

No.AC.2(S)/384/14-15

Dated: 10-06-2015

**NOTIFICATION**

**Sub:** Modification in the existing syllabus of B.Sc. in Geology.

**Ref:** 1.Proceedings of Faculty of Science & Technology Meeting held on 02-02-2015.  
2. Proceedings of the Meeting of Academic Council held on 27-03-2015.

The Board of Studies in **Geology (UG)** at its meeting held on 04-12-2014 has resolved to modify in the existing syllabus of B.Sc. Geology course from the academic year 2015-16.

The Faculty of Science and Technology and the Academic Council at their meetings held on 02-02-2015 and 27-03-2015 respectively have approved the above proposals and the same is notified.

The copy of modify in the existing syllabus B.Sc. in Geology course is annexed.

**DRAFT APPROVED BY THE REGISTRAR**

*[Handwritten Signature]*  
REGISTRAR.

To

1. The Registrar (Evaluation), University of Mysore, Mysore.
2. The Chairperson, BOS/DOS in Geology, MGM.
3. The Dean, Faculty of Science & Technology, DOS in Earth Science, MGM.
4. The Principals of the Affiliated Colleges running B.Sc. in Geology course.
5. The Director, College Development Council, UOM, Mysore.
6. The Coordinator, Online & Outreach programme, Parakalamatta, MGM.
7. The Deputy/Assistant Registrar (Evaluation), University of Mysore, Mysore.
8. The Supdt, A.B., Academic Section / P.M.E.B, UOM., Mysore.
9. The P.A. to the Vice-Chancellor/Registrar/Registrar( Evaluation), UOM., Mysore.
10. The Case Worker, AC.7, Academic Section, University of Mysore, Mysore.
11. The Section Guard File(Supdt.AC.2), A.B., A.C., UOM.
12. The Schedule File.

**UNIVERSITY OF MYSORE**  
**B.SC., GEOLOGY - COURSE STRUCTURE AND ALLOCATION OF MARKS**  
**(REVISED) 2014**

| Semester | Paper               | Title of the paper  | Theory                |       |    | Practical         |       |                    |
|----------|---------------------|---|-----------------------|-------|----|-------------------|-------|--------------------|
|          |                     |   | No. of teaching hours | Marks |    | No. of Practicals | Marks |                    |
|          |                     |   |                       | Exam  | IA |                   | Exam  | IA                 |
| First    | Paper I 20035*      | Introduction to Earth system-I and Crystallography            | 42                    | 60    | 10 | --                | --    | --                 |
|          | Practical I A542*   | Crystallography   | --                    | --    | -- | 14                | 20    | 10                 |
| Second   | Paper II 20135*     | Introduction to Earth system-II and Mineralogy                | 42                    | 60    | 10 | --                | --    | --                 |
|          | Practical II B542*  | Mineralogy  | --                    | --    | -- | 14                | 20    | 10                 |
| Third    | Paper III 20233*    | Petrology   | 42                    | 60    | 10 | --                | --    | --                 |
|          | Practical III C542* | Petrology   | --                    | --    | -- | 14                | 20    | 10                 |
| Fourth   | Paper IV 20332*     | Paleontology and principles of stratigraphy                   | 42                    | 60    | 10 | --                | --    | --                 |
|          | Practical IV D542*  | Paleontology  | --                    | --    | -- | 14                | 20    | 10                 |
| Fifth    | Paper V 20446*      | Indian stratigraphy and structural geology                    | 42                    | 80    | 20 | --                | --    | --                 |
|          | Practical V E544*   | Structural geology  | --                    | --    | -- | 14                | 40    | 10                 |
|          | Paper VI 20447*     | Economic geology and engineering geology                      | 42                    | 80    | 20 | --                | --    | --                 |
|          | Practical VI E546*  | Tracing of outcrops, dip and strike problems                  | --                    | --    | -- | 14                | 40    | 10                 |
| Sixth    | Paper VII 20648*    | Remote sensing and geoexploration                             | 42                    | 80    | 20 | --                | --    | --                 |
|          | Practical VII F90*  | Petrographic techniques-I                                     | --                    | --    | -- | 14                | 40    | 10                 |
|          | Paper VIII 20649*   | Gemology, optical mineralogy, hydrogeology and mining geology | 42                    | 80    | 20 | --                | --    | --                 |
|          | Practical VIII F90* | Petrographic techniques-II and ore geology and field report   | --                    | --    | -- | 14                | 40    | 10<br>Field Report |

Note: \* (star) denotes code nos.

**UNIVERSITY OF MYSORE**  
**SUBJECT- GEOLOGY**

**B.Sc., Degree Course Syllabus**

**FIRST SEMESTER**

**Paper -1 Introduction to Earth System-I and Crystallography**

|                                |                |    |    |
|--------------------------------|----------------|----|----|
|                                |                | Th | IA |
| <b>Dynamics of the earth-I</b> | Theory 3h/week | 60 | 10 |

**UNIT-1**

Definition of geology, relationship with other branches of science, importance, scope and different branches of geology.

Components of earth system: atmosphere, lithosphere, hydrosphere, biosphere.

Origin of earth; nebular hypothesis. 7 hr

**UNIT-2**

Age of the earth: radiometric methods (Rb-Sr, U-Pb, Sm-Nd, Pb-Pb) of age determination.

Geological agents: definition, classification- a) epigene and b) hypogene

**EPIGENE AGENTS:**

Weathering: types, mechanical, chemical and biological weathering

Wind: geological action of wind, deflation, abrasion, attrition, erosional features- pedestal rock, transportation-suspension, saltation, traction, deposition-sand dunes, barchans, and loess.

7 hr

**UNIT-3**

**Rivers:** stages of rivers-young, mature and old, geological action of rivers: erosion- hydraulic action, abrasion, attrition.

Erosional features-m pot holes, V-shaped valleys, waterfall, canyons, base level erosion, meanders, oxbow lake, transportation-suspension, solution, saltation, deposition-alluvial fans and deltas, groundwater: geological action of ground water- Erosional features-sinks, caverns, solution valleys-transportation-solutional, depositional features-concretions, stalactites and stalagmites.

**Oceans:** topography of ocean floor continental slope, shelf abyssal zone, mid ocean ridges, waves, tides, currents and circulation of waters.

7 hr

**UNIT-4**

Geological work of oceans-erosion, transportation, deposition.

**Coral reef:** types of reefs- fringing, barrier, atoll.

**Glaciers:** movement of glaciers, types of glaciers-valleys, piedmonts, icecaps, geological action of glaciers, erosion-abrasion, excavation, frost wedging. Erosional features- cirques, U-shaped valleys, hanging valleys. Transportation-glacial drift, deposition-moraines and Tillites.

7 hr

## **UNIT-5**

### **CRYSTALLOGRAPHY**

Introduction: definition and scope of crystallography, definition of a crystal, formation of crystals: crystalline and amorphous substances, crystal elements: interfacial angle, contact goniometer.

Crystallographic axes; axial characters of geometrical constants; axial ratio; classification of crystals in to systems based on geometrical constants.

7 hr

## **UNIT-6**

Symmetry in crystals: definition, elements of symmetry-centre, plane, axis and roto-inversion axis of symmetry, symmetry notation- Hermann Mauguin symbols: parameters: crystallographic notation-millers, laws of rational indices, grade of symmetry.

Twins: definition, parts of a twin, types of twins.

7 hr

-----

Total 42

hrs

### **Books:**

1. Principles of geology-Arthur Holmes
2. Physical geology-Longwell and Flint
3. General geology-Radhakrishna y
4. The dynamic earth-Wyllie P.J
5. The way earth works- Wyllie P.J
6. Physical geology-Spring Field
7. Geomorphology-Thornbury
8. Geomorphology-Cavies
9. Physical geography today-Muller and Oberlander
10. An introduction to crystallography-Buerger
11. Elementary crystallography- Buerger
12. Crystallography and crystal chemistry-Bloss D
13. Crystal chemistry-Kutty T.R.N and Tareen J.A.K
14. Elements of X-rays crystallography-Axaroff
15. An introduction to crystal chemistry- Evan.R.C.
16. Elemental crystallography-Tareen.J.A.K. And Kutty T.R.N.

17. Crystal chemistry and its significance in the growth of technical materials-Byrappa. K and Pushehorovsky.D.Yu.

### **PRACTICAL (PR-1) CRYSTALLOGRAPHY**

|  |    |              |
|--|----|--------------|
|  | Th | IA           |
| Prac. 3hrs/week  | 20 | 10           |
| The study of mathematical relationships of crystal elements (Euler's formula) $F+A=E+2$ , classification of crystals into six systems on the axial characters.<br>Measurement of interfacial angle using contact goniometer. The study of symmetry elements (grade of symmetry) in crystals. Simple holohedral forms of the six systems and Twins. |    |              |
|  |    | Total 14 hrs |

### **SECOND SEMESTER**

#### **Paper- 2. INTRODUCTION TO EARTH SYSTEM-II AND MINERALOGY**

|                |    |    |
|----------------|----|----|
|                | Th | IA |
| Theory 3h/week | 60 | 10 |

#### **UNIT-1**

##### **Dynamics of The earth-II**

##### **HYPOGENE AGENTS:**

**Volcanoes:** definition, description of typical volcano, classification of volcanoes-active, dormant, extinct, central, fissure, product of volcanoes, hot springs, geysers, fumaroles, causes of volcanoes.

**Earthquake:** definition, focus, epicenter, causes and effects of earthquakes, seismic waves-P, S, and L waves, seismograph, recent earthquakes in India.

7 hrs

#### **UNIT-2**

**Plate tectonic theory:** Plates and their margins, constructive margin, destructive margin, continental plate boundaries, ocean plate boundaries, causes of movement of the plates, paleomagnetism, seafloor spreading and hotspots.

7 hrs

#### **UNIT-3**

##### **MINERALOGY**

Introduction: definition of mineral, history of mineralogy, branches of mineralogy.  
Physical mineralogy: characters depending upon the state of aggregation –habit, form.  
Characters depending upon cohesion and elasticity: cleavage, fracture, hardness, tenacity.  
7 hrs

#### **UNIT-4**

Characters depending upon light: color, streak, luster, diaphaneity, iridescence, opalescence, luminescence, fluorescence, phosphorescence, tarnish. Characters depending upon electricity and magnetism: conductivity, pyro, piezo, para and diamagnetism.  
Specific gravity and methods of determining specific gravity: Isomorphism and Polymorphism.  
7 hrs

#### **UNIT-5**

Descriptive Mineralogy: classification of minerals based on chemical composition. Oxides and carbonates, silicates, abundance in the crust, classification of silicates, based on structures: neo, soro, cyclo, iono, phyllo and tecto silicates.  
7 hrs

#### **UNIT-6**

Study of group of minerals: garnet group, pyroxene group, amphibole group, mica group, quartz and feldspar groups.  
7 hrs  

---

Total 42 hrs

#### **Books:**

1. Principles of Geology-Arthur Holmes
2. Physical geology-Longwell And Flint
3. General geology-Radhakrishna Y
4. The dynamic earth-Wyllie P.J.
5. Mineralogy, Crystallography & Crystal Chemistry – Bloss.D
6. Textbook of Mineralogy – Dana
7. Rock Forming Minerals – Deer, Howie & Zussman
8. Mineralogy – Shrock
9. Manual of Mineralogy – Klien, C & Hurlburt, C.S.Jr.
10. Optical mineralogy- Naidu.P.R.J.
11. Optical mineralogy- Kerr. P.J.
12. Optical crystallography-Wahlstrom.E.E.

#### **PRACTICALS (PR II): MINERALOGY**

|                |          |          |
|----------------|----------|----------|
| Prac 3hrs/week | Th<br>20 | IA<br>10 |
|----------------|----------|----------|

Identification of the following minerals based on their physical characters.

1. Oxides: corundum, Corundum, Halides: Fluorite, Halite.
2. Carbonates: Calcite, Magnesite, Siderite, Rhodochrosite, Dolomite.
3. Phosphates: Monazite, Apatite.
4. Sulphates: Barytes, Gypsum.
5. Silicates:
  - Nesosilicates: Olivine, Garnet, Zircon, Andalusite, Sillimanite, Kyanite, Topaz, Staurolite
  - Sorosilicates: Epidote
  - Cyclosilicates: Beryl, Tourmaline.
  - Inosilicates:
    - Pyroxenes: Enstatite, Hypersthene, Diopside, Augite.
    - Amphibole: Hornblende, Tremolite, Actinolite.
  - Phyllosilicate: Serpentine, Talc, Muscovite, Vermiculite, Biotite, Epidote, Chlorite.
  - Tectosilicates: Quartz and its varieties.
    - Feldspars- Microcline, Orthoclase, Plagioclase- Labradorite.
    - Feldspathoids- Leucite, Nephelene, Sodalite

Total 14 hrs

### THIRD SEMESTER

#### Paper-3. PETROLOGY

|                |       |
|----------------|-------|
| Th             | IA    |
| Theory 3h/week | 60 10 |

#### UNIT-1

Introduction. Definition of a rock, relationship of petrology with other branches of Geology, composition of the earth's crust classification of rocks, igneous, sedimentary and metamorphic rock, rock cycle.

**IGNEOUS ROCKS:**Forms of igneous rocks, Extrusives and Intrusives: Concordant - Sill, Laccolith and Phacolith. Discordant - Dyke, Ring Dyke, Cone Sheets, Volcanic Neck, Stock, Boss and Batholiths. Structures: Vesicular; Amygdaloidal, Blocky, Ropy, Pillow, Columnar.

7 hrs

#### UNIT-2

**Textures** - Crystallinity, granularity and mutual relationship of crystals. Kinds of textures: Equigranular, Panidiomorphic, hypidiomorphic and allotriomorphic, Inequigranular - Porphyritic, poikilitic, ophitic, basaltic, intergrowth and flow texture.

7 hrs

#### UNIT-3

Classification: Bases of classification- chemical, mineralogical and textural. Tabular classification of Tyrrell. Petrogenesis- Introduction-concept of system, phase and component, chemical potential and phase rule. Unicomponent system (SiO<sub>2</sub>) and Binary systems (Fo-Fai, Ab-An) magma, lava, types of magma, temperature of magma, composition of magma, crystallization of binary magma. Bowen's reaction principle, differentiation and assimilation.

7 hrs

#### UNIT-4

**Sedimentary rocks:** Sedimentation - Weathering, transportation, lithification and diagenesis. Structures of Sedimentary rocks; ripple marks, sun cracks, rain prints, stratification, current bedding and graded bedding. 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.

Depositional environment - terrestrial, lacustrine, fluvial, marine.

7 hrs

#### UNIT-5

**Metamorphic rocks:** Agents of metamorphism, kinds of metamorphism-Contact (thermal), Regional (dynamothermal) and its grades, dynamic (cataclastic), plutonic, pneumatolytic.

7 hrs

#### UNIT-6

**Structures** -gneissose, schistose, granulose. Effects of thermal metamorphism on argillaceous sediments and calcareous sediments. Effects of regional metamorphism on argillaceous sediments and basic igneous rocks.

7 hrs

Total 42 hrs

Books:

1. Principles of petrology: Tyrrell - Chapman and Hall publications.
2. Igneous and Metamorphic petrology: Turner and Verhoogen - 1962, Allied Publishers, Bombay. Metamorphic petrology by Winkler HGF 1987 - Nirosa publications
3. Sedimentary rocks by Pettijohn 1984 - CDS Pub\, NEW DELHI
4. Sedimentary rocks by Greensmith 1984
5. Manual of sedimentary petrology - Krymbeyn & Pettijohn
6. Petrology of Sedimentary rocks - Folk. R.L.
7. Origin of Sedimentary Rocks - Blatt. H, Middleton, G.V. & Murray. R.C.

#### PRACTICAL (PR III) PETROLOGY

|                  |    |    |
|------------------|----|----|
|                  | Th | IA |
| Prac. 3 hrs/week | 20 | 10 |

**Identification of rocks:** megascopic study

**Igneous rocks:** granite, syenite, diorite, gabbro, peridotite, Dunite, porphyries, granite, syenite, diorite, felsites, pegmatite, dolerite, obsidian, pitchstone, rhyolite, trachyte, basalt, andesite.

**Sedimentary rocks:** conglomerate, breccia, sandstone, shale, grit, limestone, shell limestone, oolitic limestone.



**Metamorphic rocks:** quartzite, schist, gneiss, marble, slate, phyllites, charnockite, granulites and basic granulites.

Total 14 hrs

## FOURTH SEMESTER

**Paper-4. PALEONTOLOGY AND PRINCIPLES OF STRATIGRAPHY**      Th      IA  
Theory 3h/week      60      10

### UNIT-1

#### PALEONTOLOGY

Introduction: Definition, relationship with other branches of geology, classification of life plant and animals- invertebrates and vertebrates-phylum, class, order, genera, species, fossils, fossilization, different modes of fossilization; mummification, carbonization, petrification, casts and moulds, tracks and trails. Types of fossils- index, extinct, synthetic and persistent fossils with examples. Micropaleontology, utility of fossils. Uses of fossils in stratigraphic classification, paleogeography, evolution of life and in the exploration of fossil fuels. Life through ages.

7hrs

### UNIT-2

#### PALAEONTOLOGY-2

Phylum **Protozoa**: Order: **Foraminifera**-General morphology, test wall- calcareous, chitinous, and agglutinated- septa, arrangement of chambers, suture, aperture, dimorphism, classification, geological history and stratigraphic importance. An outline on the applications of foraminifera in oil exploration.

#### Phylum **Cnidaria**:

class **Anthozoa**: General morphology, corallum, corallite, theca, chambers, septa, tabulae, dissepiments, sinapticalae, fossula, columella, septal developments, classification- rugose corals, tabulate corals and modern corals, geological range and stratigraphic importance.

Phylum **Echinodermata**; class: **Echinoidea**- Morphology of the shell, regular and irregular echinoids: Apical system- ambulacral and interambulacral areas, peristome.

A brief outline on the classification of vertebrates - A very short account of the evolution of man, elephant and horse. Gondwana flora of India. An outline of the uses of Micropaleontology.

Phylum: **Hemicordita**, Subphylum; **Graptolithina**: Order: **Graptoloidea**: General morphology, rhabdosome stipe, theca, common canal, nema, virgula, sicula, uniserial, biserial, classification, geological distribution and stratigraphic importance.

7 hrs

### UNIT -3

#### Phylum Mollusca:

Class – **Pelecypoda(Lamellibranchia)**: General characters-soft parts, shell, umbo hinge line, ligament, lunule and escutcheon- adductor impressions, pallial line, pallial sinus, dentition, ornamentation, classification, geological history.

Class – **Gastropoda**: General characters- soft parts, shell, shell forms, whorl, spire, suture aperture-( holostomatus, siphonostomatus) columella, umbilicus, peristome, types of coiling- dextral & sinistral, orientation, ornamentation, classification and geological history.

Class- **Cephalopoda**: General morphology. **Nautiloidea** - morphology, shell, brief description **Ammonoidea** - Morphology, siphuncle, septa, septal necks. prosiphonate, retrosiphonate, chambers, protoconch, phragmacone, body chamber, suture lines- saddles, lobes, suture type- nautilitic, goniatitic and ammonitic- shell forms, ornamentation classification- evolution (size, coiling, suture), geological history.

7 hrs

### UNIT -4

#### Phylum Arthropoda:

class: **Trilobita**: General morphology. Cephalon-glabella, facial suture, free cheek, fixed cheek, genal angle, genal spine, cranidium, Thorax- segments, pleurae, pleural spine. Pygidium. Classification, geological history- stratigraphic importance.

Phylum **Brachiopoda**: General characters- soft parts, shell, beak, umbo, pedicle opening, delthyrium, deltidial plates, hingeline, articulata & inarticulate, teeth & sockets, brachial skeleton, ornamentation- classification, geological range in time.

7 hrs

### UNIT-5

#### PRINCIPLES OF STRATIGRAPHY:

Introduction; principles of stratigraphy; law of catastrophism, law of uniformitarianism, law of order of superposition, nature of geological record, imperfections in geological record.

7hrs

### UNIT-6

Correlation: Types of correlation, criteria for stratigraphic correlation; lithological, stratigraphical, structural, metamorphic, paleontological (biological), geochronological.

Standard stratigraphical record and its equivalents in India. Classification of geological record into Archaean, Proterozoic, Palaeozoic, Mesozoic and Cenozoic.

7 hrs

Total 42 hrs

#### Books:

1. Principles of paleontology- Wood, H
2. Principles of paleontology- Swinerton, H.M

3. Introduction to paleontology- Jain.P.C.and Anantharaman.M.S.
4. Paleobotany-Andrews
5. Principles of invertebrate paleontology- Shrock. RR. And Twenhofel.H
6. A text book of geology- P.K.Mukherjee
7. Vertebrates-Colbert C
8. Vertebrate paleontology- Romer A.

#### **PRACTICAL (PR IV) PALEONTOLOGY**

|                  |    |    |
|------------------|----|----|
|                  | Th | IA |
| Prac. 3 hrs/week | 20 | 10 |

Megascopic identification and description of the following fossils:

**Corals:** Calceola, zaphrentis, lithostrotion, favosites, halysites.

**Brachiopoda:** Spirifer, producters, terebratula, rhyconella, atrypa.

**Pelecypoda:** Cardita, pecten, trigonia, gryphea, hippurites.

**Echinodermata:** cidaris, micraster

**Gastropoda:** Natica, turritella, cerithium. conus, voluta, physa.

**Cephalopoda:** Nautilus, goniatites, ceratites, acanthoceras, hamites.

**Trilobita:** Paradoxide, calamene, phacops, trinucleus.

Identification of Micro fossils: Foraminifera: lagena, nodosaria, textularia,

Techniques of separation of microfossils from the sediments.

**Plant fossils:** Calamites, Lepidodendron, Sigillaria, Glossopteris, Ptillophyllum, and Cordiatae.

Total 14 hrs

### **FIFTH SEMESTER**

#### **Paper 5.1 INDIAN STRATIGRAPHY AND STRUCTURAL GEOLOGY**

|                |    |    |
|----------------|----|----|
|                | Th | IA |
| Theory 3h/week | 80 | 20 |

#### **INDIAN STRATIGRAPHY**

##### **UNIT-1**

Physiographic divisions of India- Peninsular, Extra-peninsular and Indo-gangetic alluvial plains. Archaeans of Peninsular India, Distribution- Karnataka. Sargur group and Dharwar super group. Proterozoic (Purana group) basins of Karnataka- Cuddapah, Kaladgi, Badami, Bhima, Karnool group.

Cambrian rocks of Spiti- Distribution, lithology, classification and a brief account of fossil record.

7 hrs

##### **UNIT 2:**

Gondwana stratigraphy- Nomenclature, lithology, distribution, classification, age, economic deposits and a brief account of plant fossil record.

Cretaceous rocks of Tiruchirapalli- Distribution, lithology , classification, life and age limit.

7 hrs

### **UNIT-3**

Deccan traps- Distribution, lithology, infra trappeans- bagh and lamata beds.

Intertrappeans- Gurumatkal intertrappeans . Supratrappeans-Nummulitic limestone. Age of Deccan traps- based on fossils evidence and geochronology. Economic importance.

Siwalik group- Distribution, lithology ,classification, life and age of Siwaliks. Recent alluvium.

7hrs

### **UNIT-4**

#### **STRUCTURAL GEOLOGY**

Introduction: structural geology and its importance. Concept of deformation. Forces - tensional, torsional. shearing and compressional. I). Primary structural forms – Igneous Rocks and Sedimentary. Conformity and unconformity-definition-origin-types-disconformity, nonconformity and angular unconformity: recognition and significance. Attitude of beds: definition of dip (true and apparent dip) and strike. Description of compass clinometers and determination of dip and strike of beds.

Outcrop-definition, width of an outcrop and thickness of bed. Factors controlling the width of the bed.

7 hrs

### **UNIT-5**

#### **SECONDARY STRUCTURES:**

**Folds:** Definitions - parts of folds, axis, axial planes, limb, plunge. Crest and troughs. Types of folds- symmetrical and asymmetrical-anticline, syncline, anticlinorium, synclinorium, overturned fold, recumbent fold. isoclinal, chevron, fan folds, monocline and drag folds. Denudational structures - Outlier and inlier.

7 hrs

### **UNIT 6:**

**Faults:** Definition - Elements of fault, Fault planes, Dip, Strike, Hade, Heave and Throw. Hanging and footwalls. Classification - I. Geometrical: I) Based on attitude of faults as compared to the adjacent beds. Dip, Strike, Diagonal and Bedding faults ii) Based on Apparent movement; normal and reverse faults. II. Genetic: Thrust faults, over thrust, and under thrust. Gravity faults - Step fault, Ridge fault, trough faults. Criteria for recognition of faults in the field.

**Joints:** Definition, Dip, Strike. Joint plane, block Joint, Joint set, Joint system. Classification – I. Geometrical: Dip, Strike, Oblique and bedding joints II. Genetic – columnar, mural sheet joints, Master joints. Importance of joints.

7 hrs

Total 42 hrs

Books:

1. Field Geology - Lahee, W.
2. Structural Geology - Billings, M.P.
3. Symbols for maps and rocks - Amer. Geol. Inst. Publ.
4. Topographic sheets - Survey of India Publ.
5. Geological Map of India and Karnataka
6. Indian Striatigraphy - Wadia, D.N.
7. Geology of India and Burma - Krishnan, M.S.
8. Geology of Karnataka - Mem.GeoI.Soc.India
9. Deccan Basalts - Mem.GeoI.Soc.India
10. Geo- Karnataka - Mys.Geol.Dept.Cent. Vol.
11. Principles of historical geology- Ravindrakumar.

**Paper 5.2 ECONOMIC GEOLOGY AND ENGINEERING GEOLOGY**

|                 |    |    |
|-----------------|----|----|
|                 | Th | IA |
| Theory 3hr/week | 80 | 20 |

**UNIT-1:**

**ORE GEOLOGY:** Introduction to ore geology in relation of industry, commerce and national economy. Essential, strategic and critical minerals. Ore minerals, Gangue minerals, Tenor of ore. Principles and Processes of Ore formation: Magmatic processes: Early and late magmatic deposits. Contact metasomatism: Skarn deposits. Hydrothermal processes: Hydrothermal fluids and their migration and deposition. Cavity filling and Replacement deposits.

7 hrs

**UNIT-2**

**Weathering processes:** Residual, mechanical concentrations (placers) - Eluvial, Stream and Marine Deposits. Sedimentation: Fe and Mn cycles. Oxidation and supergene enrichment: Gossans. Metamorphism: Metamorphic deposits. Classification of ore deposits - Jenson and Bateman. Metallogenic Epochs and Provinces.

7 hrs

**UNIT-3:**

**Indian mineral deposits**

Study of the following deposits of India with special reference to Karnataka with regards to their mineralogy, origin, occurrence and distribution.

**Metallic deposits:** gold, copper, iron, manganese, aluminium, chromium

**Non-metallic deposits:** mica, abrasives, refractories, building and ornamental stones

7 hrs

**UNIT-4:**

**Fossil fuels**

Petroleum and coal: petroleum-origin, migration and accumulation of oil. Oil taps, on-shore and off-shore oilfields of India. Coal-stages and periods of coal formation, lower gondwana coal

fields, peat and lignite deposits.

7 hrs

### UNIT-5

#### ENGINEERING GEOLOGY

**Stability of rock slopes and cutting in rocks:** Classification of slopes- stable and unstable slopes- Geological parameters. Measures for stabilization of slopes. Cuttings in rock slopes- cut design and geological parameters.

**Dams and reservoirs:** Types of Dams: 1. masonry or concrete dams- gravity, arch and buttress. 2. Earth Dams and 3.composite dams. Location of dam. Geological considerations- topography, structure and lithology. Foundation and seepage problems in dams and their treatment. Reservoir: Reservoir problems- seepage and silting.

7 hrs

### UNIT-6

**Tunnels:** terminology, definition, types- hard rock and soft rock tunnels.

**Bridge sites:** Terminology, Bridge structure, types, bridge problems, and stability of bridges. Geology of bridge sites.

7 hrs

Total 42 hours

Books:

1. Economic Mineral Deposits - Jenson and Bateman, A.M
2. Mineral Deposits by Lindgren
3. Ore Deposits by Park and Mc Diarmid
4. Ore-deposits of India - Gokhale and Rao
5. Indian Mineral Resources - Krishnaswamy, S and Sinha.
6. Metallic and Industrial minerals - Lamey, G.A.
7. Introduction to India's economic minerals - Sharma, N.L. and Ram. K.S.
8. A treatise on Industrial Minerals of India - Sinha. R.L.
9. Structural Geology - Billings, M.P.
10. Symbols for maps and rocks - Amer. Geol. Inst. Publ.

#### PRACTICAL (PR V): STRUCTURAL GEOLOGY

|               |       |
|---------------|-------|
| Th            | IA    |
| Prac. 3h/week | 40 10 |

Study and Interpretation of Topographical Maps: Description of the relief features and drawing of profile of contour maps. Geological Maps – Drawing of section and interpretation. Horizontal series and inclined series without intrusive and with intrusive rocks.

Faults: vertical and inclined with intrusive rocks. Folded series, unconformity series. Complex map consisting of folds, faults, unconformities and intrusions.

A total of 20 maps covering the above topic.

Total 14 hrs

## **PRACTICAL (PR VI): TRACING OF OUTCROPS, DIP AND STRIKE PROBLEMS.**

|               |    |    |
|---------------|----|----|
|               | Th | IA |
| Prac. 3h/week | 40 | 10 |

Tracing of outcrops, dip and strike problems.

1. Determination of the amount of apparent dip in the given direction, from given amount and direction of true dip.
2. Determination of true dip, when the amount and direction of apparent dips are known.
3. Determination of the apparent dips, when the true dip amount and directions are known.
4. Determination of the direction of the apparent dip, when the true dip and amount of apparent dips are known.

Calculations of the thickness of the strata, horizontal surface, slope in the direction of dip and slope against the direction of dip.

Total 14 hrs

## **SIXTH SEMESTER**

|  |    |    |
|--|----|----|
| <b>Paper 6.1 REMOTE SENSING AND GEOEXPLORATION</b> | Th | IA |
| Theory 3hr/week                                    | 80 | 20 |

### **UNIT-1**

**Remote sensing using aerial photograph.** Types of aerial photography-controlling factors of aerial photography. Scale of photography. Flight plan-area, purpose-time and season. Overlap, sidelap, drift and crab. Types of mosaics and camera parameters. Photogrammetry and instrumentation in aerial photography.

7 hrs

### **UNIT-2**

**Satellite Remote Sensing:** Principles of Remote sensing, stages in remote sensing.

Electromagnetic radiation- characteristics of electromagnetic spectrum; interaction of EMR with the earth's surface (reflection, surface roughness, transmission, spectral signature) and with the atmosphere (scattering, absorption, atmospheric windows, refraction, atmospheric haze).

Platform, sensors, resolution, multispectral scanners- across- track and along- track multispectral Scanning, data reception and product generation.

Microwave remote sensing: SLAR & SAR, LISS, NIR, TIR and different Indian satellites in brief, NRSA centers, RRSSC centers, IIRS centers and activities with respect to Indian satellite data products.

7 hrs

### **UNIT-3**

#### **GEOEXPLORATION:**

Introduction on Prospecting and Exploration. Classification of Prospecting methods Principles of Exploration: Geological, Geophysical and Geochemical Methods.

#### **GEOLOGICAL EXPLORATION**

Guides and criteria for locating ore deposits. Stratigraphic, lithological, structural, geomorphological, palaeogeographic and palaeoclimatic Criteria. Preliminary and detailed exploration, exploratory works – drilling and core logging, exploratory grids, sampling methods, economic evaluation of mineral deposits.

7 hrs

### **UNIT-4**

#### **GEOPHYSICAL EXPLORATION**

Introduction: Methods of Exploration.

**Gravity Method:** Introduction, basic principle, gravity of the earth, gravity reductions, densities of rocks and minerals, density estimates from field results, Gravimeters-Stable type, field operations, results and interpretation.

**Magnetic Method:** Introduction, Basic principle, Magnetism of the Earth, Magnetism and magnetic susceptibilities of rocks and minerals, Field instruments, field operations. Results and interpretation.

**Electrical Methods:** Introduction, electrical properties of rocks and minerals.

Resistivity method: Elemental theory, resistivity meters, electrode layouts – Wenner and Schlumberger spreads, Field procedure, Application of resistivity method in ground water search.

**Seismic Methods:** Introduction, principles of reflection and refraction methods, field equipments – Geophones, results and interpretation.

7 hrs

### **UNIT-5**

#### **GEOCHEMICAL AND BIO-GEOCHEMICAL EXPLORATION**

Introduction, Geochemical Cycle – Deep seated & surficial, geochemical mobility of elements. Pathfinder elements. Threshold values and geochemical anomaly. Dispersion – Primary & secondary. Litho geochemistry, soil metallometry, stream sediments, Hydrochemical, Atmochemical and Biogeochemical methods, Geobotany.

7 hrs

### **UNIT-6**

#### **FIELD GEOLOGY**

Introduction, field equipments, a brief note on taking geologic notes in the field, collection of samples, numbering and marking specimens. Determination of dip and strike using compass clinometer and Brunton compass. Types of maps- topographic, geologic and aerial photographs.



Study of toposheets. General survey procedures, selecting and preparation of a base map, detailed mapping and sampling and their types. Preparing of geological reports.

7 hrs

Total 42 hrs

Books:

1. Introduction to photogrammetry by Wolf
2. Aerial photographic interpretation. Principles and applications – D.R.Leuder.
3. Photogeology – Miller.J.C
4. Photogeology by S.L.Pandey
5. Principles of remote sensing –A.S.Patel and Surendra Singh
6. Geochemistry in mineral exploration Hawkes. H & Wobb J.S. Harper & Row New York.
7. Principles of Geochemical prospecting. Ginzburg. I.I. Petgaon Press, N.Y. London.
8. Biochemical methods of Prospecting - Malyuga, D.P.
9. Principles of Mining Geology-Arogya Swamy.
10. Introduction to geophysical prospecting - Milton B, Dobrin Mc Graw Hill Book

## **Paper 6.2 GEMOLOGY, OPTICAL MINERALOGY, HYDROGEOLOGY AND MINING GEOLOGY**

### **UNIT-1**

#### **GEMOLOGY**

Introduction- a brief history of gemstones. Carot, colour, clarity, inclusion, gem defects, water and fire. A detailed study of important gem materials, their characters and occurrences- Indian occurrences in particular:

**Precious varieties:** a) diamond b) Ruby c) Sapphire d) Topaz e) Emerald f) Aquamarine g) Pearls h) Zircon

**Semi precious varieties:** a) star ruby b) star sapphire c) Spinel d) Garnets- different varieties e) Malachite f) Lapislazuli g) Turquoise h) Moonstone g) tiger's eye.

Synthetic gemstones and its importance, gem cutting techniques.

7 hrs

### **UNIT-2**

#### **OPTICAL MINERALOGY (Petrographic techniques)**

Refractive index, Critical angle, Total reflection. Double refraction- Isotropic and Anisotropic crystals, Polarisation of light, Polaroids, Behaviour of light under crossed nicols with mineral section.

7 hrs

### **UNIT-3**

**OPTICAL ACCESSORIES:** Mica plate, Gypsum plate and Quartz wedge (construction and use). Pleochroism (Dichroism, Trichroism) Interference colours, Michael Levy's chart. Order of Interference colour, Extinction- Straight, inclined, undulose and symmetrical extinctions. Extinction angle.

7 hrs

#### **UNIT-4**

##### **HYDROGEOLOGY**

Hydrologic cycle. Ground Water – Introduction, origin, types, occurrence, movement of ground water, distribution of ground water in the earth's crust, global water balance, vertical distribution of ground water- water table and its fluctuation- springs and artesian wells. Darcy's law and its application. Hydrologic properties of rocks: Porosity; permeability; specific yield; specific retention, hydraulic conductivity, transmissivity, storage coefficient. Water bearing geologic formations – Aquifers (confined, unconfined & perched), aquiclude, aquifuge, aquitard.

7 hrs

#### **UNIT-5**

Physical, chemical and biological properties of groundwater, drinking water standards. Groundwater pollution and its causes. Methods of groundwater conservation and management . Rain water harvesting.

7 hrs

#### **UNIT-6**

##### **MINING GEOLOGY**

Introduction and terminology for mining, methods of mining, mining of metalliferous deposit, surface and subsurface mining. Mine safety, mine ventilation, advantages and disadvantages of surface and subsurface mining. Ore reserve estimation and its methods. Impact of mining and mineral processing on environment and human health.

7 hrs

Total 42 hrs

#### Books:

1. Gems and Gem Materials - Kvangs, E.H. & Slawson, S.B.
2. Gemstones - Smith, H.
3. Gems - Webster, R.
4. Gems and Gem Industry in India – R.V. Karanth
5. Gemstones-Enchanting Gifts of Nature – R.V. Karanth
6. Navarathnagalu - Prasaraanga Publication, Mys.Univ.
7. Environmental Geology & Conservation, Land use planning and Resource Management – Peter T. Flawn
8. Environmental Geography – Savindra Singh
9. Groundwater Hydrology - D. K. Todd
10. Hydrology - S. N, Davis and R.J.M. Dewiest
11. Groundwater - C. L. Tolman
12. Groundwater studies - R. H. Brown and Ahers
13. Groundwater Hydrology - Hermann Bouver
14. Hydrology - C. W. Fetter
15. Principles of Mining Geology-Arogya Swamy.

16. Hydrology - Raghunath
17. Hydrology – Karanth
18. Indian Mineral Resources - Krishnaswamy, S and Sinha..
19. Metallic and Industrial minerals - Lamey, G.A.
20. Introduction to India's economic minerals - Sharma, N.L. and Ram. K.S.

|  |    |    |
|--|----|----|
| <b>PRACTICAL (PR VII): PETROGRAPHIC TECHNIQUES-I</b> | Th | IA |
| Prac. 3h/week  | 40 | 10 |

**Optical mineralogy:**

Petrological microscope: parts and its accessories  
 Determination of the following optical properties.  
 Pleochroic scheme, sign of elongation, order of interference colors.  
 Extinction angles.  
 Identification of the following rock forming minerals under the microscopic quartz, feldspars, micas, olivine, augite, hornblende, hypersthene, calcite, garnet.

Total 14 hours

**PRACTICALS (PR VIII): PETROGRAPHIC TECHNIQUES-II AND ORE GEOLOGY**

|              |    |    |
|--------------|----|----|
|              | Th | IA |
| Prac 3h/week | 40 | 10 |

**Igneous rocks:** granite, syenite, diorite, gabbro, Dunite, phorphyries, pegmatite, dolerite, rhyolite, trachyte, basalt.

**Sedimentary rocks:** sandstone, arkose, limestone (oolitic)

**Metamorphic rocks:** quartzite, schist, gneiss, marble, charnockitic granulites and basic granulite.

**Study and identification of the following economic minerals based on physical properties:**

Native copper, graphite, sulphur, chalcopyrite, azurite and malachite, realgar and orpiment, cinnabar, cassiterite, stinnite, Galena, Sphalerite, pyrite, hematite, magnetite, limonite, pyrolusite and psilomelane, bauxite illiminite, wolframite, chromite.

Fossil fuels: coal and its varieties.

Total 14 hrs

10 marks is allotted for field work and report

Brief note on taking geologic notes in the field. Collection of samples, numbering and marking specimens. Use of compass and clinometers in the field and determination of strike and dip of rocks. Use of topographic maps and geologic maps. Selecting and preparing a base map.

Plotting geologic features on a base map. Locating field data on a base map. Mapping by the

outcrop or exposure method preparing geological reports.

**FIELD WORK:** Field work for minimum of three days accompanied by staff members should be arranged during sixth semester. Submission of field report by students is compulsory. The actual TA/DA for accompanying staff members should be borne by the college from E.C. funds or other heads.

\*\*\*\*\*

## **Question paper pattern**

CODE

I/II/III/IV SEMESTER B.Sc., DEGREE EXAMINATION

GEOLOGY

Time: 3 hours

**Paper-I: TITLE**

max

marks: 60

### INSTRUCTIONS TO CANDIDATES

1. Answer all question
2. Draw labeled diagrams wherever necessary.

#### **I.Simple answer question:**

Answer the following in a word or a phrase or a sentence

7X1=7 marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

#### **II. Short answer question:**

Answer any **FIVE** of the following

5X3=15 marks

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.

#### **III. Medium answers questions:**

Answer any **THREE** of the following

3X6=18 marks

- 15.
- 16.
- 17.
- 18.
- 19.

#### **IV. Long answer questions:**

Answer any **TWO** of the following:

2X10=20 marks

- 20.
- 21.
22. Explain
  - a).
  - b).

## Question paper pattern

CODE

V/VI SEMESTER B.Sc., DEGREE EXAMINATION GEOLOGY

Time: 3 hours

**Paper:- TITLE**

max

marks: 80

### INSTRUCTIONS TO CANDIDATES

1. Answer all question
2. Draw labeled diagrams wherever necessary.

#### **I.Simple answer question:**

Answer the following in a word or a phrase or a sentence

7X1=7 marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

#### **II. Short answer question:**

Answer any **SIX** of the following

6X3=18 marks

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.

#### **III. Medium answers questions:**

Answer any **FIVE** of the following

5X5=25 marks

- 16.
- 17.
- 18.
- 19.
- 20.
- 21.
- 22.

#### **IV. Long answer questions:**

Answer any **THREE** of the following:

3X10=30 marks

- 23.
- 24.
- 25.
26. Explain
  - a).
  - b).