Discipline Specific Elective 3 DSE (12 credits): **(i) Marine microfossils and biostratigraphy (L3, P1), (ii) Earthquake Geology (L3, P1), (iii) Environmental Geology (L3, P1)**

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DSE-5 Marine microfossils and biostratigraphy	**4**	**3**	**0**	**1**	**12th pass with science**	**Studied Earth System Science and Structural Geology, Hydrogeology or Equivalent**

Learning Objectives

This course aims to:

- Introduce students to the role of microfossil evolution in establishing relative time within marine sedimentary sequences.
- Enable students to understand the distribution of marine microfossils in oceanic sediments.
- Train students to apply biostratigraphic zonation, quantitative stratigraphic correlation, and magnetic stratigraphy for interpreting relative ages.
- Teach students various methods for integrated stratigraphic correlation at regional and global scales.
- Provide training in integrated stratigraphy, including biostratigraphy combined with magneto-, chemo-, event stratigraphy, and its calibration with the astronomical time scale.

Learning outcomes

Upon successful completion of the course, students will be able to:

- Use microfossil distributions in deep-sea cores to apply biostratigraphic zonation and interpret relative geological age.
- Correlate oceanic sediment sections from one region of the world to another and calculate rates of sediment accumulation.
- Independently conduct biostratigraphic studies of marine sections and evolve integrated stratigraphic frameworks.
- Perform stratigraphic correlation of marine sections at regional and global levels.

- Understand and interpret the cause-and-effect relationships in the ocean–climate system and recognize teleconnections.

THEORY (45 Hours)

UNIT – I 12 Hours

Definition and scope of Micropaleontology. Relationship of Micropaleontology with Ocean Science. Deep Sea Drilling Project (DSDP); Ocean Drilling Program (ODP) and Joint Global Ocean Flux Studies (JGOFS) and their major accomplishments. Integrated Ocean Drilling Program (IODP) and its aims and objectives; Sampling Modern Ocean Biogenic Flux including Joint Global Ocean Flux Studies (JGOFS). Introduction to important Deep Sea Drilling Vessels like Sagar Kanya, GLOMAR Challenger, JOIDES Resolution and Chikyu.

UNIT – II 12 Hours

Sample processing techniques and brief idea about Equipment like mass spectrometer, scanning electron microscope and stereo zoom binocular microscope which are used for micropaleontological studies.

UNIT – III 11 Hours

A brief study of various types of microfossils including calcareous (Foraminifera, Calcareous nannofossils, Ostracoda, Pteropods, Calpionellids and Calcareous algae), Siliceous microfossils (Diatoms, Radiolaria and Silicoflagellates), Phosphatic microfossils (Conodonts) and Organic walled microfossils (Acritarchs and Dinoflagellates, Pollens and spores) and their application in biostratigraphy.

UNIT – IV 10 Hours

Application of microfossil biostratigraphy in hydrocarbon exploration. Basic concepts of Biostratigraphy, Chemostratigraphy, magnetostratigraphy, and astronomical tuning. Regional and global stratigraphic correlation. Diachronism and methods to identify the extent of diachronism. Diachronism and paleoceanographic interpretation.

PRACTICALS: 30 Hours

1. Techniques of separation of microfossils from the matrix
2. Microscopic identification of (a) Types of microfossils: Calcareous, Siliceous, Phosphatic and organic-walled microfossils
3. Microscopic study of important planktic foraminifera useful in surface water paleoceanography and biostratigraphy
4. Study of larger benthic foraminifera useful in Indian stratigraphy with special reference to Cenozoic petroliferous basins of India
5. Study of modern surface water mass assemblages of planktic foraminifera from Indian, Atlantic and the Pacific Ocean
6. Exercises on Integrated Oceanic Biostratigraphy for regional and global correlation.

Essential/Recmmended readings

Bignot, G, 1985. Elements of micropalaeontology; Microfossils, their geological and palaeobiological applications, Graham & Trotman, London, United Kingdom.

Braiser, M.D., 1980. Microfossils, George Alien and Unwin Publisher.

Fischer, G and Wefer, G, 1999. Use of Proxies in Paleoceanography: Examples from the South Atlantic, Springer,

Recommended readings

Gross, M.G, 1977. Oceanography: A view of the Earth, Prentice Hall.

Haq and Boersma, 1978. Introduction to Marine Micropaleontology, Elsevier.

Hasllett, S.K., 2002. Quaternary Environmental Micropalaeontology, Oxford University Press, New York.

Jones, R.W., 1996. Micropaleontology in Petroleum exploration, Clarendon Press Oxford.

Kennett and Srinivasan, 1983. Neogene Planktonic Foraminifera: A phylogenetic Atlas, Hutchinson Ross, USA. 9.

Sinha, D.K., 2007. Micropaleontology: Application in Stratigraphy and Paleoceanography, Alpha Science International, Oxford & Narosa Publishing House Pvt. Ltd. Delhi.