

Subject Code: 1ET4060301	Subject Title: Sedimentary and Petroleum Geology
Pre-Requisite	--

RATIONALE:

Sedimentary and Petroleum geology concepts have been evolving in recent years with the development of shale gas and tight oil. The old methodology for conventional resources that relied on assessing source rocks, thermal maturity, migration paths, and reservoir traps and seals has become mostly irrelevant for continuous, unconventional resources like shale. For these resources, some level of production is possible from almost anywhere in the formation, although some locations typically produce better than others. Finding these so-called “sweet spots” and understanding the geological parameters that create them have become the new focus of petroleum geology.

COURSE OBJECTIVE:

1. Demonstrate the fundamentals of sediments
2. Demonstrate the geological process involved in formation of rocks
3. Imbibe the knowledge of petroliferous Basins of India
4. Improve analytical skills to interpret the geological history with current state of rocks

TEACHING AND EVALUATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory		Practical	
				University Assessment	Continuous Assessment	University Assessment	Continuous assessment
2	-	2	3	60	40	20	30

DETAILS OF COURSE CONTENTS:

UNIT.	TOPIC	Total Hrs.	WEIGHTAGE in Percentage
1	Sedimentology Subaerial weathering processes: physical and chemical weathering; distinction between soil, alluvium and sediments; Transport and deposition of sediments: fundamentals of fluid flow, particle transport by fluids and by sediment gravity flows. Sedimentary textures: grain size, particle shape, sorting and fabric and their effect on porosity and permeability of sedimentary rocks; sedimentary structures: stratification and bedforms, bedding plane markings; paleocurrent analysis.	6	20

2	Sedimentary Rocks and Depositional Environments Diagenesis of siliciclastic sediments. Classification of siliciclastic sedimentary rocks: rudaceous, arenaceous, and lutaceous sedimentary rocks; carbonate sedimentary rocks: textures, classification, diagenesis; other nonclastic sedimentary rocks: evaporites, cherts, coal, oil-shale. Introduction to different types of sedimentary basins. Introduction to depositional environments: Eh-pH fence diagram; continental (fluvial, lake, aeolian), marginal marine (estuarine, lacustrine), shallow marine (tidal flat, beach, deltaic), shelf and deep marine environments.	8	30
3	Origin and Migration of Petroleum Introduction to petroleum system. Theories of inorganic, Organic and duplex origin of petroleum. Conversion of organic matter to petroleum: diagenesis of organic matter and formation of kerogens, pristane and phytane; classification of kerogens; catagenesis, and metagenesis of kerogens; thermal maturity indicators. Classification, composition, and physical properties of crude oils; composition of natural gases. Primary, Secondary, and Tertiary Migrations; physico-chemical aspects of migration of petroleum; effects of temperature (geothermal gradients, thermal conductivities of subsurface rocks) and pressure (types and causes of subsurface pressures) on primary and secondary migration; possible modes of primary migration of petroleum; mechanisms of secondary migration under hydrostatic and hydrodynamic conditions; petroleum prospect of sedimentary basins; termination of secondary migration and accumulation of oil and gas; oil/gas saturation in reservoirs. Reconstruction of the migration history.	8	30
4	Petroleum Traps and Petroliferous Basins of India Traps and their associations. Cap rock and seal formation: lithological aspects and capillary characteristics of seals; diagenetic seals. Trap formation: structural – fold (anticlinal) traps, fault (sealing/non-sealing) traps; growth faults; traps associated with salt domes; stratigraphic – channel sand, up-dip wedges, sand lenses, sand bars; carbonate traps (bioherm and biostrome), etc. Classification of sedimentary basins of India. Structures, petroleum geology of petroleum producing basins of India.	6	20

COURSE OUTCOME:

CO1- Recognize, describe and classify the different types of sediments and sedimentary rocks; and petroleum components too;
CO2- Understand and analyze the different components of the petroleum system;
CO3- Analyze the depositional environment and correlate with the petroleum system;
CO3- Evaluate the petro-physical properties of the sedimentary rocks, and estimate the reservoir potential and evaluate the seal integrity;
CO5- Evaluate the petroleum source rocks, and estimates the petroleum potential of the petroleum system(s) in a sedimentary basin;
CO6- Understand, and analyze the different components of the petroleum systems viz., source rocks, reservoir rocks, migration paths, and traps in the different petroliferous basins of India thereby evaluate the petroleum potential of a sedimentary basin.

LIST OF PRACTICALS:

1. To prepare students for the field of Petroleum Exploration
2. To imply ability of reading maps, planning exploration and taking risk and decision
3. To help students in identifying sedimentary rocks and its relation to petroleum system
4. To able to help students in identifying and interpreting structural aspects in field.

Note: Practical classes/Field trips shall be based on theory course content of Earth science, Sedimentary geology, Petroleum Geology and Petroleum Exploration courses with aim of Field familiarization of exploration in sedimentary basin and petroleum System

LIST OF REFERENCES:

Sr. No.	Title of Books	Author	Publication
01	Introduction to Sedimentology	Sengupta S.M.	
02	Sedimentology and Petroleum Geology	Kunt Bjorlykke	
03	Sedimentary Rocks	F.J. Pettijohn	
04	Principals of Sedimentology and Stratigraphy.	Sam Boggs	
05	Depositional Sedimentary Environments; Springer	Reineck H.E. and Singh I.B	
06	Petroleum formation and occurrence: a new approach to oil and gas exploration.	B.P. Tissot and D.H. Welte:	
07	Petroleum Geology.	F.K. North	
08	Petroleum Geology	Lavorsen	