

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF THE DEPARTMENT/CENTRE/SCHOOL: Department of Earth Sciences

1. **Subject Code:** ESC-101 **Course Title:** Computer Programming
2. **Contact Hours:** L: 3 T: 0 P: 2
3. **Examination Duration (Hrs.):** Theory: 3 Practical: 2
4. **Relative Weightage:** CWS: 10-25 PRS: 25 MTE: 15-25 ETE: 30-40 PRE: 0
5. **Credits:** 4 **6. Semester:** Autumn **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** To introduce Computer Systems and develop basic skills in programming.
10. **Details of the Course:**

S.No.	Contents	Contact Hours
1.	Basic Computer Fundamentals: Introduction to computer systems; number system, integer, signed integer, fixed and floating point representations; IEEE standards integer and floating point arithmetic; CPU organization, ALU, registers, memory, the idea of program execution at micro level; concept of flow chart and algorithms, algorithms to programs.	7
2.	Basic Programming and Aspects of C++: Input/Output: Constants, variables, expressions and operations; Naming conventions and styles; Conditions and selection statements; Looping and control structures; File I/O, header files, string processing; Pre-processor directives such as #include, #define, #ifndef, #endif; Compiling and linking.	8
3.	Programming Through Functional Decomposition: Functions (void and value returning), parameters, scope and lifetime of variables, passing by value, passing by reference, passing by constant reference; Design of functions and their interfaces (concept of functional decomposition), recursive functions, function overloading and default arguments; Library functions.	8
4.	Aggregate Data-types: Arrays and Pointers, structures, dynamic data and pointers, dynamic arrays; Introduction to data structures, use of pointers in linked structures.	7
5.	Object Oriented Programming: Data hiding, abstract data types, classes, access control; Class implementation – default constructor, constructors, copy constructor, destructor, operator overloading, friend function; Object oriented design, inheritance and composition; Dynamic binding and virtual functions; Polymorphism; Dynamic data in classes.	12
Total		42

11. Suggested Books:

S.No.	Name of Authors/Books/Publisher	Year of Publication/Reprint
1.	Stroustrup, B., "The C++ Programming Language", 4 th Ed., Pearson Education India.	2022
2.	Prata, S., "C++ Primer Plus", 6th Ed., Pearson Education India.	2015

3.	Lafore R., "Object-Oriented Programming in C++", 4 th Ed., Pearson Education India.	2008
4.	Deitel, P. and Deitel, H., "C++ How to Program", 10 th Ed., Pearson Education India.	2017
5.	Lippman, S. B., Lajoie, J. and Moo, B.E., "The C++ Primer", 5 th Ed., Addison-Wesley Professional.	2012
6.	Mueller, J. P., "C++ All-in-one for Dummies", 4 th Ed., Wiley.	2020

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESB-101

Course Title: Geological Processes

L-T-P: 3-1-0

Credits: 4

Subject Area: BSC

Course Outline: Formation and interior of Earth; Igneous, sedimentary and metamorphic processes; Weathering and their products; Fluvial, coastal, sub-marine, glacial and aeolian processes; Formation of mineral and fuel deposits; Application of geological processes.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-102

Course Title: Mineralogy and Petrology

L-T-P: 3-0-2

Credits: 4

Subject Area: PCC

Course Outline: Crystal systems and crystal chemistry; Silicate structures and major mineral groups; Optical mineralogy and identification of minerals; Formation, structure, texture and classification of igneous-sedimentary-metamorphic rocks; Rock cycle.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**NAME OF DEPARTMENT/ CENTRE/SCHOOL:** Department of Earth Sciences**Subject Code:** ESC-191**Course Title:** Technical Communication**L-T-P:** 0-0-4**Credits:** 2**Subject Area:** PCC

Course Outline: Introduction and objectives of Technical communication; Formulation of scientific/research problem; Data collection, interpretation and presentation; Preparation of maps, figures and charts; Oral and poster presentation of scientific reports; Prevention of plagiarism.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESE-101

Course Title: Geology for Engineers

L-T-P: 3-1-0

Credits: 4

Subject Area: ESC

Course Outline: Internal structure of the earth; Weathering and erosion; Minerals, soil and rocks; Igneous, sedimentary and metamorphic rocks; Structures and discontinuities in rocks; Physical and mechanical properties of rocks; Rock mass characterisation; Site investigation and geological mapping; Application of geological investigations to various engineering projects.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESB-102

Course Title: Global Geophysics

L-T-P: 3-1-0

Credits: 4

Subject Area: BSC

Course Outline: Earth as a planet and its processes; Earth's internal structure; Earth's heat flow; Plate tectonics and geodynamics; Gravity and magnetic fields of the Earth; Overview of geophysical prospecting.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-201

Course Title: Structural Geology

L-T-P: 2-0-2

Credits: 3

Subject Area: PCC

Course Outline: Primary versus secondary structures; Orientation of planar and linear structures; Classifications of folds, faults and joints; Unconformity; Foliation, lineation, and shear zones; Structural map interpretation; Application of structural geology in geo-exploration.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-203

Course Title: Palaeontology

L-T-P: 2-0-2

Credits: 3

Subject Area: PCC

Course Outline: Classification of organisms, habitats, evolutionary processes, dispersal, paleobiogeography, extinction, taphonomy, evolution of life through ages; Morphology, major groups, ecology, geological history and geographical distribution of invertebrate fossils; Major vertebrate groups, microvertebrates and their applications; Paleobotany, Micropaleontology, Molecular Paleontology and Quantitative techniques in Paleontology.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-205

Course Title: Metamorphic Petrology

L-T-P: 2-0-2

Credits: 3

Subject Area: PCC

Course Outline: Types of metamorphism; Texture, structure and classification of metamorphic rocks; Thermodynamics, phase equilibria and phase diagrams; Metamorphic facies and their tectonic settings; Mineral assemblages and paragenesis of metamorphic rocks.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESL-202

Course Title: Applications of Satellites in Geophysics

L-T-P: 3-1-0

Credits: 4

Subject Area: PEC

Course Outline: Satellite-based observation systems for geophysical applications; Equipotential surfaces and gravity anomalies; Spherical harmonic representation of potential fields; Time-varying gravity from satellite (GRACE/GOCE); Space-based water monitoring; Applications in tectonics, geodynamics, geomagnetism and marine geophysics.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: Department of Earth Sciences

Subject Code: ESL-203

Title: Stratigraphy

LT-P: 3-1-0

Credits: 4

Subject Area: PEC

Course Outline: Principles of stratigraphy, scope and importance; Geological time scale; Stratigraphic contacts and correlation; Facies; Major stratigraphic sequences of India: Archean, Protozoic, Paleozoic and Cenozoic.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: EST-103

Course Title: Environmental Geology

L-T-P: 3- 0 - 2

Credits: 4

Subject Area: TEB

Course Outline: Physical and chemical environment; Impacts due to Earthquakes, tsunamis, volcanoes, floods, mass-movements, dams and reservoirs, urbanization, groundwater depletion, land subsidence; sea level rise; Fossil fuels and alternative energy resources; Public health issues; Technological interventions on environment; Critical minerals, mining environment and challenges; Medical geology.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: EST-105

Course Title: Geology of Petroleum

L-T-P: 3-0-2

Credits: 4

Subject Area: TEB

Course Outline: Geological conditions for the formation of petroleum; Surface and subsurface occurrence of petroleum; Different forms of hydrocarbon; Depositional environments of petroleum occurrence; Petroleum exploration; Global petroleum market including India.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: EST-153

Course Title: Computational Geophysics

L-T-P: 3-0-2

Credits: 4

Subject Area: TEB

Course Outline: Computational techniques, discrete signals in Geophysics and its analysis; Finite difference methods; Computation of error functions and resolution matrix; Computation of forward response of discrete Earth model for various geophysical methods.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: EST-155

Course Title: Geology of Petroleum

L-T-P: 3-0-2

Credits: 4

Subject Area: TEB

Course Outline: Origin, migration and occurrence of petroleum; Favorable depositional environments and tectonic settings; Types of traps; Petroleum exploration, drilling, reserve estimation; Coalbed methane and gas hydrate; Global petroleum market; Indian petroliferous sedimentary basins.