20PEB410E					HYDROFRACTURING					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

COURSE OBJECTIVES

1. provides a background on the physical and mechanical characteristics of the unconventional reservoirs as compared to conventional ones
2. To apply stimulation methods to improve recovery from conventional reservoirs
3. To augment stimulation methods to increase recovery from the unconventional.

Unit I conventional vs Unconventional reservoirs **Hours: 5**

Comparison of conventional vs unconventional reservoirs, Geochemistry & Geomechanics properties relating radial and linear forms of Darcy's law to hydraulic fracturing, Near wellbore pressure drawdown and its significance, Inflow and Outflow performance with/without stimulation

Unit II Well Stimulation **Hours: 7**

Types of formation damage , Formation damage in Upstream and downstream areas, Sanding as formation damage and FracPacking, Types of stimulation methods, Acid wash, Matrix stimulation and hydraulic fracturing, Hydraulic fracturing applications , Hydraulic fracturing geometries for conventional vs unconventional reservoirs

Unit III **Hours: 7**

Geomechanics: Failure mechanisms and criteria – compressive, tensile, shear, creeping, pore collapse, plastic behaviour, Brittleness & ductility, Effective stress concept of the conductive elements; matrix, natural fractures, beddings, and induced fracture. Stress profile and fracture height containment, Mechanical Earth Model Stress shadowing effect, Understanding the critically stressed natural fractures & beddings and shearing effect Dynamic and static mechanical properties Stress field; measurement and estimation, Fracturing fluid rheology Fluid leakoff; fluid loss modeling, fluid shear history, Fracture conductivity, Acid vs. proppant fracturing, Proppant design; size, concentration, lb/ft,selection, Diagnostic techniques, Modeling a hydraulic fracture: Plain strain, elastic deformation, width development and fracture propagation, CGD, KGD, Fracpro, Gohfer, and new models for network fracturing

Unit IV **Hours: 7**

Major shale oil and shale gas basins, Well-pad configuration and horizontal wells, Horizontal wells placement and spacing, Sweetspot identification, Well completion: Multistage fracturing; plug & perf, ball-activated sliding sleeves, Fracturing stages, stages spacing and clusters spacing, Fracturing fluids; slick water fracturing, high viscosity friction reducer, Proppant selection: local sand, light weight proppant, hybrid in size or density, Minimizing footprint, Complex fracture modelling, Diagnostic methods: DFIT, microseismic, fiber sensing, and tiltmeter, Water management, Production optimization Refracturing: is it successful? candidate selection, procedures, economics and case histories. IOR/EOR techniques, Refracturing through diverter, Multistage fracturing Waterless fracturing; energetic fracturing, Pulse fracturing, Cryogenic fracturing, Exothermic chemical pulse fracturing, and laser perforation/fracturing

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 Apply basin understanding of Geomechanical properties to evaluate the reservoir

CO2 Evaluate the stress direction, Stress profile and fracture height for the Reservoir

CO3 To design suitable propants for the selected hydrofracturing job in reservoir.

CO4 Evaluate suitable candidate for Hydrofracturing/Refracturing/ and Multistage fracturing

CO5 Evaluate suitable Hydrofracturing models to be applied in specific reservoirs

CO6 Create suitable workflow for Hydrofracturing Job work for selected reservoir conditions.

TEXT / REFERENCE BOOKS

1. **Petroleum Well Construction, 1998, edited by Michael Economides, Larry Watters and Shari Dunn-Norman: Chapter 5: Rock Mechanics by Hazim Abass and Justo Neda. The chapter will be provided to the students.**
2. **Hydraulic Fracture Modeling, 2018, edited by Yu-Shu Wu: Chapter 14: Hydraulic Fracturing: Experimental Modeling by Hazim Abass and Chris Lamei. The chapter will be provided to the students.**
3. **Unconventional Oil and Gas Resources Exploitation and Development, 2016, by Usman Ahmed and Nathan Meehan**

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Question: <Short Notes, Problems, Numerical> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**