DAVANGERE UNIVERSITY
Bachelor of Science (B.Sc.) Semester Scheme
Curriculum Structure for Undergraduate Programme for 2025-26
Syllabus for Geology

Sl. No	Course/Paper Code	Title of the Paper	Subject Category	Teaching Hours/ week	Semester End Exam.	Internal Assessment	Total Marks	Credits	Examination Duration
1	2	3	4	5	6	7	8	9	10
Semester-III									
1	Petrology		Gel03	04	80	20	100	3	3 hrs.
	Petrology Lab-III		Gel03P	04	40	10	50	2	3 Hrs.
2	Watershed Management		GelOE-1	2	40	10	50	2	2 hrs
3	Marine Geology		GelOE-2	2	40	10	50	2	2 hrs
Semester-IV									
4	Palaeontology and Stratigraphy		Gel04	04	80	20	100	3	3 hrs.
	Palaeontology and Stratigraphy Lab - IV		Gel04P	04	40	10	50	2	3 Hrs.
5	Geotourism		GelOE-3	2	40	10	50	2	2 hrs
6	Climatology		GelOE-4	2	40	10	50	2	2 hrs

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Theory Paper- III
Third Semester
Paper Title: PETROLOGY

TOTAL HOURS – 56

Course Learning Objectives (CLOs): By the end of this course, students will be able to:

1. **Understand the classification schemes and genesis of igneous rocks**, including their tectonic affiliations and chemical/mineralogical systems such as QAPF and CIPW norms.
2. **Explore the origin, classification, and petrographic characteristics of sedimentary rocks**, including sedimentary processes and associated structures and textures.
3. **Examine the processes and agents of metamorphism**, the resulting textures and structures, and the classification and petrogenesis of metamorphic rocks.
4. **Interpret the mineral assemblages and metamorphic facies**, and analyze the metamorphic zones and index minerals to understand metamorphic grade and environment.
5. **Develop practical skills in petrography and hand specimen identification** of igneous, sedimentary, and metamorphic rocks and relate them to their geological significance.

Course Outcome: On successful completion of the course, the student will be able to:

1. **Classify igneous rocks** based on silica content, mineralogy (QAPF), and chemistry (CIPW), and explain their **petrogenesis** in different tectonic settings.
2. **Identify and describe igneous rocks** like granite, basalt, gabbro, etc., and **correlate their textures and mineral content** with their origin and evolution.
3. **Differentiate types of sedimentary rocks** and understand **sedimentary processes** such as weathering, transport, deposition, and diagenesis.
4. **Recognize sedimentary structures and textures**, and perform petrographic analysis of sandstones, limestones, shales, and other common sedimentary rocks.
5. **Explain metamorphic processes and agents**, and **distinguish between different metamorphic textures, structures, and rock types.**
6. **Interpret metamorphic facies and zones** using index minerals and isograds to assess pressure-temperature conditions of metamorphism.
7. **Demonstrate analytical and observational skills** in studying rock specimens and thin sections, enhancing both theoretical understanding and field/lab-based geology competencies.

SYLLABUS

Unit I – Igneous Petrology: Magma and Igneous Processes **(14 Hours)**

- Introduction to Igneous Rocks – Definition, significance, mode of occurrences: intrusive, extrusive, hypabyssal
- Magma and Magmatic Processes – Origin, types, evolution (partial melting, crystallization), Bowen's Reaction Series, differentiation, assimilation, mixing
- Forms and Structures – Concordant and discordant bodies (sills, dykes, laccoliths, batholiths), vesicular, amygdaloidal, pillow, columnar jointing
- Textures – Crystallinity, granularity, porphyritic, intergranular, ophitic, graphic, poikilitic, pegmatitic

Unit II – Classification and Petrogenesis of Igneous Rocks **(14 Hours)**

- Classification – Based on silica content, origin, QAPF, CIPW norm vs modal classification
- Petrography and Petrogenesis – Granite, syenite, gabbro, dolerite, basalt, peridotite, andesite, rhyolite

- Igneous Rock Series and Tectonic Affinity – Tholeiitic, alkaline, calc-alkaline, MORB, OIB, island arcs

Unit III – Sedimentary Petrology **(14 Hours)**

- Introduction and Classification – Clastic, chemical, organic; rudaceous, arenaceous, argillaceous
- Sedimentary Processes – Weathering, transportation, deposition, diagenesis
- Structures and Textures – Bedding, cross-bedding, ripple marks, mud cracks, grain size and shape
- Petrography – Sandstone, limestone, shale, conglomerate, breccia, coal

Unit IV – Metamorphic Petrology **(14 Hours)**

- Introduction – Agents of metamorphism, types (contact, regional, cataclastic, etc.)
- Textures and Structures – Foliated and non-foliated types, special structures like augen, banding, porphyroblastic
- Classification and Petrography – Slate, phyllite, schist, gneiss, marble, quartzite, amphibolite
- Metamorphic Facies and Zones – Greenschist, amphibolite, granulite, index minerals and isograds

LIST OF REFERENCES

- Richard P. Selley (2000): Applied Sedimentology. Second Edition Academic Press, UK. P. 543
- Ricci Lucchi F (1995): Sedimentographica: A Photographica Atlas of Sedimentary Structures. 2nd Edn., Columbia University Press, New York. P.255.
- Collinson J.D., and Thompson D.B (1988): Sedimentary structures.2nd ed., Allen and Unwin., London p. 194.
- Selley R.C. (1996): Ancient sedimentary environment and their subsurface diagnosis. 4th ed. Chapman & Hall, London. P. 300.
- Reineck H. E.,& Singh I.B., (1980): Depositional Sedimentary Environments. 2nd ed., Springer-Verlag, Berlin., p. 549
- John D. Winter (2010): An Introduction to Igneous and Metamorphic Petrology. Pearson Education, Inc. Published by Pearson Prentice Hall. P. 745
- Principles of petrology: Tyrrell - Chapmann and Hall publications.
- Igneous and Metamorphic petrology: Turner and Verhoogen - 1962, Allied Publishers, Bombay. Metamorphic petrology by Winkler HGF 1987 - Nirosa publications
- Sedimentary rocks by Pettijohn 1984 - CDS Pub\. NEW DELHI
- Sedimentary rocks by Greensmith 1984
- Manual of sedimenlary petrology - Krymbein & Pettijohn
- Petrology of Sedimentary rocks - Folk. R.L.
- Origin of Sedimentary Rocks - Blalt. H, Middleton, G.V. & Murray. R.C.
- Bose, M.K., 1997. Igneous petrology. World press
- Tyrell, G. W., 1989. Principles of Petrology. Methuren and Co (Students ed.).
- Ehlers, WG, and Blatt, H., 1987. Petrology, Igneous, Sedimentary and Metamorphic rocks, CBS Publishers
- Moorhouse, WW., 1969. The study of rocks in thin sections. Harper and sons.
- Friedman & Sanders, 1978. Principles of Sedimentology. John Wiley and sons.
- Prasad, C., 1980. A text book of sedimentology.
- Sengupta. S., 1997. Introduction to sedimentology. Oxford-IBH.
- Turner, F.J., 1980. Metamorphic petrology. McGraw Hill.
- Mason, R., 1978. Petrology of Metamorphic Rocks. CBS Publ.
- Winkler, H.G.C., 1967. Petrogenesis of Metamorphic Rocks. Narosa Publ.

PRACTICAL PAPER
III SEMESTER B.Sc. DEGREE PROGRAMME, GEOLOGY
CORE COURSE: PETROLOGY (PRACTICALS-3)

(4 hours/ week per batch of not more than 15 students)

Course Learning Objectives (CLOs): By the end of this course, the student will be able to:

1. Understand and interpret optical mineralogical properties using a polarizing microscope.
2. Identify and describe the interference colors, extinction angles, vibration directions, and pleochroism of minerals.
3. Develop skills in megascopic identification of igneous, sedimentary, and metamorphic rocks.
4. Analyze and interpret microscopic features of rocks in thin section for classification and petrogenetic interpretation.
5. Correlate mineralogical and textural features with geological processes and tectonic settings.

Course Outcomes (COs): On successful completion of the course, the student will be able to:

1. **CO1:** Determine the optical properties of minerals including interference color, extinction type, vibration directions, elongation sign, and pleochroic scheme.
2. **CO2:** Classify and identify common igneous, sedimentary, and metamorphic rocks based on megascopic features.
3. **CO3:** Examine thin sections and identify key features and mineral assemblages of igneous, sedimentary, and metamorphic rocks.
4. **CO4:** Interpret textures and structures observed in hand specimens and thin sections to infer rock-forming processes.
5. **CO5:** Apply petrographic knowledge in understanding regional geology, tectonic implications, and economic geology.

SYLLABUS

Determination of –

1. Order of Interference colours,
2. Extinction (straight, inclined & symmetrical)
3. Vibration direction and sign of elongation and
4. Pleochroic (Dichroic, Trichroic) scheme.

Megascopy: Identification of the following Rocks in hand specimens.

Igneous Rocks:

- **Plutonic rocks** - Granite, Syenite, Diorite, Gabbro, Dunite, Peridotite;
- **Hypabyssal rocks** - Granite porphyry, Syenite porphyry. Diorite porphyry, Pegmatite, Dolerite;
- **Volcanic rocks** - Rhyolite, Trachyte, Andesite, Basalt, Obsidian, Pitchstone

Sedimentary rocks: Conglomerate. Breccia, Sandstone, Shale, Grit. Limestone, Shell limestone, Oolitic limestone

Metamorphic Rocks: Quartzite, Shale. Schists, Gneiss. Marble, Phyllites, Charnockitic granulite and Pyroxene granulites.

Microscopy: identification of the following rocks in thin sections:

Igneous Rocks:

- **Plutonic** - Granite, Syenite Diorite, Gabbro, Dunite;
- **Hypabyssal** -Granite porphyry, Syenite porphyry, Diorite porphyry, Dolerite & Pegmatite;
- **Volcanic** - Rhyolite., Andesite, Basalt.

Sedimentary rocks - Sandstone, Limestone (oolitic).
Metamorphic rocks - Quartzite, schist, gneiss, marble, charnockitic granulites

MODEL QUESTION PAPER FOR C_3
II B.Sc., III Semester Examination
GEOLOGY
CORE COURSE: PRACTICALS-III

Time: 3 Hour **Max. Marks: 40**

I. Determination of any one from the following three (with procedure): **4 Mark**
   i. Order of Interference colour and Extinction angle.
   ii. Sign of elongation
   iii. Pleochroic scheme.

II. Identify and describe the rocks in hand specimens kept in tray numbers 1 to 4. **4 x 3 = 12 Mark**

III. Identify and describe the rocks in thin sections kept in tray numbers 5 to 8. **4 x 4 = 16 Mark**

IV. Lab Record **4 mark**

V. Viva-Voce **4 mark**

III Semester, OPEN-ELECTIVE - 1
Paper Title: Watershed Management
Total Teaching Hours: 28 Hrs

Course Learning Objectives (CLOs): By the end of this course, students will be able to:

1. **CLO1**: Understand the basic concepts, definitions, and objectives of watershed management.
2. **CLO2**: Learn and apply principles of land capability classification and identify priority watersheds.
3. **CLO3**: Gain knowledge of watershed planning, data collection, development planning, and financial planning.
4. **CLO4**: Develop awareness of participatory approaches in watershed management and sustainable use of land and water resources.
5. **CLO5**: Examine various soil and water conservation techniques applicable in irrigated and dry land areas.
6. **CLO6**: Explore different methods of water harvesting, groundwater recharge, and moisture conservation.

Course Outcomes (COs): After successful completion of this course, students will be able to:

1. CO1 Define and describe the concept and objectives of watershed and its classification.
2. CO2 Identify land capability classes and priority watersheds in different regions.
3. CO3 Prepare a basic watershed development plan, including cost estimation and evaluation.
4. CO4 Demonstrate participatory watershed management principles and practices.
5. CO5 Compare and apply different soil and moisture conservation measures.
6. CO6 Explain water conservation methods and their role in sustainable water resource use.

Syllabus

Unit I: Introduction and Watershed Planning

- **Watershed:** Definition and concept, Objectives of watershed development
- **Land Capability Classification:** Classification of land based on capability, Importance in watershed planning
- **Priority Watersheds and Land Resource Regions:** Identification of priority watersheds, Overview of land resource regions in India
- **Watershed Planning:** Principles of watershed planning, Data Collection: Baseline data and Present land use patterns
- Preparation of Watershed Development Plan
- Cost-Benefit Estimation
- Financial Planning
- Selection of Implementation Agency
- Monitoring and Evaluation Systems

Unit II: Watershed Management and Water Conservation

- **Participatory Watershed Management:** Community involvement and stakeholder participation
- **Runoff Management:** Factors affecting runoff and Techniques for runoff regulation
- **Gully Control Measures:** Temporary measures and Permanent measures
- **Soil and Water Conservation Practices:** In irrigated lands and In dry lands
- **Water Conservation Practices**
    - In-situ & Ex-situ Moisture Conservation: Principles and practices
    - Afforestation Principles
    - Microcatchment Water Harvesting
    - Groundwater Recharge Techniques

        - Percolation ponds
        - Water harvesting structures
        - Farm ponds
    - Supplemental Irrigation
    - Evaporation Suppression Techniques
    - Seepage Reduction Measures

Recommended Learning Resources

1. Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.
2. Ghanashyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.
3. Gurmel Singh et al. 2004. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.
4. Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.
5. Tripathi R.P. and H.P.Singh 2002, Soil erosion and conservation, Willey Eastern Ltd., New Delhi
6. Murthy, V.V.N. 2005, Land and water management, Kalyani publishing, New Delhi.
7. Tideman, E.M., "Watershed Management", Omega Scientific Publishers, New Delhi, 1996

III Semester, OPEN-ELECTIVE – 2
Paper Title: Marine Geology

Total Teaching Hours: 28 Hrs

Course Learning Objectives (CLOs): By the end of the course, students will be able to:

1. **CLO1**: Understand the physical characteristics and dynamics of ocean systems.
2. **CLO2**: Describe marine ecosystems and the role of marine organisms in the food web.
3. **CLO3**: Explain geological processes shaping the ocean floor and basin evolution.
4. **CLO4**: Identify major marine mineral resources and their geological settings.
5. **CLO5**: Develop an appreciation of the ocean as a vital source of resources and ecological diversity.

Course Outcomes (COs): After successful completion of this course, students will be able to:

1. CO1 Describe the physical and chemical properties of sea water and oceanographic processes.
2. CO2 Illustrate marine food webs and differentiate between types of marine life.
3. CO3 Explain the formation and evolution of ocean basins using geological principles.
4. CO4 Identify and classify different marine mineral resources and their economic significance.
5. CO5 Discuss the importance of oceans in terms of biodiversity, resource availability, and sustainability.

Syllabus

Unit I – Oceanography and Marine Ecosystems (14 Hours)

- **Physical Oceanography**: Physical properties of sea water
  - Waves, tides, and ocean currents
  - Composition of seawater and the processes controlling it
- **Marine Ecosystems**:
  - Marine food-web (primary, secondary, and tertiary production)
  - Classification of marine life: planktonic and benthic life
  - Marine organisms and their economic importance

Unit II – Geological Oceanography and Marine Mineral Resources (14 Hours)

- **Geological Oceanography**:
  - Morphology of the ocean floor
  - Origin and evolution of ocean basins
  - Continental drift, sea-floor spreading, and plate tectonics
- **Marine Mineral Resources**:
  - Classification and distribution of marine minerals
  - Sea water as a source of elements/minerals
  - Placer and heavy mineral deposits
  - Phosphorites, petroleum, coal, gas hydrates
  - Polymetallic nodules and hydrothermal metalliferous sediments

Recommended Learning Resources

1. Alan Strahler (2016) Introducing Physical Geography, 6th Edition, Wiley.
2. Miller, C.B. (2004) Biological Oceanography. Blackwell Publishers. 416p.
3. Paul R. Pinet (1992) Oceanography: An introduction to the Planet Oceanus, West Publ., Co.571p.
4. Thruman, H. V. (1994) Introductory Oceanography. 7th Ed. McMillan Pub., Co.
5. George Karleskint, Richard Turner, James Small, (2012) Introduction to Marine Biology Publisher: Brooks Cole, 512p.
6. Fasham, Michael J.R. (2003) Ocean Biogeochemistry. The Role of the Ocean Carbon Cycle in Global Change Series.

7. Komar, P. D., (1976) Beach Processes and Sedimentation, Prentice-Hall. 429p.
8. Reddy M.P.M. (2001) Descriptive Physical Oceanography, AA Balkema Press. 440p.

THEORY PAPER
IV SEMESTER B.Sc. DEGREE PROGRAMME
GEOLOGY (Paper-IV)
CORE COURSE: Palaeontology and Stratigraphy

TOTAL HOURS – 56

Course Learning Objectives (CLOs):

1. To introduce students to the fundamental concepts of palaeontology, fossilization processes, and classification of fossils.
2. To enable understanding of the evolution and diversity of invertebrate, vertebrate, and plant life through geological time.
3. To impart knowledge on the principles and methods of stratigraphy and its correlation techniques.
4. To familiarize students with the stratigraphic framework of India and its economic significance.
5. To explore the applications of fossils in biostratigraphy, paleoecology, and petroleum exploration.

Course Outcomes (COs): Upon successful completion of the course, the students will be able to:

1. **CO1**: Define and describe fossils, fossilization modes, and identify various invertebrate, vertebrate, and plant fossils.
2. **CO2**: Explain the significance of fossils in biostratigraphy and paleoenvironmental interpretations.
3. **CO3**: Illustrate and interpret stratigraphic principles and reconstruct paleogeographic settings using fossil and lithological records.
4. **CO4**: Describe major stratigraphic units of India, including the Precambrian and Phanerozoic successions, with their economic importance.
5. **CO5**: Apply paleontological and stratigraphic knowledge in hydrocarbon exploration and sequence stratigraphy.

SYLLABUS

UNIT I: PALEONTOLOGY – I (14 Hours)

Introduction to Palaeontology: Definition and scope, Relationship with other branches of geology
Fossils: Definition and types Index, body, trace, synthetic, pseudofossils, transported and leaked fossils
Fossilization Processes: Favorable conditions for fossilization, Modes of preservation:

- Unaltered and altered hard parts
- Mummification, petrification, permineralisation, carbonisation, recrystallisation, silicification
- Moulds, casts, tracks, trails, borings

Fossil Record: Nature and importance of the fossil record
Invertebrate Palaeontology

- Brief intro to Brachiopoda, Lamellibranchs, Gastropoda, Cephalopoda
- Biostratigraphic significance
- Ammonites in Mesozoic biostratigraphy and paleobiogeographic implications
- Functional adaptations:
  - Trilobites and ammonoids
- Morphology of Trilobites: Head, Thorax, Pygidium
- Graptolites: General study
- Study of Foraminifera: Morphology and distribution
- Echinodermata (Echinoidea): Regular and irregular forms

UNIT II: PALEONTOLOGY – II (14 Hours)

Vertebrate Palaeontology

- Origin and classification
- Mesozoic reptiles: Origin, diversity, extinction of dinosaurs
- Brief evolutionary accounts: Man, elephant, horse - Intercontinental migrations

Paleobotany: Introduction-Gondwana flora of India

Ichnology - Basic introduction

Micropaleontology: Organic and inorganic-walled microfossils

Applications of Fossils - In stratigraphy: Biozones, index fossils, correlation, Role in sequence stratigraphy, Use of foraminifera in oil exploration, Fossils in: Paleoenvironmental analysis, Paleobiogeography (provinces, dispersals, barriers), Paleoecology (ecosystem evolution)

UNIT II: STRATIGRAPHY – I (14 Hours)

Introduction: Definition and interrelation with geology - Stratigraphic Principles; Law of superposition, Uniformitarianism, Faunal and floral succession, Imperfections in geological records, Unconformities: Types-Correlation Methods: Physical criteria: Lithological continuity, position, well logging, radiometric age-Palaeontological criteria: Index fossils, assemblages, evolutionary stages

Stratigraphic Units: Lithostratigraphy, biostratigraphy, chronostratigraphy, Seismic, chemo-, magneto-, and sequence stratigraphy

Stratigraphic Analysis - Facies concept: Walther's Law, Paleogeographic reconstruction

Geological Time Scale: Eras: Archean to Cenozoic

Characteristics: Nomenclature, lithology, climate, tectonics, life

UNIT 4: STRATIGRAPHY – II (14 Hours)

Physiographic Divisions of India: Peninsular, extra-peninsular, Indo-Gangetic plains

Precambrian Stratigraphy, Sargur Group, Dharwar Supergroup (Bababudan, Chitradurga), Peninsular Gneiss and schist belts, Chitradurga schist belt: Distribution and economic importance

Proterozoic Basins:

Cuddapah, Kaladgi, Vindhyan, Bhima groups-Lithology, classification, life, age, economic importance

Phanerozoic Stratigraphy

Palaeozoic: Gondwana Supergroup and hydrocarbon potential

Mesozoic: Triassic (Spiti), Jurassic (Kutch), Cretaceous (Cauvery basin, Tiruchirapalli)

Cenozoic: Kutch basin, Siwalik succession, Assam, Andaman, Arakan basins

Indian Petroliferous Basins

Krishna-Godavari, Cauvery, Bombay offshore, Kutch, Saurashtra

Volcanic Provinces

Deccan Traps: Distribution, lithology - Infra-, inter-, supra-trappean beds (Bagh, Lameta, Gurumatkal, Nummulitic limestones)-Fossil-based age, economic importance

Rajmahal and Sylhet Traps

RECOMMENDED BOOKS

Note to candidates: the listed textbooks below are only suggested reading. The list does not define or limit the syllabus.

1. Krishnan, M. S. (1982) Geology of India and Burma, CBS Publishers, Delhi
2. Doyle, P. & Bennett, M. R. (1996) Unlocking the Stratigraphic Record. John Wiley
3. Ramakrishnan, M. &Vaidyanadhan, R. (2008) Geology of India Volumes 1 & 2, Geological society of India, Bangalore.
4. Valdiya, K. S. (2010) The making of India, Macmillan India Pvt. Ltd.
5. Raup, D. M., Stanley, S. M., Freeman, W. H. (1971) Principles of Paleontology

6. Clarkson, E. N. K. (2012) Invertebrate paleontology and evolution 4th Edition by Blackwell
7. Publishing.
8. Benton, M. (2009). Vertebrate paleontology. John Wiley & Sons.
9. Shukla, A. C., & Misra, S. P. (1975). Essentials of paleobotany. Vikas Publisher
10. Armstrong, H. A., & Brasier, M.D. (2005) Microfossils. Blackwell Publishing.
11. Wadia, D., 1973. Geology of India. Mc Graw Hill Book co.
12. Ravindra Kumar, 1985. Fundamentals of Historical Geology & Stratigraphy of India. Wiley Eastern.
13. Shrock, R.R. & Twenhoffel, W.H., 1952. Principles of Invertebrate Paleontology. CBS Publ.
14. Swinerton, HH., 1961. Outlines of Paleontology. Edward Arnold Publishers
15. Jain, P.C. & Anantharaman, M.S., 1983. Paleontology: Evolution & Animal Distribution. Vishal Publ.
16. Lehmann, U., and Hillmer 1983. Fossil Invertebrate. Cambridge Univ. Press.
17. Rastogi, 1988. Organic evolution. Kedrnath and Ramnath Publ.
18. Moore, Lalicker and Higher: - Invertebreate Palaeontology
19. Remer : - Invertebrate Palaeontology
20. Arnold: - Introduction to Palaeontology
21. Glaessner: - Principles of Micropalaeontology
22. Mem.GeoI.Soc.India Geology of Karnataka
23. GSI Publication Geology of Karnataka.
24. Mem. Geol. Soc of India Deccan Basalts
25. Henry Woods - Invertebrate paleontology - Cambridge press
26. Romer. A.S - Vertebrate paleontology, Chicago press.
27. Arnold. C.A - An introduction to paleobotany, MC-Graw-Hill
28. B.U.Hag and A. Boersma (1978) Introduction to Marine Micropaleontology, Elsevier, Netherlands
29. Ramp. D.M. and Stanely.M.S - Principles of Paleontology
30. Moore.R.C. Laliker C.G & Fishcher.A.G – CBS Publishers InvertebrateFossils, Horper brothers

PRACTICAL PAPER
IV SEMESTER B.Sc. DEGREE PROGRAMME
CORE COURSE: PALAEONTOLOGY AND STRATIGRAPHY

(4 hours/ week per batch of not more than 15 students)

Course Learning Objectives (CLOs): By the end of the course, students will be able to:

1. Understand the fundamental principles of palaeontology and stratigraphy, including the processes of fossilization and the use of fossils in interpreting Earth's history.
2. Identify major fossil groups (invertebrates, microfossils, vertebrates, and plants) and interpret their evolutionary and stratigraphic significance.
3. Recognize and classify different modes of fossil preservation and apply fossil evidence in paleoenvironmental and paleobiogeographic reconstructions.
4. Develop knowledge of stratigraphic principles and units and apply them to correlation and interpretation of sedimentary sequences.
5. Gain insight into the stratigraphic framework of India, including key formations, fossiliferous horizons, and petroliferous basins.
6. Apply practical skills in megascopic and microscopic identification of rocks and fossils, and interpret geological maps and fossil distribution.

Course Outcomes (COs): Upon successful completion of this course, the students will be able to:

1. **CO1**: Describe fossilization processes, preservation modes, and the importance of fossils in geological interpretations.
2. **CO2**: Identify and describe major invertebrate, plant, and microfossils with respect to morphology, taxonomy, and stratigraphic significance.
3. **CO3**: Explain vertebrate evolution and the significance of Gondwana flora in the Indian stratigraphic record.
4. **CO4**: Apply stratigraphic principles to interpret geological sequences and correlate stratigraphic units.
5. **CO5**: Analyze the stratigraphy of Indian geological formations and evaluate their economic and paleontological importance.
6. **CO6**: Demonstrate practical proficiency in fossil identification, preparation of geological maps, and stratigraphic correlation exercises.

SYLLABUS

- Study of fossils showing various modes of preservation
- **Study of diagnostic morphological characters, systematic position, stratigraphic position and age of the following invertebrate, micro and plant fossils.**
- **Description with neat diagrams and labelling the parts are compulsory.**
- **Corals:** Calceola, zapherentis , lithostrotion, favosites, halysites.
- **Brachiopoda**: Spirifer, producters, terebratula, rhynconella, atrypa.
- **Pelecypoda**: Cardita, pectin, trigonia, gryphea, hippurites.
- **Gastropoda**: Natica, turritella, cerithium. conus, voluta, physa.
- **Cephalopoda:** Nautiloids (Nautilus, Orthoceras) and Ammonoids (goniatites, ceratites, acanthoceras, hamites.
- **Trilobita**: Paradoxide, calamene, phacops, trinucleus.
- **Plant fossils**: Glassopteris, gangamopteris, ptillophyllum, lepidodendron, sigillaria and calamites.

- **Identification of Micro fossils:** Foraminifera: lagena, nodosaria, textularia,
- **Preparation of maps** showing distribution of important metallic and non-metallic deposits (Iron, Gold, Copper, Bauxite, Mica) and important coal and oil fields of India.

MODEL QUESTION PAPER FOR C_3
II B.Sc., IV Semester Examination
GEOLOGY
CORE COURSE: PRACTICALS-4

Time: 3 Hour Max. Marks: 40

1	Explain briefly about the mode of fossilization of the given model.	1 X 3 = 3 Mark
2	Identify and describe with a neat diagram the macrofossils kept in tray from 2 to 7.	5 X 4 = 20 Mark
3	Identify and describe the given microfossil kept in tray No. 8.	1 x 3 = 3 Mark
4	Identify and describe with a neat diagram the plant fossil kept in tray No. 9.	1 X 3= 3 Mark
5	Show the distribution of a mineral resource on a given map.	1 X 4 = 3 Mark
6	Lab. Record	4 Mark
7	Viva-Voce	4 Mark
Total		40 Mraks

IV Semester, OPEN-ELECTIVE – 3
Paper Title: Geotourism
Total Teaching Hours: 28 Hrs

Course Learning Objectives (CLOs): By the end of this course, students will:

1. **CLO1**: Understand the importance of geodiversity and its role in geotourism.
2. **CLO2**: Learn about geo-conservation tools and the planning of geosites and geoparks.
3. **CLO3**: Explore the role of natural and cultural landscapes in tourism.
4. **CLO4**: Identify and assess the threats to geodiversity and how to manage them sustainably.
5. **CLO5**: Develop awareness of major geosites in India, with a focus on Karnataka.
6. **CLO6**: Understand the role of geo-tour guides and educational outreach for geosite preservation.

Course Outcomes (COs): After successful completion of this course, students will be able to:

CO1 Define key concepts like geodiversity, geo-conservation, and geoparks.
CO2 Explain the role of geotourism in promoting natural and cultural heritage.
CO3 Analyze the differences between geotourism and other tourism forms.
CO4 Evaluate the threats to geodiversity and propose mitigation and conservation plans.
CO5 Identify major Indian and Karnataka geosites and describe their geotourism potential.
CO6 Develop basic skills for geo-guiding and promote geosite preservation awareness.

Syllabus

Unit I : Introduction to Geotourism

- **Geodiversity**: Concept and significance
- **Rarity of Geological Features**
- **Geo-conservation**: Definition and need
- **Key Concepts**: Geo-site, Geo-heritage and Geo-park
- **National Parks of Geological Origin**
- **Landscapes**: Natural landscapes and Cultural landscapes
- **Geo-conservation Planning**: Selection and management of geosites and Role of UNESCO Global Geoparks
- **Geotourism vs Other Tourism Forms**: Educational, Ecological, Adventure, and Cultural Tourism and Positive and negative impacts of geotourism
- **Geodiversity**: Values and significance and Threats and degradation
- **Geo-tour Guides**: Role and responsibilities and Basic geodiversity knowledge for guides

Unit II: Geodiversity, Geosites, and Sustainable Management

- **Important Geosites in India**: National importance and Focus on Geosites in Karnataka
- **Geotourism Development**: Infrastructure and interpretation tools and Local community involvement
- **Sustainable Management Practices**
- **Education and Awareness**: Geosites preservation and Role of institutions, tourists, and local stakeholders
- Locations of important fossil parks in India - Marine Gondwana Fossil Park, Fossil Wood Parks, Siwalik Fossil Park, Stromatolite Parks, etc. Rock monuments of India – Peninsular Gneiss, Columnar Basalt, Pillow Lava, Pyroclastic Rocks, Nepheline Syenite, Barr Conglomerate,

Welded Tuff, Charnockite. Geological Marvels - Lonar Lake, Eddy Current Markings, Natural Arch.

Recommended Leaning Resources

1. Gray, M., 2004. Geodiversity: Valuing and conserving abiotic nature. John Wiley & Sons Ltd. 434 p. (or later edition).
2. Dowling, R.K., and Newsome, D., 2006. Geotourism. Elsevier, 260p.
3. Gray, M. (2004) Geodiversity: valuing and conserving abiotic nature; John Wiley & Sons.
4. Henriques, M.H.; dos Reis, R.P.; Brilha, J.; Mota, T. Geo-conservation as an Emerging Geo-science. Geo-heritage 2011, 3, 117–128.
5. IUCN Geo-diversity, World Heritage and IUCN Available online: https://www.iucn.org/theme/world-heritage/our-work/global-world-heritageprojects/geodiversity-world-heritage-and-iucn.
6. National Geological Monument, from Geological Survey of India website. (www.gsi.gov.in).
7. "Geo-Heritage Sites". pib.nic.in. Press Information Bureau. 2016-03-09.

IV Semester, OPEN-ELECTIVE – 4

Paper Title: Climatology

Total Teaching Hours: 28 Hrs

Course Learning Objectives (CLOs): Upon completion of this course, students will be able to:

1. **CLO1**: Understand the principles and dynamics of meteorological phenomena.
2. **CLO2**: Analyze weather systems and hazards relevant to India and beyond.
3. **CLO3**: Differentiate between climatology and meteorology and interpret climate classifications.
4. **CLO4**: Comprehend the science of past climate systems using paleo-archives.
5. **CLO5**: Build foundational knowledge for further studies or careers in meteorology, climatology, and environmental modeling.

Course Outcomes (COs): After successful completion, the student will be able to:

1. CO1 Describe and explain core meteorological concepts and their significance in weather prediction.
2. CO2 Evaluate the impact of meteorological hazards on society and how satellite data aids monitoring.
3. CO3 Distinguish climate types and apply climate classification schemes to real-world examples.
4. CO4 Interpret climate change patterns through paleoclimatic proxies and datasets.
5. CO5 Demonstrate interdisciplinary insight into Earth systems, supporting employability and higher studies.

Unit I – Meteorology and Applied Weather Systems (14 Hours)

- Introduction to Meteorology and its elements:
  - Temperature, atmospheric pressure, wind, humidity, clouds, precipitation
- Earth's radiation balance and anthropogenic impacts
- Meteorological hazards: floods, droughts, famines, cyclones, cloudbursts, thunderstorms, dust storms, and hailstones
- General weather systems of India:
  - Monsoon dynamics – onset, withdrawal, trends, causative factors
- Basics of Satellite Meteorology and its applications

Unit II – Climatology and Paleoclimatology (14 Hours)

- Climatology:
  - Principles and distinction from meteorology
  - Global climate types and classifications: Greek, Köppen, and Thornthwaite
  - Short-term and long-term climate cycles; Continental and oceanic climates
- Paleoclimatology:
  - Climate proxies/tracers: ice cores, tree rings, lake/marine sediments, cave deposits
  - Archives of paleoclimate and their interpretation
  - Introduction to General Circulation Models (GCMs) and Climate Modeling principles

Recommended Learning Resources

1. **Ahrens, C.D. & Henson, R.** (2017)
   Meteorology Today: An Introduction to Weather, Climate, and the Environment, 12th Edition
   Publisher: Cengage Learning
   - A foundational text covering all aspects of weather systems and climate in an accessible manner.
2. **Lutgens, F., Tarbuck, E., & Herman, R.** (2018)
   The Atmosphere: An Introduction to Meteorology, 14th Edition
   Publisher: Pearson Education
   - A classic introductory textbook that effectively bridges meteorology and climatology.
3. **Donn, W.L.** (1975)
   Meteorology, McGraw-Hill Book Co., New York
   - Offers a strong grounding in atmospheric science fundamentals.
4. **Bryant, E.** (1997)
   Climate Processes and Change
   Publisher: Cambridge University Press
   - Explains climate mechanisms and their implications for Earth systems.
5. **Pick, W.P.** (2017)
   A Short Course in Elementary Meteorology
   Publisher: Andesite Press
   - A concise and beginner-friendly book suitable for non-specialists.
6. **Raymond, S.B.**
   Reconstructing Climates of the Quaternary, 3rd Edition
   Publisher: Academic Press, New York
   - A key resource for understanding paleoclimatology and long-term climate evolution.
7. **Holton, J.R.** (1992)
   An Introduction to Dynamic Meteorology, 3rd Edition
   Publisher: Academic Press
   - Useful for students interested in dynamic processes and advanced meteorological studies.
8. **Kelkar, R.R.** (2017)
   Satellite Meteorology, 2nd Edition
   Publisher: CRC Press, Florida
   - An essential guide to remote sensing and satellite applications in weather and climate.

THEORY EXAMINATION QUESTION PAPER PATTERN

B.Sc. Examination, (Semesters I –VI)

(Semester Scheme) (SEP)

GEOLOGY

Paper Title:

Paper Code:

Time: 3 Hours Max. Marks: 80

Instructions to candidates

1. All sections are compulsory
2. Draw a neat and labelled diagrams wherever necessary.

SECTION – A

1. Answer ALL the following questions (2 × 10 = 20 Marks)

a) .
b) .
c) .
d) .
e) .
f) .
g) .
h) .
i) .
j) .

SECTION – B

Answer any SIX questions (5 × 6 = 30 Marks)

2. .
3. .
4. .
5. .
6. .
7. .
8. .
9. .

SECTION – C

Answer any THREE questions (10 × 3 = 30 Marks)

10. Unit - 1
11. Unit - 2
12. Unit - 3
13. Unit – 4

THEORY EXAMINATION QUESTION PAPER PATTERN FOR COMPULSORY & ELECTIVE/OPTIONAL PAPERS (Semesters I – V)

B.Sc. Semester-I/II/III/IV/V Degree Examination;
2024-25 (Semester Scheme; New Syllabus: 2024-25)

SUBJECT: SCIENCE COURSES

Paper – CMPL & ELECTIVE/OPTIONAL I - V _____: _____
Paper Code: _____

Time: 2 Hours **Max. Marks: 40**

Instructions to candidates:

1) All sections are compulsory
2) Draw neat and labelled diagrams wherever necessary.

SECTION-A

Answer all the following questions: (2×5=10)

1.
2.
3.
4.
5.

SECTION-B

Answer any SIX of the following: (5×6=30)

6.
7.
8.
9.
10.
11.
12.
13.

Question Paper Pattern for Practical Paper Examination

(Semesters I –VI)

Duration: 3Hrs.

Experimentation (Major & Minor/Spotters) - 36 Marks
Viva Voice - 4 Marks

Total 40 Marks

Internal Assessment for Theory Paper I-VI semesters

Sl. No.	Internal Assessment	Maximum Marks
1	2	3
1	Two Session Tests with proper record for assessment	10
2	Assignment / Seminar with proper record	05
3	*Attendance with proper record	05
	Total	20

*Attendance Marks-breakup
<75% - 00 Marks
75-80% - 01 Mark
80-85% - 02 Marks
85-90% - 03 Marks
90-95% - 04 Marks
>95% - 05 Marks

Internal Assessment for Practical Paper I-VI semesters

Attendance - 05 Marks
Test - 05 Marks

Total 10 Marks

Continuous Assessment Programme/Internal Assessment/Formative Assessment Compulsory Courses & Elective/Optional

Sl. No.	Continuous Assessment Programme/Internal Assessment	Maximum Marks
(1)	(2)	(3)
01	Two Session Tests with proper record for assessment (2+2 = 4)	04
02	Assessment of Skill Development activities/Seminars/Group Discussion/ Assignment etc., with proper record	03

03	• Attendance with proper record	03
TOTAL MARKS		10

- **Attendance Marks-breakup**

<75% - 00 Marks
75-80% - 01 Mark
85-90% - 02 Marks
90-100% - 03 Marks

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