

Petroleum Geology

1.1 Course Number: PE221

1.2 Contact Hours: 3-0-2 Credits: 11

1.3 Semester-offered: 3rd Year-Odd

1.4 Prerequisite: Basic Knowledge of the Geology

1.5 Syllabus Committee Member: Dr. Satish Kumar Sinha

2. **Objective:** To impart knowledge about the genesis, generation, migration, accumulation, exploration, geological and spatial distribution of hydrocarbon.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Introduction of Petroleum System and Nature of Petroleum	Definition of petroleum, Historical review petroleum exploration, Context of Petroleum Geology, Petroleum System Concept – Petroleum System Elements and Petroleum System Process. Physical and chemical properties of crude oil, composition of natural gas.	6
2	Origin of Petroleum, Generation, Migration and Accumulation of Petroleum	Origin of petroleum-organic and inorganic theories, limiting conditions; source material Generation of Hydrocarbon- Transformation of organic matter into petroleum (bacterial activity, heat and pressure, catalytic reaction, radioactivity), Kerogen, transformation of kerogen, factors influencing maturation of kerogen, Surface and subsurface occurrence of petroleum. Migration- Definition, type of migration, Causes of migration, Primary migration, Secondary Migration and Tertiary migration Traps and Seals – Definition of trap, Basic geological condition that create traps, Classification of Traps, Nomenclature of Trap, Distribution of Petroleum within a Trap, Structural Traps, Stratigraphical traps, Combination traps, Hydrodynamic traps and Diapiric Traps. Cap rocks/ Seals – Definition, Characteristics of cap rock and role of cap rock in petroleum system.	13

3	Reservoir Characteristics of Rock and Petroleum Exploration	Reservoir rocks: classification, characteristics, relationship between porosity and permeability, Factors affecting the porosity and permeability, Reservoir fluids (water, oil and gas): distribution and classification in the reservoir, Characters of oilfield waters. Reservoir Characterization, Reserve Calculations; Petroleum Exploration- Introduction, Direct Indication, Direct Oil Finding Methods, Geological Exploration, Geophysical Exploration, Geochemical Exploration. Environmental impact of oil extraction, land subsidence caused by petroleum withdrawal, environmental concerns regarding use of petroleum.	13
4	Oil and Natural gas in India	Geological and geographical distribution of oil and natural gas in India. Geology of the major oilfields of India	8
Total			40

Laboratory Works:

1. Study of physical properties of important rock forming minerals
2. Study of sedimentary rocks in hand specimens
3. Study of important sedimentary structures and textures.
4. Study of optical properties of minerals under the microscope
5. Identification of rocks based of mineralogical composition under microscope
6. Study of topographic sheets
7. Exercise of the contour maps
8. Identify the traps and mark the accumulation of oil in the given figures

4. Readings

Journals and magazines related with petroleum geology and upstream hydrocarbon industry

4.1 Textbook:

- Geology of Petroleum by A.I. Levorsen
- Elements of Petroleum Geology by R.C. Shelly
- Petroleum Geoscience by J. G. Gluyas and R. E. Swarbrick
- Petroleum Geology by F.K. North

4.2 Reference books:

- Petroleum Geoscience: From Sedimentary Environments to Rock Physics by Knut Bjorlykke,
- Petroleum Geochemistry and Geology by John Hunt
- Petroleum formation and occurrence by B.P. Tissot and D.H. Welte
- Geology of Petroliferous Basins of India by P. L. Zutshi and M. S. Panwar
- The World of Petroleum by B.J. Despande

5 Outcome of the Course:

- Upon successful completion of the course, the students would be able to-Understand the processes leading to petroleum generation, migration and accumulation
- Recognize the methods of petroleum exploration and reserves assessments
- Characterize the petroleum reservoirs
- Recognize the important reservoir rock and fluid properties
- Appreciate the importance of geology and geophysics for good petroleum engineering