Course Type	Course Code	Name of Course	L	T	P	Credit
DE3	PED405	Pipeline Engineering	3	0	0	9

Course Objective
To provide the basic knowledge of the pipeline operations required for transportation of oil and gas. It also provides knowledge right from its design to construction underground and offshore along with various safety requirements and mitigating problems.
Learning Outcomes
Able to design the buried pipeline as per industry (API/ASME) specification. Able to apply this knowledge in the industry as well as in the research organization in various aspects of pipeline.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	**Introduction**: Objective and scope of pipeline as a means of fluid transportation with special reference to crude oil/gas/refined products, Economics of Pipeline transportation.	4	Will have the understanding of the use of pipeline as a means of transportation and its superiority over other methods techno-economically.
2.	**Design of Pipeline:** Factors influencing oil, gas and products pipeline design; Hydraulic surge and water hammer; river crossing; pipeline buoyancy.	6	The designing of oil & gas pipeline as per ASME/API code and the consideration of different factors in designing oil , gas and product pipeline will be learnt. A special case of river crossing and the effect of buoyancy factor will also be evaluated.
3.	**Flow of fluids through pipeline:** Basic equations for the flow of fluids through pipes; Theory and different formulae of the fluid flow for both oil and gas pipelines, pressure drop calculations, complex piping systems (series and parallel), looping of pipelines (oil & gas), Multiphase flow and its correlations, Pumps, their series and parallel connection & Pump stations, station spacing; Compressors and Compressor stations.	10	Right from basic fluid flow equations, the students will learn its application in oil & gas pipelines separately. They will also learn the advantages of connecting pipes in series or parallel and pumps in series or parallel. Application of multiphase flow calculations in the transportation of well fluid will also be learnt, knowledge of Pumps and Compressor stations in oil and gas pipeline is an integral part of this chapter.
4.	**Construction and Maintenance of pipelines;** Materials and project specifications, General equipment specifications (pipes, valves and fittings), Route location survey and laying of cross country pipelines, Installation of expansion loop and themodymetric tapping plant, Pigs, Intelligent pigs, Pigging technology, Pig launcher and receiver.	8	A complete idea right from the surveying of the pipeline route upto the laying of cross-country pipeline will be available besides the complexity in the construction in different terrain. The maintenance of pipeline by routine pigging is very important in pipeline operation which students will learn.
5.	**Corrosion protection and control;** Design of cathodic protection system, Pipeline automation.	6	Here basics of corrosion and detail design of cathodic protection of underground pipeline will be learnt.
6.	**Offshore Pipeline:** Design and control of Sag and Over bend; Description of stinger; and Riser, articulated stinger, construction of offshore pipeline, Method of underwater welding.	4	Main emphasis here will be on the various methods of laying offshore pipeline and the detail design and laying aspects of each method, specially ‘lay barge’ method will be stressed.

7.	**Hydrates, Wax & Scale:** Formation and prevention. Crude conditioning and use of additives to improve flow conditions.	2	The main problems in pipeline transportation are Wax, hydrate and scale and students will learn about the scientific theory behind these and also the different methods for combating each of these problems.
8.	**City distribution network** of oil and gas pipeline, Lease automatic custody transfer.	2	Networking of oil/gas pipeline in a specific area with Lease Automatic Custody Transfer (LACT) System will be learnt.
	Total contact hours:	**42**	

Text Books:

i. Pipeline Transportation Handbook: H.S. Bell
ii. Gas Production engineering: Sanjay Kumar
iii. Oil and Gas Pipelines and Piping Systems -- Design, Construction, Management, and Inspection: Alireza Bahadori

Reference Books:

i. Offshore Pipeline Design, analysis and Methods: A. H. Mousselli
ii. Oil and Gas Pipelines: Integrity and Safety Handbook: R. Winston Revie
iii. Pipeline Pigging Technology: J. N. H. Tiratsoo
iv. Gas Pipeline Hydraulics: E. Shashi Menon