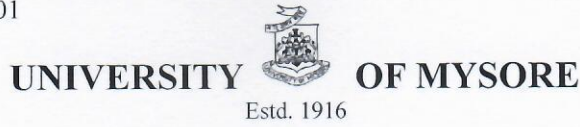


Telephone No. 2419677/2419361  
Fax: 0821-2419363/2419301

e-mail : registrar@uni-mysore.ac.in  
[www.uni-mysore.ac.in](http://www.uni-mysore.ac.in)



Vishwavidyanilaya Karyasoudha  
Crawford Hall, Mysuru- 570 005

No.AC2(S)/151/2020-21

Dated: 04.10.2023

### Notification

**Sub:-** Modification Syllabus and Scheme of Examinations Earth Science (UG) (III<sup>rd</sup> & IV<sup>th</sup> Semester) with effect from the Academic year 2023-24.

**Ref:-** Decision of Board of Studies in Earth Science (UG) meeting held on 05.08.2023.


\*\*\*\*\*

The Board of Studies in Earth Science (UG) which met on 05.08.2023 has resolved to recommended and approved the syllabus and scheme of Examinations of Earth Science Programme (III<sup>rd</sup> & IV<sup>th</sup> Semester) with effect from the Academic year 2023-24.

Pending approval of the Faculty of Science & Technology and Academic Council meetings the above said syllabus and scheme of examinations are hereby notified.

The syllabus and scheme of Examinations contents may be downloaded from the University website i.e., [www.uni-mysore.ac.in](http://www.uni-mysore.ac.in).

**DRAFT APPROVED BY THE REGISTRAR**

  
**Deputy Registrar (Academic)**  
Deputy Registrar (Academic)  
University of Mysore  
Mysore-570 005

To:

1. All the Principal of affiliated Colleges of University of Mysore, Mysore.
2. The Registrar (Evaluation), University of Mysore, Mysuru.
3. The Chairman, BOS/DOS in Earth Science, Manasagangothri, Mysore.
4. The Director, Distance Education Programme, Moulya Bhavan, Manasagangothri, Mysuru.
5. The Director, PMEB, University of Mysore, Mysore.
6. Director, College Development Council, Manasagangothri, Mysore.
7. The Deputy Registrar/Assistant Registrar/Superintendent, Administrative Branch and Examination Branch, University of Mysore, Mysuru.
8. The PA to Vice-Chancellor/ Registrar/ Registrar (Evaluation), University of Mysore, Mysuru.
9. Office Copy.

## III Semester Syllabus

### THEORY PAPER – Paleontology ERS-A5

Credits-4

Teaching hours- 04 hours/Week

#### Unit I :

Introduction- Scope and subdivisions – Organic world – Animal Kingdom - Definition of a fossil, types of fossils- index, body fossils and Unaltered hard parts, Altered hard parts : Petrification, permineralisation, carbonisation, recrystallisation, silicification; trace fossils- mould, casts, tracks, trails, borings: synthetic & pseudofossils transported and leaked fossils. Uses of fossils- stratigraphic indicators- climatic indicators- indicators of palaeogeography- indicators of evolution and migration of life forms –uses in the exploration of fossil fuels - Taxonomy and Species concept. Taxonomic hierarchy. Life through ages.

#### Unit II :

**Invertebrates** : 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, Functional adaptation in trilobites- geological history- stratigraphic importance. Phylum **Cnidaria**: class **Anthozoa**: General morphology, corallum, corallite, theca, chambers, septa, tabulae, dissepiments, sinapiculae, fossula, columella, septal developments, classification- rugose corals, tabulate corals and modern corals, geological range and stratigraphic importance. Phylum: **Hemicordita**, Subphylum; **Graptolithina**: Order: **Graptoloidea**: General morphology, rhabdosome stipe, theca, common canal, nema, virgula, sicula, uniserial, biserial, classification, geological distribution and stratigraphic importance.

#### Unit III:

Phylum Mollusca: Phylum Pelecypoda- General characters, ornamentation, classification , geological history. Class –Gastropoda: General morphology, shell forms, types of coiling- dextral & sinistral, orientation, ornamentation, classification and geological history. Class- Cephalopoda: General morphology, (Nautilitic, Goniatic, Ceratitic and Ammonitic)- shell forms-ornamentation- classification, geological history-. Significance of Ammonites in Mesozoic biostratigraphy and their paleobiogeographic implications. Phylum Brachiopoda: General morphology,- brachial skeleton, morphometric details, ornamentation- classification, geological history

#### Unit IV:

**Micro Palaeontology**: Phylum **Protozoa**: Order: **Foraminifera**-General morphology, test wall- calcareous, chitinous, agglutinated- septa, arrangement of chambers, suture, aperture, dimorphism, classification, geological history and stratigraphic importance. An outline on the applications of foraminifera in oil exploration. Applications of Micro Palaeontology **Vertebrates** A brief outline of the classification of Vertebrates. A short account of Devonian fishes, Mesozoic Reptiles with special reference to origin, diversity and extinction of dinosaurs., Siwalik mammals A very short account of the evolution of man, elephant and horse. **Plant kingdom**: General classification of plant kingdom- plant fossils from India with special reference to Gondwana flora- A brief account of the following plant fossils Ex: Glossopteris, Gangamopteris, Ptilophyllum, Calamites, Lepidodendron and Sigillaria

## **Practical Paper-Paleontology practicals**

### **ERS-A6**

**Credits-2**

**Teaching hours: 4hrs/Week**

Megascopic identification and description of the following fossils:

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

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

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

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

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

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

**Identification of Micro fossils:** Foraminifera: lagenas, nodosaria, textularia

**Plant fossils:** Glassopteris, gangamopteris, ptillophyllum, lepidodendron, sigillaria and calamites.

**FIELD VISITS:** Trichirapalli, Tamilnadu, Gujarat and Himalayas.

### **References**

1. Swinnerton: - Outlines of Palaeontology
2. Moore, Lalicker and Higher: - Invertebrate Palaeontology
3. Remer: - Invertebrate Palaeontology
4. Shrock and Twenhofel: - Principles of Invertebrate Palaeontology
5. Arnold: - Introduction to Palaeontology
6. Lahmann and Hillmer: - Fossil Invertebrates
7. Glaessner: - Principles of Micropalaeontology
8. Wadia, D.N. Indian Stratigraphy
9. Krishnan, M.S. Geology of India and Burma
10. Mem. Geol. Soc. India Geology of Karnataka
11. GSI Publication Geology of Karnataka.
12. Mem. Geol. Soc of India Deccan Basalts
13. Ravindrakumar. Principles of historical geology.
14. Henry Woods - Invertebrate paleontology - Cambridge press
15. Romer. A.S - Vertebrate paleontology, Chicago press.
16. Arnold. C.A - An introduction to paleobotany, MC-Graw-Hill

# THEORY PAPER -Stratigraphy

## ERS-B5

**Credits-4**

**Teaching hours- 04 hours/Week**

**Unit I: Principles of Stratigraphy:** Introduction, relationship with other branches of geology. Law of order of superposition, Law of uniformitarianism and Law of faunal and floral succession. Imperfections in geological record.. Stratigraphic concepts of correlation, criteria and methods. Standard stratigraphic scale. Elements of lithostratigraphic, biostratigraphic and chronostratigraphic classification and their units. Standard stratigraphic scale. A brief study of individual era with regard to their nomenclature, classification, lithology, climate, earth movement and life.

### **Unit II:**

Physiographic divisions of India: Peninsular India, Indogangetic alluvial plains and Extra Peninsular India. Precambrian Era: Brief introduction to cratons and mobile belts. Precambrian stratigraphy of India. Archeans of Karnataka: Ancient supracrustals - Sargur group and Peninsular Gneissic Complex.

Proterozoic Era: - Classification - Bababudan and Chitradurga group of rocks. Chitradurga schist belt: Distribution and economic importance. An introduction to Purana Basins - Lower Puranas: Kaladgi and Cuddapahs basins. Upper Puranas: Badami, Bhima, Kurnool and Vindhyan basins. Distribution, lithology classification and economic importance. Life in Proterozoic.

### **Unit III:**

Paleozoic stratigraphy of India: Paleozoic succession of Kashmir and its correlatives from Spiti. 5 Gondwana formations of India: Depositional environment- distribution-life-classification and economic importance of Gondwana formations of India. Coastal Gondwana of India.

Mesozoic stratigraphy of India Triassic of Spiti- The Lilang System, Jurassic of Kutch, Cretaceous of Tiruchirapalli. Deccan Volcanic Episode: Introduction, distribution, nature of eruption, nomenclature, intra( Bagh and lametabeds), inter( Gurumatkal), supra trapeans ( Nummulitic limestone). Age and economic importance of Deccan traps.

### **Unit IV:**

Cenozoic Stratigraphy: Comprehensive account of the geological events during Cenozoic Era in India. Rise of Himalayas. Stratigraphy of Siwalik System: Distribution, lithology, classification, fauna and flora of Siwaliks with particular reference to mammalian fossils. Pleistocene glaciation. Economic importance of Cenozoic Period: Stratigraphy and structure of onshore and offshore hydrocarbon basins of India. Important stratigraphic boundary problems in India. Precambrian-Cambrian boundary, Permian- Triassic boundary, Cretaceous - Tertiary boundary.

## **Practical Paper- Stratigraphy Practicals**

### **ERS-B6**

**Credits-2**

**Teaching hours: 4hrs/Week**

1. Study of geological map of India and identification of major stratigraphic units.
2. Study of rocks in hand specimens from known Indian stratigraphic horizons
3. Drawing various paleogeographic maps of Precambrian time
4. Study of different Proterozoic supercontinent reconstructions.
5. Preparation of Lithostratigraphic maps of India showing distribution of important geological formations.

#### **References**

- Balasubrahmanyam, M. N. (2006), Geology and Tectonics of India: An Overview, IAGR Memoir No.9, 204p.
- Brookfield, E B. (2004), Principles of Stratigraphy, Blackwell Publishing Ltd, 340p.
- Claude, C. and Albritton J. (1995), Catastrophic Episodes in Earth History, Chapman & Hall, 221p.
- Donovan, S K (Ed.), (1989). Mass Extinctions – Processes and Evidence, Belhaven Press, 266p.
- Gradstein, F M, Ogg, J G, Schmitz, M D and Ogg, G M. The Geological Time Scale 2012. Vol I and Vol II, Elsevier, Amsterdam.
- Hedberg, H.D. (Ed.), International Stratigraphic Guide - International Subcommission on Stratigraphic Classification of IUGS Commission on Stratigraphy.
- Kumar, R, (1985), Fundamentals of Historical Geology and stratigraphy of India, Wiley Eastern Ltd., New Delhi, 254p.
- Lemon, R.R. (1990), Principles of Stratigraphy, Merrill Publishing Company, 559p.
- Miall, A D (2000). Principles of Sedimentary Basin Analysis, Springer Verlag.
- Naganna, C. (Ed.), (1975), Studies in Precambrians, Bangalore University, 291p.
- Naqvi, S. M., Mahmood, S. and Rogers, J.W. (1983), Precambrian Geology of India., Oxford University Press, 240p.
- Naqvi, S.M. and Rogers, J.W. (Eds.) (1987), Precambrian of South India, Geological Society of India, 575p.
- Pichamuthu, C.S. (1985), Archaean Geology, Indian Soc. of Earth Scientists, Oxford and IBH Publishing Co., New Delhi, vol.14, 221p
- Ramakrishnan, M. and Vaidyanathan, R. (2008), Geology of India. Geological Society of India, Bangalore, Vol. 1 & 2.
- Schoch, R.M. and Reinhold, V.N. (1969), Stratigraphy -Principles and Methods, New York, 375p.
- Spencer, E W (1962) Basic concepts of Historical geology, Oxford IBH, New Delhi
- Stanley S M (2005) Earth system history, II Edn., W H freeman & Co., New York
- Weller, Marvin, J. (1960), Stratigraphic principles and practice, Harper and Brothers, New York, 725 p.

## OE-3

### Climatology

Credits-3

Teaching hours- 03 hours/Week

#### Unit I: Meteorology

Elements of meteorology and their significance. Temperature, atmospheric pressure and air masses, wind, humidity, clouds precipitation (rainfall). Earth's radiation balance and human interference: Meteorological hazards: floods, drought, famine, cyclones, cloud burst, thunder storms, dust storms and hail stones. General weather system of India. Monsoons, their seasonality, onset and withdrawal, causative factors and trends. A brief introduction to Satellite Meteorology and its applications

#### Unit II: Climatology

Principles of climatology and differences between meteorology and climatology. Climate of the globe and its classification. Climate Change: short-term and long-term climate cycles. Classification of continental and oceanic climates: Greeks, Koppen's and Thornthwaite's schemes of classification.

#### Unit III:

**Paleoclimatology:** Tracers or proxies for understanding the long-term paleoclimate. Archives of paleoclimate: ice cores, tree rings, lake and marine sediments, speleothem/cave deposits. Principles of General Circulation and Climate Modelling.

#### References:

- 1) Ahrens, C.D. and Henson, R. (2017) Meteorology today: an introduction to weather, climate, and the environment. 12<sup>th</sup> Ed. [www.cengage.com/highered](http://www.cengage.com/highered), [www.cengagebrain.com](http://www.cengagebrain.com).
- 2) Bryant, E. (1997) Climate Processes and Change Cambridge Univ. Press. Cambridge.
- 3) Donn, W.L. (1975) Meteorology - - McGraw-Hill Book Co., New York.
- 4) Holton, J. R. (1992) An introduction to Dynamic Meteorology, III Ed, Academic Press, London.
- 5) Kelkar, R. R. (2017) Satellite Meteorology, Second Edition, CRC Press, Florida.
- 6) Lutgens, F., Tarbuck, E. and Herman, R. (2018) Atmosphere: An Introduction to Meteorology 14<sup>th</sup> Ed., Pearson 0135213134 / 9780135213131 Pearson.
- 7) Pick W.P. (2017) A Short Course in Elementary Meteorology. Andesite Press (22 August 2017).
- 8) Raymond S.B. Reconstructing Climates of the Quaternary. 3<sup>rd</sup> Edn, Academic Press, New

## IV Semester

### THEORY PAPER -Structural Geology

#### ERS-A7

**Credits-4**

**Teaching hours: 4hrs/Week**

**Unit I:** Introduction. Structural Forms of Rocks: Primary Structural Forms & Secondary Structural Forms. Concept of brittle and ductile deformation. Forces – compression, tension, torsion and shear

Primary structural forms – Sedimentary and Igneous Rocks. Lination, Foliation and Unconformity. Description and origin of foliations: axial plane cleavage and its tectonic significance. Description and origin of lination and relationship with the major structures.

#### **Unit II:**

Secondary structural forms:

*A. Cohesive Dislocations* – Distortion, bending and Folds.

Folds: Definitions - parts of folds, axis, axial planes, limb, plunge. Crest and troughs. Mechanics of folding: Buckling, Bending, Flexural slip and flow folding. 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.

*B. Disruptive Dislocations* – Joints and Faults.

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.

#### **Unit III:**

Fractures and Faults: Definition - Elements of fault, Fault planes, Dip, Strike, Hade, Heave and Throw. Hanging and footwalls

Classification –I. Geometrical: a) Based on attitude of faults as compared to the adjacent beds. Dip, Strike, Diagonal and Bedding faults.

b) 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.

#### **Unit IV:**

Unconformity types – para, dis, non, angular and regional unconformities.

#### **Foliation and Lination**

Description and origin of foliations: axial plane cleavage and its tectonic significance; theory of cleavage formation in deformed rocks.

Description and origin of lination and their relationships with the major structures.



## References:

1. Field Geology - Lahee, W.
2. Structural Geology, Billings, M. P. (1987) 4th edition, Prentice-Hall.
3. Symbols for maps and rocks - Amer. Geol. Inst. Publ.
4. Topographic sheets - Survey of India Publ.
5. Structural Geology of Rocks and Region. Davis, G. R. (1984). John Wiley
6. Foundations of Structural Geology. Park, R. G. (2004). Chapman & Hall.
7. Fundamental of Structural Geology. Pollard, D. D. (2005) Cambridge University Press.
8. Structural Geology: an introduction to geometrical techniques. Ragan, D. M. (2009) (4th Ed). Cambridge University Press (For Practical).

## **Practical Paper-Structural Geology practicals**

### **ERS-A8**

**Credits-2**

**Teaching hours: 4hrs/Week**

- 1 Calculation of the thickness of the strata: Geometric & mathematical methods- 3 types.
- 2 Study and interpretation of topographical maps – Description of the relief features and drawing of profile of contour maps.-3 maps.
- 3 Geological Maps – Drawing of section and interpretation.  
Folds- 2 maps, Intrusion- 2 maps, Faults- 2 maps and Unconformities- 2 maps
- 4 Completion of outcrops- 3 maps.
- 5 Dip and Strike problems-Geometric and trigonometric – 4 types
- 6 Bore hole problems
- 7 Engineering maps: Tunnel, road, rail and dams – 1 map each
8. Surveying- Chain, Plain table, Compass, Dumpy and theodolite survey.



# **THEORY PAPER - Hydrogeology**

## **ERS-B 7**

**Credits-4**

**Teaching hours: 4hrs/Week**

### **Unit I:**

Introduction and basic concepts. Scope of hydrogeology and its societal relevance Hydrologic cycle. Precipitation, evapo-transpiration, run-off, infiltration and subsurface movement of water. Rock properties affecting groundwater, Vertical distribution of subsurface types of aquifer, aquifer parameters, anisotropy and heterogeneity of aquifers.

Groundwater flow Darcy's law and its validity intrinsic permeability and hydraulic conductivity, Groundwater flow rates and flow direction, Laminar and turbulent groundwater flow.

**Unit 2:** Well hydraulics and Groundwater exploration, Basic Concepts (Drawdown, specific capacity) Elementary concepts related to equilibrium and Non-equilibrium conditions for water flow to a well in confined and unconfined aquifers. Surface-based groundwater exploration methods, Introduction to subsurface borehole logging methods.

**Unit 3:** Groundwater chemistry: Physical ,chemical and Biological Parameters of water and water quality parameters, Introduction to methods of interpreting groundwater quality data using standard graphical plots, Sea water intrusion in coastal aquifers. Groundwater management, Surface and subsurface water interaction, Groundwater level fluctuations.

**Unit IV:** Basic concepts of water balance studies, issues related to groundwater resources development and management, Rainwater harvesting and artificial recharge of groundwater. Interpretation of hydrogeomorphic units using satellite imageries. Radio isotopes in hydrogeological studies. Water budget equation and Groundwater management

**References:**

- Groundwater Hydrology - D. K. Todd
- Hydrology - S. N. Davis and R.J.M. Dewiest
- Groundwater - C. L. Tolman
- Groundwater studies - R. H. Brown and Ahers
- Groundwater Hydrology - Hermann Bover
- Hydrology - C. W. Fetter
- Hand book and applied Hydrology - Ven Te Chew
- Hydrology - Raghunath
- Hydrology – Karanth

**Practical Paper-Hydrogeology practicals****ERS-B8****Credits-2****Teaching hours: 4hrs/Week**

1. Simple numerical problems related to: determination of porosity, permeability and transmissibility of geological formations, groundwater flow, Well hydraulics, water budget. Preparation and interpretation of water table maps. .
2. Study, preparation and analysis of hydrographs for differing groundwater conditions
3. Introduction to methods of interpreting groundwater quality data using standard graphical plots: Wilcox, USSL, Facies – Piper trilinear diagram, Gibbs diagram, drinking water (TDS,fluoride, nitrate, WQI zonation maps).

## OE-4

### Geo-tourism

**Credits-3**

**Teaching hours- 03 hours/Week**

**Unit I: Introduction-** Geodiversity and rarity of geological features, Geo-conservation, Geo-site, Geo-heritage and Geo-park and their role in geo-tourism development. Concept of National Parks of geological origin. Natural and cultural landscapes, A geo-conservation plan for geosites and the development of UNESCO's Global Geopark. Geotourism- impacts and other types of tourism.

**Unit II:** Geodiversity values and threats, Geo-tour guides and basic knowledge of geodiversity. Important Geo-sites of India and in particular Karnataka, Geotourism Development & Sustainable Management, Education on Geosites preservation.

**Unit III:** 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, Wind erosion structures, Sendra Granite, etc. Other monuments – stratigraphic and economic important locations/ mines. Natural caves and tunnels, Stalactites and Stalagmites.

#### References:

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. 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-heritage-projects/geodiversity-world-heritage-and-iucn>.
6. National Geological Monument, from Geological Survey of India website. ([www.gsi.gov.in](http://www.gsi.gov.in))
7. "Geo-Heritage Sites". pib.nic.in. Press Information Bureau. 2016-03-09.