals: Native copper, graphite, sulphur, chalcopyrite, azurite, malachite, realgar, orphiment, cinnbar, stibnite, galena, sphalerite, pyrite, hematite, magnetite, limonite, pyrolusite, psilomelane, bauxite and chromites. Coal and its varieties, selected radioactive minerals and their host rocks.
Structural Geology:
Excercises on structural geology problems:
Thickness problems: 3 types
Dip and strike problems: 3 types
Stereographic projections of structural data
Drawing of sections and interpretation of horizontal series, inclined series, folded series, faulted series, unconformities and complex structural.
Tracing of outcrops

REFERENCES
Ore deposits – Park, Jr. C.F and M.C. Diarmid, 1980
Structural Geology: Billings M.P, 1972, Printice Hall, New Jersey
Ore Deposits of India, Gokhale&Rao, CBS Publication

SEMESTER V

GT-502. Geoexploration and Statistical Geology 70 Marks
 2 Credits/Week= 4hrs/Week, 42 hrs/Semester

Unit 1
Geoexploration: Introduction, principles and methods of geoexploration – geological, geophysical and Geochemical. 3 hrs
Geological exploration: Introduction, guides to ores – physiographic, mineralogical, stratigraphic, lithological and structural. 4 hrs

Unit 2
Geophysical exploration: Introduction, definition, physical properties of rocks and minerals, physical fields, geophysical anomalies and applications.
Electrical methods – Electrical methods and principles, resistivity, conductivity, resistivity of rocks and minerals. Prospecting for groundwater – electrical resistivity method, Wenner and Schlumberger methods VES curves, types of curves and curve matching techniques. 4 hrs
Magnetic methods – principles, magnetometers – torsion – vertical force and horizontal force, air borne fluxgate magneto meter. 4 hrs

**Unit 3**
Geophysical exploration: Gravity methods – gravitational force of the earth, Worden gravimeter, gravity corrections – latitude, free air, Bougur, terrain, tidal. 4 hrs
Seismic methods – types of seismic waves, principles of refraction and reflection techniques. 4 hrs
Radiometer methods – radioactivity of rocks and minerals, instruments – G.M. counter and scintillation counter. 3 hrs

**Unit 4**
Geochemical exploration – Basic principles, geochemical cycle and geochemical, litho geochemical mineral exploration, geo-botanical and biogeochemical exploration. 8 hrs

**Unit 5**
Statistical Geology: Introduction to statistical geology. Determination of mean median, mode, standard deviation for grouped and ungrouped data Construction of frequency distribution tables and diagrams. Application of statistics in geological problems. 8 hrs

**GP-502. PRACTICALS**
**35 Marks**
**Geoexploration and Statistical geology**
Geophysical problems – Seismic, magnetic, gravity anomalies, electrical conductivity (resistivity).
Groundwater exploration by resistivity method.
Interpretation of two layers and three layers resistivity curves.
Determination of mean, median, mode, standard deviation for grouped and ungrouped data.
Construction of frequency distribution tables, histograms
Application statistics in geological problems.

**REFERENCES**
SEMESTER VI

GT-601. Remote Sensing and Engineering Geology 70 Marks
2 Credits/Week= 4hrs/Week, 42 hrs/Semester

Unit 1
Remote Sensing: Aerial Remote Sensing: - Introduction to aerial remote sensing, types of aerial photography, Vertical, oblique, geometry of aerial photographs. 2 hrs
Scale of aerial photography. 1 hr
Instruments of aerial photography – Stereoscopes – Rockets, Mirror and Prism. 2 hrs
Interpretation keys – tone, texture, shape, size and patterns. 2 hrs
Application of aerial photography in geological studies. 1 hr

Unit 2
Satellite remote sensing:- Introduction, basic principle of satellite remote sensing-EMR, Platforms, Sensors, scanners, energy interaction with atmosphere, earth surface, minerals, water, soils and vegetation. 2 hrs
Interpretation of satellite images – Visual and digital process. 1 hr
Applications of remote sensing techniques in mapping soil cover, forest cover, surface resources, valley fills, floor, Pediplanes, pediments, denudational hills, structural dykes, lineaments, inselbergs. 3 hrs

Unit 3
Introduction, field equipments, a brief note on taking geological notes in the field collection samples, numbering and making specimens. 3 hrs
The compass clinometer, Brunton compass, use of clinometer in the field. Determination of dip and strike. 3 hrs
Study of toposheets and geological maps. 2 hrs
Selection and preparation of base maps. 2 hrs

Unit 4
Field Geology: Plotting the geological features in the base map and sampling methods. 2 hrs
Preparation of geological reports. 2 hrs
Engineering Geology:-Introduction, role of geology in the field of engineering. 1 hrs
Rock as material of construction, properties of rock required for their selection of building stones and road metals. Important building stones and road metals. 3 hrs

Unit 5
Dams and reservoirs: Types of dams, geotechnical considerations in selection of dam sites and reservoir sites. 3 hrs
Tunneling: Types of tunnels, Geological considerations in tunneling. 2 hrs
Environmental considerations in the location and construction of large dams, reservoirs Tunnels. 3 hrs
Bridges: Geological consideration, stability of bridges, foundation of bridges. 2 hrs
GP-601. PRACTICALS            35 Marks

Remote Sensing and Field Geology

Stereoscopic vision test
Visual Interpretation of Aerial photographs by using photographic elements – Tone, texture, size, shape and shadow
Study of Aerial photographs – photo index, scale, air and eye base determination, Relief displacement.
Study and Interpretation of satellite imageries for geology, structures, drainage and geomorphology.
Study of Toposheets – Contour, drainage, road and settlements
Preparation of base maps
Morphometric analysis from topographic maps
Use of Clinometers and Brunton compass.
Field Mapping – visit to field for collection of ground data – Location, measurements of dip & strike of different litho units & preparation of the thematic maps.
Field trip: Field trip for minimum of three days, and submission of field report by students is compulsory.

REFERENCES
Principles and applications of photo geology – Shiv N Pondy, 1987, Wiley Eastern Limited
Remote sensing of the environment: An earth resource and prospective – John R. Renson,

SEMESTER VI

GT-602. Hydrogeology and Mining Geology            70 Marks

2 Credits/Week= 4hrs/Week, 42 hrs/Semester

Unit 1
Hydrogeology: Introduction – Hydrological cycle, precipitation, evapotranspiration, run off, infiltration soil moisture storage, aquifer, aquiclude, aquitard, aquifuge. 3 hrs
Types of aquifers and their characteristics confined, unconfined, perched, coastal aquifers, leaky aquifers. 3 hrs
Water budget and groundwater resource estimation. 3 hrs

Unit 2
Occurrence, distribution and movement of groundwater. 2 hrs
Vertical distribution of groundwater – zone of aeration, water table, zone of saturation. 2 hrs
Water table fluctuations – springs and artesian wells. 2 hrs
Hydrological properties of rocks: - porosity, permeability, specific yield, specific retention, transmissibility, storage co-efficient. 4 hrs

Unit 3
Artificial recharge to groundwater – Rain water harvesting, roof top rain water harvesting. 2 hrs
Concept of watershed development and management.  2 hrs
Physical and Chemical quality of waters: Chemical quality of groundwater – introduction, chemical quality, spatial variation of differentions - Ca, Mg, Na, K, S, chlorides, Nitrates, Carbonates, Bi-Carbonates, Fluorides, Silicon oxides total dissolved solids (TDS), Total Hardness (TH), pH, EC, Turbidity, BOD, COD.  3 hrs

**Unit 4**
Mining Geology: Introduction to mining.  2 hrs
Methods of mining, surface and sub-surface mining.  3 hrs
Surface mining – alluvial and open cast/pit mining and related equipments.  3 hrs
Sub surface mining – stopping and cavity methods, mine safety, mine ventilation.  2 hrs

**Unit 5**
Mining of metalliferous deposits.  2 hrs
Ore reserve estimation – grade, tonnage and their relationship.  3 hrs
Impact of mining on environment and human health.  2 hrs

**GP-602. PRACTICALS**  35 Marks

**Hydrogeology and Mining Geology**
Hydrogeological problems – estimation of annual rainfall by Theisson and polygon methods
Water budget calculations
Determination of potential evapotranspiration by Thronth Waite method
Determination of specific capacity and specific yield of the open wells
Chemical analysis of water
Graphical representation of water quality
Ore reserve estimation problems

**REFERENCES**

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