



Syllabus for IVth Semester Courses in M.Sc. Geology (November 2019 onwards)

Courses:

SGEO1001 – Micropalaeontology and Oceanography

SGEO1002– Engineering Geology

SGEO1003 – Economic Geology

SGEO1004* – Dissertation

Practical Course:

SGEO1001PR, SGEO1002PR, SGEO1003PR (Pertinent to the above-mentioned theory courses)

M.Sc-II Geology Course: SGEO1001
Title: Micropalaeontology and Oceanography

Learning Objectives: To give an insight of the various microfossils with respect to their morphology, shell composition and their habitats. To emphasize on the applications of various microfossils in the field of paleoclimatology, paleoceanography and biostratigraphy.

Number of lectures: 60

Unit 1: (15 lectures)

Definition and scope of the subject; Relationship of micropaleontology with ocean sciences; Modern field and laboratory techniques in the study of microfossils (collection, sampling and processing techniques, scanning electron microscopy and mass spectrometry).

Types of Microfossils

Calcareous Microfossils:

(i) Foraminifera - planktic foraminifera, their modern biogeography, outline of morphology, significance in Cenozoic oceanic biostratigraphy and paleoceanographic, paleoclimatic interpretations.

Benthic foraminifera – outline of morphology; application in deep-water paleoceanography and paleobathymetric reconstructions.

Larger foraminifera- their outline of morphology and application in stratigraphy;

(ii) Calcareous nannofossils - outline of morphology, modern biogeography and their application in oceanic biostratigraphy and paleoceanographic, paleoclimatic reconstructions.

(iii) Pteropoda - a brief introduction, application of pteropods in reconstruction of the Quaternary oceanography and climate;

Organic Walled Microfossils:

Organic walled microfossils and their significance, significance of spores, pollen, in biostratigraphy, Concept of palynofacies and its application in paleoenvironment interpretation.

Unit 2: (15 lectures)

Types of Microfossils

Siliceous Microfossils:

Radiolaria and diatoms - outline of morphology, modern biogeography, their environmental significance and application in biostratigraphy.

Phosphatic Microfossils:

Conodonts - outline of morphology, paleoecology, geological significance and biological affinities; Stratigraphic significance of conodonts with special reference to India.

Micropaleontology in petroleum exploration; Environmental significance of microfossils;

Geochemical study of microfossil tests (stable isotopes, radiocarbon isotopes and elemental composition) and its application in paleoceanography and paleoclimatology; Application of palynology in identifying ancient coast lines; Role of micropaleontology in marine geology and oceanography.

Unit 3:

(15 lectures)

History of development of oceanography; Sampling of modern ocean biogenic flux including sediment trap sampling; Methods of measuring properties of sea water; Temperature and salinity distribution (horizontal and vertical) in ocean waters; Dissolved gases in sea water, factors affecting the concentration of gases in sea water; Carbon dioxide equilibria, precipitation and dissolution of carbonates; Biological - chemical - physical interactions in the oceans; Oxygen minimum layer in the ocean. Scientific ocean drilling and its major accomplishments

Unit 4:

(15 lectures)

Concept of mixed layer, thermocline, pycnocline halocline, and pycnocline, Coriolis force and Ekman spiral, upwelling, El Niño and La Nina, Ocean circulation- surface circulation; deep ocean circulation (concept of thermohaline circulation, formation of bottom waters, water masses of the world oceans, oceanic sediments).

Practical Course

Micropaleontology

Sediment processing for calcareous microfossils (foraminifera)

Types of microfossils - calcareous, siliceous, and organic walled microfossils; Microscopic study of important planktic and benthic foraminifera; Study of larger benthic foraminifera.

Sand -silt-clay analysis of sediments and its interpretation

Oceanography

Depth biotopes; Identification of planktic foraminifera characteristic of warm and mixed layer, thermocline and deep surface water of the modern oceans;

Quantitative study of planktic foraminifera and their interpretation in relation to paleoclimatology.

List of Recommended Reference Books

1. Kennett, J.P. and Srinivasan, M.S. (1983): Neogene Planktonic Foraminifera- a phylogenetic atlas, Hutchinson Ross Publishing Company.
2. Bignot, G., Graham and Trottmann (1985): Elements of Micropaleontology, Micropaleontology Press, London.
3. Armstrong, H.A. and Brasier, M. (2005): Microfossils, Blackwell Publishing, Australia.
4. Pinet, Paul R. (2006): Invitation to Oceanography, Jones & Bartlett Learning.
5. Grant Gross, M. (1995): Oceanography; A view of the Earth (7th Ed.), Prentice Hall.
6. Garrison, T. (2007): Oceanography: an invitation to marine sciences, Cengage Learning.
7. Haq, Bilal and Boersma, Anne (Ed.) (1998): Introduction to Marine Micropaleontology, Elsevier.
8. Bradley, R.S. (Ed.) (1999): Paleoclimatology (2nd Ed.), Elsevier.
9. Marcel, C.H. and Vernal, A.D. (Ed.) (2007): Proxies in Late Cenozoic Paleooceanography, Elsevier.

M.Sc-II Geology Course: SGEO1002

Title: Engineering Geology

Learning Objectives: To understand the engineering properties of rocks. Detailed study of various geological and geotechnical investigations for various civil engineering projects.

Number of lectures: 60

Unit 1:

(15 lectures)

Rock and soil mechanics

Techniques of determining properties of rocks and soil:

Specific Gravity

Porosity

Sorption

Compressive Strength

Tensile Strength

Elasticity of Rocks

Residual Stress and Shear Stress in Rocks.

Soil mechanics

Rocks as construction material

Unit 2:

(15 lectures)

Geological and Geotechnical investigations for Civil Engineering Projects:

1. **Geotechnical investigations-** Sounding, Drilling equipment and methods, Wash borings, core samples, borehole logs.

2. **Building site exploration-** Types of foundations, load tests, groundwater problem. Commercial, residential and industrial building site investigation

3. **Tunnels:** Terminology, Geological conditions for tunnel sites, Tunnels in folded rocks and bedded rocks. Influence of divisional planes, Effects of faults, Crushed zones, Tunnels near slopes, Role of Groundwater in tunneling.

4. **Bridges and pavements-** Abutments and piers, foundations, cofferdams, Caissons, rigid and flexible pavement. Site exploration.

Unit 3:

(15 lectures)

Tunnels and shoreline engineering

1. **Tunnels-** Terminology, technical classification, roof bolting, arching, effect of bedding orientation on tunnels. Gases and water in tunnels, geothermal gradient. Methods of tunnel excavation and site exploration

2. **Shoreline engineering-** Beach and shorelines, construction of shore cliffs and steep banks, Littoral barriers, harbour location, sedimentation in harbours and jetties.

3. **Earthquakes and Aseismic design of buildings**

Unit 4:

(15 lectures)

Dams, reservoirs and landslides

1. **Dams and Reservoirs:** Geological conditions for the selection of dam and reservoir sites.

Terminology associated with dams. Types of dams: Masonary Dams (Gravity Buttress and Arch types), Earthen dams. Types of spillways. Case studies of dam construction and failures.

2. **Landslides-** Causes, types and prevention of landslides.

Practical Course:

Engineering Geology

- Correlation of borehole data
- determining uniaxial compressive strength of rock
- Equal-area net- Determining slope stability and rotation problems.

List of Recommended Reference Books

1. Waltham, T. (2009): Foundations of engineering geology, 3rd edition, CRC press
2. Vallejo, L.G, Mercedes, F., Freitas, M. (2011): Geological Engineering, 1st edition, CRC press
3. West, T.R (2010): Geology applied in Engineering, Waveland Pr Inc; 1 edition
4. Narayanswami S.B.S. (2000), Engineering Geology, Dhanpat Rai & Co, India.
5. Legget F. R and Hatheway A.W. (1988), Geology and Engineering., 3rd ed. McGraw-Hill.
6. Gupte R.B. (1992), A Textbook of Engineering Geology.2nd ed. Pune Vidyarthi Griha Prakashan.
7. Krynine D.P. And Judd W.R (2003), Principles of Engineering Geology and Geotechniques, CBS Publishers.
8. Wahlstrom E.E. (1974), Dams, Dam Foundations and Reservoir Sites. Elsevier Scientific.
9. Dunn I.S., Anderson L.R and Kiefer F.W. (1980), Fundamentals of Geotechnical Analysis, John Wiley.
10. Maslov N.N. (1987), Basic Engineering Geology and Soil Mechanics. Mir Publishers.
11. Gokhale K.V.G.K and Rao D.M. (1981), Experiments in Engineering Geology. Tata McGraw-Hill

M.Sc-II Geology Course: SGEO1003

Title: Economic Geology

Learning Objectives: To understand the various processes of ore formation, with special reference to the distribution in India.

Number of lectures: 60

Unit 1: (15 lectures)

Concept of ore bearing fluids, their origin and migration; Processes of formation of ore deposits- metasomatic, hydrothermal and supergene enrichment; Controls of ore localization; Ore deposits and plate tectonics.

Unit 2: (15 lectures)

Mineralogy, classification and genesis of ore deposits associated with mafic-ultramafic rocks; Ores of felsic-silicic rocks; Ores of sedimentary affiliation; Ores of metamorphic affiliation; Placer and residual concentration deposits.

Unit 3: (15 lectures)

Study of ore minerals related to the following metals with special reference to their mineralogy, genesis, specification, uses and distribution in India:
Iron, Manganese, Base Metals, Chromium, Gold, Tin and Tungsten.

Unit 4: (15 lectures)

Study of important Indian ore deposits with reference to their geology, stratigraphy and reserves; A few case studies of occurrence of economic mineral deposits from provinces other than Indian sub-continent.

Practical Course:

Identification of important ore minerals in hand specimens.

Ore microscopy- textures, microstructures, optical properties of ores.

List of Recommended Reference Books

1. Branes, H.L. (1979): Geochemistry of Hydrothermal Ore Deposits, John Wiley.
2. Cuilbert, J.M. (1986): The Geology of Ore Deposits, Freidman.
3. Evans, A.M. (1993): Ore Geology and Industrial Minerals, Blackwell.
4. Jensen M.R. and Bateman A.M. (1981), Economic mineral deposits, John Wiley & Sons.
5. Craig, J.R. and Vaughan, D.J. (1994): Ore Microscopy and Petrography.
6. Klemm, D.D. and Schnieder, H.J. (1977): Time and Strata Bound Ore Deposits, Springer-Verlag.
7. Wolf, K.H. (1976-1981): Handbook of Stratabound and Stratiform Ore deposits, Elsevier.
8. Mookherjee, A. (1999): Ore Genesis- A Holistic Approach., Allied Publishers.

M.Sc.II Geology Course: SGEO1004

DISSERTATION

(Topic for dissertation will be assigned during the 3rd semester.)

Evaluation of Dissertation: (CIA - 40%, Dissertation report and Viva - 60%)

CIA I: (30 marks):Reference work - pre-field / pre lab literature survey, preparation of field material (toposheet, satellite imagery etc)

CIA II: (30 marks): Field work , Lab work, Geological mapping, Sample collection, field diary.

End Semester Examination: Dissertation Report and Open Viva: (90 marks)

Dissertation report - 60 marks

Viva voce - 30 marks
