Second Year Curriculum

Lateral Entry

Admission Year 2026-27

Bachelor of Technology
Petroleum Engineering

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

Semester 3

(1)

a) **Course Name:** Drilling Engineering-I
b) **Course Code:** 03011703PC01
c) **Prerequisite:** Basics of Physics and Maths for understanding the problems in Drilling Rig design
d) **Rationale:** This course will introduce students to learn about the methodology of making a conduit into the earth surface creating a overbalance. The various steps are included through subject by which students can efficiently plan for a completion of a well.

e) **Course Learning Objective:**

CLOBJ 1	Understand the fundamentals of drilling operations including well planning, drilling rig components, and operating systems used in petroleum drilling practices.
CLOBJ 2	Explain the principles and applications of drilling fluids, their properties, formulations, rheological behavior, and hydraulic calculations for efficient drilling performance.
CLOBJ 3	Develop knowledge of drill string, casing, and drill bit design and their role in ensuring safe and effective well construction.
CLOBJ 4	Apply cementation principles and techniques for designing cement slurry systems and evaluating various cementing operations in drilling practices.
CLOBJ 5	Analyze drilling challenges and operational problems such as pipe sticking, lost circulation, well control issues, and borehole instability, and propose appropriate remedial measures.

f) Course Learning Outcomes:

CLO 1	Identify the basic equipment for operation of rig and its accessories.
CLO 2	Summarize the different fluid system with basic designs used in conventional drilling system.
CLO 3	Describe the basic procedure for cementation and its importance in drilling industry.
CLO 4	Construct the various operational problems and its method for remedies.

g) Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
L	**T**	**P**	**C**	**T**	**CE**	**P**	**Theory**	**P**	**Total**

2	1	-	**3**	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Course Content

Sr.	Topics	W	T
1	**Basic Drilling Practices**Well Planning, Drilling Rig: Components, Selection and Operating systems - Hoisting, Circulation and Rotary systems, Power transmission, Rig control system. Wire lines and service life evaluation, Drilling Fluids – Basics, Functions, Classification, Properties and Nature. Drilling fluids equipment related to pressure and separation. Formulations of drilling fluid, Mud systems like Pneumatic, Synthetic oil based, Inhibitive and Non-inhibitive Rheology models of drilling fluids Mud Hydraulics and Mud weight and Pressure loss calculations in round trip circulation cycle, Pore Pressure prediction, Fracture pressure.	**30**	**9**
2	**Drill string, Casing and Bit Design**Drill String - Components, functions and design, Casing Practices – Configuration, operation, properties, types and design, casing setting depth and hole sizes, liner design, casing handling practices Drill Bits –Types, Performance and Criteria for design.	**24**	**7**
3	**Cementation Techniques**Cementing, Cements & cement slurry: Objectives of cementing, oil well cements, Classification of cement, Slurry design, Slurry additives, Factors influencing cement slurry design, Cementing equipment. Cementing Methods -Primary cementing, Stage cementing, Liner cementing, Plugging, Squeeze. Cementing techniques in practice. Cementing calculations.	**30**	**9**
4	**Drilling Problems and Remedies**Pipe sticking and failure, Lost circulation, Hole Deviation, Sloughing shale, Formation damage, Borehole instability. Drill string fatigue failure. Bit failure, wire line failure etc. Fishing and coring operations. Well kick and Blow outs: Problem, symptoms and controlling measures, Hole Cleaning.	**16**	**5**
	Total	**100**	**30**

i) Text Book and Reference Book:

- Oil Well Drilling Engineering Principles and Practices, (TextBook) By H Rabia (1986) | Kluwer Law International
- Petroleum Engineering Drilling & Well completion, By Carel Gatlin. | Prentice Hall.
- Petroleum Engineering: Drilling and Well Completion, By Carl Gatlin (1960) | Prentice Hall; 1st Ed

2)

a) **Course Name: Drilling Engineering-I Laboratory**

b) Course Code: 03011703PC02

c) **Prerequisite:** Basic knowledge of drilling engineering, fluid mechanics, and well planning concepts

d) Rationale: To develop practical skills in drilling operations, equipment handling, and problem-solving using real-field scenarios**.**

e) Course Learning Objective:

CLOBJ 1	Understand the preparation procedures and calibration techniques of equipment used in drilling fluid laboratories.
CLOBJ 2	Measure and evaluate important drilling fluid properties such as mud weight, marsh funnel viscosity, rheology, filtration characteristics, and resistivity using standard laboratory instruments.
CLOBJ 3	Analyze the solid and liquid content, cation exchange capacity, and contamination effects in drilling fluids through different laboratory tests.
CLOBJ 4	Apply bentonite and barite additives for mud weight control and optimize drilling fluid performance under different operational conditions.
CLOBJ 5	Interpret laboratory test results and correlate drilling fluid properties with drilling performance, wellbore stability, and formation protection

f) Course Learning Outcomes:

CLO 1	Prepare and evaluate drilling fluids by measuring key properties such as mud weight, viscosity, and rheology.
CLO 2	Analyze filtration characteristics, wall-building properties, and solid–liquid content of drilling mud.
CLO 3	Determine chemical and electrical properties of drilling fluids, including resistivity and cation exchange capacity.
CLO 4	Assess mud performance and control techniques under contamination and varying composition conditions.

g) Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
L	**T**	**P**	**C**	**T**	**CE**	**P**	**Theory**	**P**	**Total**

-	-	2	**1**	-	-	20	-	30	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

List of Practical	
1.	To prepare the Drilling fluid and calibrate the equipment used in the drilling fluid laboratory.
2.	To determine the Mud Weight using mud balance.
3.	To determine the Marsh Funnel Viscosity of mud using marsh funnel.
4.	To perform the Mud Rheology Test using rotational viscometer.
5.	To determine the Filtration, Wall Building characteristics of mud using LPLT API filter-press.
6.	To determine the Mud Resistivity using the conductivity meter.
7.	To determine the Solid and Liquid Content in mud using the Baroid Sand Content Set.
8.	To determine the Cation Exchange Capacity of the drilling fluid using the Methylene Blue Dye Test (MBT)
9.	To estimate the Mud Weight Control using Bentonite and Barite.
10.	To perform the Drilling Fluid Contamination test using Rotational Viscometer.

3)

a) Course Name: Petroleum Exploration

b) Course Code: 03011703PC03

c) Prerequisite: Basics of Physics and Geology

d) Rationale: The role of exploration is to provide the information required to exploit the best opportunities presented in the choice of areas, and to manage research operations on the acquired blocks.

e) Course Learning Objective:

CLOBJ 1	Understand the fundamentals of petroleum exploration, petroleum system elements, exploration techniques, and the E&P life cycle.
CLOBJ 2	Explain the concepts of source rock, reservoir, migration, trap, seal, play, lead, prospect, reserves, leases, and reservoirs in hydrocarbon exploration.
CLOBJ 3	Analyze and interpret geochemical exploration data including seep analysis, mud logging, rock pyrolysis, and geochemical indices for hydrocarbon evaluation.
CLOBJ 4	Understand the principles of seismic acquisition, processing, interpretation, and seismic attributes used in hydrocarbon exploration.
CLOBJ 5	Interpret seismic sections, fault and horizon maps, and apply concepts of 2D/3D seismic data analysis for reservoir characterization

f) Course Learning Outcomes:

CLO 1	Label the fundamentals regarding exploration in various prolific areas of the earth.
CLO 2	Paraphrase the various geophysical and geochemical methods involved in oil and gas exploration.
CLO 3	Categorize the various attributes related to seismology in earth variations.
CLO 4	Develop the idea behind geophysical methods like gravity and Magnetic.

g) Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		
L	**T**	**P**	**C**	**T**	**CE**	**P**	**Theory**	**P**	**Total**
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Course Content

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Fundamentals of Petroleum Exploration:** Ingredients of Petroleum Exploration, Concept of source, reservoir, migration, trap and seal, Concept of Play, Lead, Prospect and Drillable Prospect, Types of Petroleum Traps- Structural, Stratigraphic and Combinational traps, Primary and Secondary Migration, E&P Life Cycle, Concept of Reserve, Lease and Reservoir, Techniques of Petroleum Exploration, Geochemical, Gravity, Magnetic, Electrical and seismic method of hydrocarbon exploration.	**25**	**8**
2	**Geochemical Analysis :** Geochemical seep, Classification of seep by Link, Weathering of seeps, a geochemical program for petroleum exploration, Surface Reconnaissance, hydrocarbon Mud Logging, Rock Pyrolysis, Understanding S1, S2, S3, S1/S1+S2, Production Index, Hydrogen Index and Oxygen Index, Processing and interpretation of Geochemical data.	**20**	**6**
3	**Fundamentals of Seismic processing, Interpretation and Attribute:** Body waves and surface waves, Rayleigh, Love, P and S wave, Seismic acquisition principle, Seismic refraction and reflection surveys, Land and marine sources, Geophone, Hydrophone and Vibroseis survey, Seismic Fold, Signal and Noise, Seismic Processing, CDP/CMP and NMO, DMO, Seismic migration, Base map, Strike Line and Dip Line, 2D and 3D	**35**	**10**

	seismic, inline and cross line, 3D fold, time slice and its importance. Horizon and Fault mapping, Seismic impedance and reflection coefficient, convolution and autocorrelation, Synthetic generation, Time and depth map, VSP survey, Attributes: Amplitude, Frequency and Sweetness, AVO analysis, Classification of sands, Rock solid attributes.		
4	**G and M Methods:** Gravity and magnetic prospecting, Instruments of G&M survey, Gravity and magnetic data correction, Interpretation of G&M anomaly, Correlation of Gravity anomaly with seismic anomaly. SP, Telluric and Magnetotelluric data interpretation, Electrical properties of hydrocarbon, Electrical conductivities, Resistivities of various lithology's, Dielectric constants, land airborne EM, Basic well logs, GR and SP logs, Shallow, Medium and Deep Resistivity logs, Porosity logs-Sonic, Neutron and Density logs, Importance of log interpretation, qualitative and quantitative Interpretation	**20**	**6**
	Total	**100**	**30**

i) Text Book and Reference Book:

- Introduction to Sedimentology, (TextBook)By Supriya Mohan Sengupta, | A.A.Balkema publication
- Mamdough, R. Gadallah, Reservoir Seismology, Pennwell Books, Pennwell Publishing Company, Tusa, Oklahoma.
- Applied Geophysics,By Telford, W M, Geldart, L.P., Sheriff, R.E. and Keys, D.E. | Oxford and IBH Publishing Co Pvt Ltd.

4)

a) Course Name: Production Engineering-I

b) Course Code: 03011703PC05

c) Prerequisite: Physics and mathematics of basic science and transport phenomena of chemical engineering

d) Rationale: Production engineering include evaluating inflow and outflow performance between the reservoir and the wellbore and also designing completion system. including tubing selection, perforating, sand control, matrix stimulation, and hydraulic fracturing.

e) Course Learning Objective:

CLOBJ 1	Understand the design, function, and operation of wellhead equipment, Christmas trees, packers, tubulars, flow control devices, and well completion systems.
CLOBJ 2	Explain conventional and unconventional well completion and perforation techniques, including tubing-conveyed and underbalanced perforation methods.
CLOBJ 3	Analyze the selection, installation, testing, and maintenance of downhole equipment and intelligent completion systems for efficient well operations.
CLOBJ 4	Understand the principles, planning, and execution of well servicing and workover operations using rig and rig-less techniques.

CLOBJ 5	Evaluate formation damage, sand production problems, water/gas shutoff treatments, and conformance control methods in oil and gas wells.

f) Course Learning Outcomes:

CLO 1	Will learn the design parameter for the well completion techniques.
CLO 2	Will design the well assembly based on all available equipments for self flowing and artificially lifted wells.
CLO 3	Will understand the concepts behind flow in tubing and pipes for different phase of crude-oil.
CLO 4	Will get an idea of the artificial technology in assisting the well optimization for enhancing the production in oil industry.

g) Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
L	**T**	**P**	**C**	**T**	**CE**	**P**	**Theory**	**P**	**Total**
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Course Content

W - Weightage (%) , **T** - Teaching hours

Sr.	**Topics**	**W**	**T**
1	**Well Equipment and Completion Design:**Well Head Equipment, Christmas tree, valves, hangers, flow control devices, packers, tubular and flow lines, Well completion Methods, Perforating Oil & Gas Wells - Conventional and Unconventional techniques viz. through tubing and tubing conveyed underbalanced perforating techniques, type size and orientation of perforation holes. Well activation, use of compressed air & liquid Nitrogen. Down-hole equipment selection, servicing, installation & testing, smart wells-intelligent completions.	**27**	**12**
2	**Well Servicing & Workover:**Workover system, workover rigs and selection, rig less workover including Endless/ Coiled tubing unit, minor & major workover jobs-diagnosis & remedial measures water shut off and gas shut off- Chemical treatment and conformance control. Wire-line operations, Workover & completion fluids - types & selection, Formation damage, Workover planning & economics, asphaltenewax ,Sand control techniques, Formation Sand Size analysis, optimum gravel - sand ratio, gravel pack thickness, gravel selection, gravel packing fluid & gravel pack techniques.	**20**	**9**

3	**Production System Analysis & Optimization:**Self-flow wells - PI & IPR of self-flowing and artificial lift wells, production testing - back pressure test, flow after flow test & isochronal test, surface layout, test design & analysis of test data. Production characteristics of Horizontal and multilateral wells - coning, IPR & skin factor. Multiphase flow in tubing and flow-lines. Sizing, selection and performance of Tubing, chokes and surface pipes. Production Optimization – Nodal System analysi	**26**	**12**
4	**Introduction to Artificial Lift Techniques**Principle and application of artificial lift methods- Rod Pump (SRP/PCP), Gas Lift (Continuous/Intermittent), Electric submersible Pump (ESP), Hydraulic lifts (Jet Pump) etc.	**27**	**12**
	Total	**100**	**45**

i) Text Book and Reference Book:

- Computer Aided Petroleum Production Engineering (TextBook)By Boyun Guo | Gulf Professional Publishing, Pub. Year 2007
- The technology of artificial lift methods By Kermit Brown | Penn Well Publishing
- Production Optimization Using Nodal Analysis By H. Dale Beggs | Oil & Gas Consultants International, Pub. Year 2008

5)

a) Course Name: Production Engineering-I Laboratory

b) Course Code: 03011703PC06

c) Prerequisite: Basic knowledge of reservoir engineering, drilling, fluid mechanics, and production engineering concepts

d) Rationale: To provide hands-on experience in analyzing and optimizing well production by applying theoretical concepts to practical field scenarios.

e) Course Learning Objective:

CLOBJ 1	Understand the principles and procedures for measurement of physical properties of crude oil and petroleum fluids.
CLOBJ 2	Determine density, specific gravity, and API gravity of petroleum fluids using standard laboratory methods.
CLOBJ 3	Measure and analyze the viscosity of crude oil using Brookfield and U-tube viscometers.
CLOBJ 4	Determine water content in crude oil using distillation and centrifuge methods and compare their applications.
CLOBJ 5	Estimate the total salt content in crude oil using the conductivity method and evaluate its significance in petroleum processing.

f) Course Learning Outcomes:

CLO 1	Apply production engineering principles to analyze well performance and flow

	behavior.
CLO 2	Conduct nodal analysis for optimizing oil and gas well production systems.
CLO 3	Evaluate multiphase flow and pressure losses in wellbore and surface facilities.
CLO 4	Analyze and interpret production data to diagnose well problems.

g) Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		
L	**T**	**P**	**C**	**T**	**CE**	**P**	**Theory**	**P**	**Total**
-	**-**	**2**	**1**	-	-	20	-	30	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

List of Practical	
1.	Measuring the density
2.	Measuring the specific gravity and API gravity.
3.	Measuring the viscosity using Brookfield Viscometer
4.	Measuring the viscosity using U – tube Viscometer.
5.	Determination of the water in crude oil by distillation.
6.	Determination of the water in crude oil by the centrifuge.
7.	Determination of the total salts content of crude oil by conductivity method.
8.	Determination of natural gas composition using GC chromatography.

6)

a) **Course Name: Thermodynamics of Petroleum Reservoir Fluids**
b) **Course Code:** 03011703PC07
c) **Prerequisite**: Basic knowledge of Reservoir fluid and thermodynamic behaviors
d) **Rationale:** Study the fundamentals of thermodynamics of reservoir fluids and their phase behaviour and understanding of fluid sampling and PVT study. Learn the compositional characterization and application of various correlations in real field and simulation application

e) Course Learning Objective

CLOBJ 1	Understand the origin, classification, and thermodynamic behavior of petroleum reservoir fluids and hydrocarbon systems.
CLOBJ 2	Explain the phase behavior of single, two, three, and multicomponent hydrocarbon systems under reservoir conditions.
CLOBJ 3	Evaluate the physical and chemical properties of natural gas, crude oil, and reservoir fluids using standard correlations and characterization techniques.
CLOBJ 4	Apply methods for characterization of heavy hydrocarbon fractions, including PNA analysis, splitting, and lumping schemes.
CLOBJ 5	Understand reservoir fluid sampling procedures and perform interpretation of PVT laboratory studies such as CCE, flash liberation, differential liberation, and separator tests.

f) Course Learning Outcomes:

CLO 1	Understand the compositional range of hydrocarbon components present in reservoir fluids with crude typing.
CLO 2	Understand hydrocarbon phase behaviour in dynamic reservoir conditions.
CLO 3	Understand chemical characterization of hydrocarbon reservoir fluids and available correlations.
CLO 4	Design sample collection for various purposed and understand PVT study and analysis.

g) Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**		
				Internal Evaluation	**ESE**	

L	T	P	C	T	CE	P	Theory	P	Total
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Course Content

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Reservoir fluids and Hydrocarbon phase behaviour:** Reservoir and reservoir fluids, Hydrocarbon-formation in source rock and crude oil in reservoirs, Thermodynamic behaviour – single, two, three and multicomponent system. Physical properties of petroleum reservoir fluids, classification of reservoirs and reservoir fluids.	27	8
2	**Properties Hydrocarbon components, characterization and correlation:** Natural gas properties, behavior of ideal and real gases. Characterizing Hydrocarbon-plus fractions: generalized correlations, PNA determination, splitting and lumping scheme including various correlation methods.	23	7
3	**PVT properties and laboratory study of PVT:** Collection of reservoir fluid samples for PVT study, PVT analysis: Constant composition expansion, flash liberation, differential liberation, separator test for PVT data of hydrocarbon fluids. Evaluation and correlation of physical and chemical properties of reservoir fluids including laboratory and empirical methods. Water from petroleum reservoirs, water production and parameters	27	8
4	**Equation of state and application:** Vapor-liquid equilibrium calculation, Use of various equations of state for simulation of laboratory PVT data, tuning EOS parameters and original fluid composition calculation.	23	7
	Total	100	30

i) Text Book and Reference Book:

- A Course in Thermodynamics and Heat Engines By Kothandaraman C P Khajuria P R and Arora S C
- Applied Engineering Thermodynamics (TextBook) By Chowdhury, R | Khanna Publishers, New Delhi, 1986.
- Applied Petroleum Reservoir Engineering, By B.C. Craft, M. Hawkim, | Prentice Hall, 1991.

7)

a) Course Name: Theory of Complex Variable, Partial Differential Equations
b) Course Code: 03019103BS03
c) Prerequisite: Geometry, Multivariable Calculus, Ordinary Differential Equations
d) Rationale:

e) Course Learning Objective:

CLOBJ 1	
CLOBJ 2	
CLOBJ 3	
CLOBJ 4	
CLOBJ 5	

f) Course Learning Outcomes:

CLO 1	Analyse various properties of a function of complex variable such as differentiability, analyticity as well as Conformal mappings.
CLO 2	Understand various types of singularities, Residues and apply it to evaluate complex integrals using residue theorem,
CLO 3	Solve linear PDEs using separation of variables, transform methods

g) Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
L	**T**	**P**	**C**	**T**	**CE**	**P**	**Theory**	**P**	**Tota l**

3	-	-	**3**	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Course Content

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Analytic Functions and Complex Integration:** Cauchy-Riemann equations (Cartesian and polar forms), Harmonic functions and harmonic conjugates. Contours and line integrals, Cauchy-Goursat theorem (without proof), Cauchy's integral formula (without proof).	**30**	**14**
2	**Series representation, Residue Theory and Conformal Mapping:** Taylor Series, Laurent's series. Singularity and its' type, Residues, Cauchy Residue theorem (without proof), Residue Integration method. Mobius transformations and their properties.	**30**	**14**
3	**Partial Differential Equations:** Solutions of first order linear and nonlinear PDEs, Classifications of PDE, Separation of Variables Method.	**40**	**17**
	Total	**100**	**45**

i) Text Book and Reference Book:

- Complex variables and Applications (TextBook)By J. W. Brown and Ruel V. Churchill | McGraw-Hill
- Advanced Engineering Mathematics (TextBook)By Erwin Kreyszig | Willey India Edition
- Elements of Partial Differential Equations (TextBook)By I. Sneddon | McGraw Hill
- Elementary Applied Partial Differential equations with Fourier Series and oundary Value ProblemBy R. Haberman | Prentice Hall | 4th

8)

a) **Course Name: Functional Communication Skills**
b) **Course Code:** 03010003HM01
c) **Prerequisite:** Knowledge of Advanced Communication and Interpersonal Skills
d) **Rationale:** This course develops workplace-oriented communication skills by bridging academic language competence with professional communication requirements

e) Course Learning Objective:

CLOBJ 1	
CLOBJ 2	
CLOBJ 3	
CLOBJ 4	
CLOBJ 5	

f) Course Learning Outcomes:

CLO 1	Identify grammatical, usage, and style errors; logically reorder sentences; and differentiate facts from assumptions in workplace problem scenarios.
CLO 2	Understand the usage of grammatical rules, cohesion markers, professional writing formats, and communication etiquette to produce accurate workplace communication.
CLO 3	Analyse effective verbal, digital, and virtual communication skills through JAM participation, LinkedIn profile optimization, and telephone/video call interactions
CLO 4	Create ATS-friendly resumes, customized cover letters, professional emails, structured reports, optimized LinkedIn profiles.
CLO 5	Apply principles of professional communication to ensure clarity, coherence, time management, and etiquette in both written and spoken workplace contexts

g) Teaching & Examination Scheme:

Teaching Scheme	Evaluation Scheme

L	T	P	C	Internal Evaluation			ESE		Tota l
				T	CE	P	Theory	P	
1	-	2	2	40	-	20	60	30	150

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Course Content

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Sentence Correction** Error identification (grammar, usage, style) Common workplace errors Contextual grammar usage	10	2
2	**Para Jumbles & Sentence Reordering** Logical sequencing Cohesion markers Theme identification	8	1
3	**Statement and Assumptions** Fact vs assumption Logical reasoning basics Workplace problem scenarios	10	1
4	**Reading Comprehension (Level of Difficulty - Advanced)** Inferential questions Author's tone & intent Vocabulary in context	12	2
5	**Resume and Cover Letter Writing** Resume formats Achievement-based bullet points Customizing cover letters	14	2
6	**Building a Professional LinkedIn Profile** Professinal headline Summary writing Digital networking ethics	8	1
7	**Just a Minute (JAM)** Idea organization Fluency techniques Time management in speech	8	1
8	**Telephone and Video Call Etiquette** Opening & closing calls Voice modulation Virtual meeting etiquette	8	1
9	**Email Writing** Format Professional tone Subject lines	10	2
10	**Report Writing Report Writing** Types of reports Structure & formatting Use of visuals & data		

i) Text Book and Reference Book:

- Business Communication Today By Bovee, Courtland L., and John V. Thill | Pearson Education, Pub. Year 2019
- Essentials of Business Communication By Guffey, Mary Ellen, and Dana Loewy. | Cengage Learning, Pub. Year 2018
- Advanced Grammar in Use By Hewings, Martin. | Cambridge University Press, Pub. Year

2013
- English Vocabulary in Use: Advanced. By McCarthy, Michael, and Felicity O'Dell | Cambridge University Press, Pub. Year 2017
- Personality Development and Soft Skills. By Mitra, Barun K | Oxford University Press, Pub. Year 2011

Semester 4

(1)

a) **Course Name:** Reservoir Engineering-I
b) **Course Code:** 03011704PC01
c) **Prerequisite:** Basics of Physics, Mathematics and Petroleum Geology.
d) **Rationale:** The working tools of the reservoir engineer are subsurface geology, applied mathematics, and the basic laws of physics and chemistry governing the behaviour of liquid and vapour phases of crude oil, natural gas, and water in reservoir rock.

e) **Course Learning Objective:**

CLOBJ 1	Understand the fundamental properties of reservoir rocks including porosity, permeability, fluid saturation, wettability, capillary pressure, and core analysis techniques
CLOBJ 2	Explain the behavior and characteristics of reservoir fluids including hydrocarbon phase behavior, PVT properties, fluid sampling, and laboratory evaluation methods
CLOBJ 3	Apply the principles of fluid flow through porous media using Darcy's law and analyze single-phase and multiphase flow under different flow conditions
CLOBJ 4	Develop an understanding of reservoir drive mechanisms and recovery processes influencing hydrocarbon production performance.
CLOBJ 5	Apply reserve estimation techniques including volumetric methods, material balance equations, and decline curve analysis for reservoir evaluation and management.

f) **Course Learning Outcomes:**

CLO 1	To understand the different petrophysical properties of the reservoir rock.
CLO 2	Learn the concepts of fluid flow in reservoir rock and how the flow changes with rock properties
CLO 3	Learn the importance of recovery factor in different drive and how the production occurs with respect to natural phenomena.
CLO 4	Understand the concepts of Darcy law and how this law is implemented in reservoir engineering.

g) **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	1	2	5.	20	20	20	60	30	150

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Reservoir Rock Properties Porosity and permeability determination, combination of permeability in parallel & series beds, porosity permeability relationship, fluid saturation determination and significance, effective and relative permeability, wettability, capillary pressure characteristics, measurements and uses. Coring and Core Analysis.	**11**	**24**
2	Reservoir Fluids: Phase behavior of hydrocarbon system, ideal & non ideal system, equilibrium ratios, reservoir fluid sampling, PVT properties determination, different correlations and laboratory measurements, data reduction, evaluation and application.	**9**	**20**
3	Flow of Fluids through Porous Media: Darcy's law, single and multiphase flow, linear, radial & spherical flow, steady state & unsteady state flow, GOR, WOR equations.	**11**	**24**
4	Reservoir Drives and Reserve Estimation Reservoir drive mechanics and recovery factors, Reserve resource & reserve concept, Different reserve estimation techniques: Volumetric, MBE, decline curve analysis.	**14**	**32**
Total		**45**	**100**

i) Text Book and Reference Book:

- Fundamentals of Reservoir Engineering – L. P. Dake – Elsevier, 17th Edition, 1998
- Applied Petroleum Reservoir Engineering (Second Edition)- B. C. Craft and M. F. Hawkins Revisedby Ronald E. Terry – Prentice Hall.
- Worldwide Practical Petroleum Reservoir Engineering Methods – H. C. "Slip" Slider – PennwellPublishing Company.

- Advance Reservoir Engineering- Tarek Ahmed and Paul D. McKinney – Gulf Professional Publishing

i) List of Practicals

Sr. No.	Practical
1	Preparation of cylindrical Core Plug from the sample by using core plugger.
2	To Trim a Core sample (obtained from plugging machine) using Trim Saw machine and measure its length.
3	Determination of Effective porosity of given core sample by saturation method.
4	Determine the Permeability of given sample by using Ruska Liquid Permeameter
5	Permeability measurement by using Gas Permeameter
6	Determine the viscosity of oil sample by using capillary viscometer (Ostwald viscometer).
7	Determination of Density of given oil sample using pycnometer and hydrometer.
8	BHP chart analysis using travelling microscope.
9	Preparation of cylindrical Core Plug from the sample by using core plugger.
10	To Trim a Core sample (obtained from plugging machine) using Trim Saw machine and measure its length.

(2)

a) **Course Name:** Drilling Engineering-II
b) **Course Code:** 03011704PC03
c) **Prerequisite:** Basics of Physics, Mathematics and Petroleum Geology.
d) **Rationale:** The working tools of the reservoir engineer are subsurface geology, applied mathematics, and the basic laws of physics and chemistry governing the behaviour of liquid and vapour phases of crude oil, natural gas, and water in reservoir rock.
e) **Course Learning Objective:**

CLOBJ 1	Understand the principles and objectives of directional drilling including well profiles, deflection techniques, drilling tools, and directional control systems.
CLOBJ 2	Explain horizontal well drilling concepts and technologies including well selection, drilling techniques, mud requirements, and measurement systems used during drilling operations.
CLOBJ 3	Develop knowledge of well surveying methods and data interpretation techniques for determining and analyzing well trajectories and coordinates.

CLOBJ 4	Understand emerging drilling technologies and advanced practices including coiled tubing drilling, multilateral wells, slim-hole drilling, automation, robotics, and data analytics applications in drilling.
CLOBJ 5	Apply well control principles and procedures to identify kick situations, analyze causes, and implement suitable kick control methods for safe drilling operations.

f) Course Learning Outcomes:

CLO 1	Students will learn the various trajectory of well profile done in oil industry.
CLO 2	Will understand the various parameters required to make the advanced profile.
CLO 3	Will analyze the different concepts to make a successful drilling in onshore and offshore areas.
CLO 4	Will rephrase the concepts the MWD and LWD technology in oil industry.

g) Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				T	**CE**	**P**	**Theory**	**P**	
3	0	0	3	**20**	**20**	**-**	60	40	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Directional Drilling** Directional Drilling Technology, Objectives of Directional Drilling. Tools for deflection & orientation. Directional well profiles and well path – deflection & corrections Motor Types: PD motors and Turbodrills; their description, power calculations and applications. Directional drilling problems & their remedies. Auto and Verti-track systems: Rotary steerable motors and geo-steering tools.	**13**	**29**

2	**Horizontal Well Drilling** Horizontal Well Drilling, Introduction of Horizontal well drilling: objectives & selection, drilling techniques and different well profiles, special mud requirements and their characteristics. Measurements while Drilling: objectives, MWD / LWD tools, Telemetry system and data interpretation Well Surveying: Objectives & methods. surveying analysis & calculations for well coordinates	**13**	**29**
3	**EMERGING TRENDS IN DRILLING** Coil tubing drilling technique and application, Slant drilling techniques and the specialized tools, Introduction to multilateral drilling, Technology advancement of multilaterals, Slim hole drilling, Casing While Drilling, Prospects of big data analytics in drilling: Automation and robotics in drilling operations.	**10**	**22**
4	Well Control Principles& Procedures The Anatomy of a Kick, Kicks - Definition, Kick Control (a) Dynamic kick control (b) Other Kick control methods-Driller & Engineer methods of kick control.	**9**	**20**

i) Text Book and Reference Book:

- Bourgoyne , Adam T. Jr., Martin E. Chenevert, Keith K. Millheim and F.S. Young Jr.,Richardson, TX (1991) Applied Drilling Engineering, Society of Petroleum Engineers.
- Joshi, S. D. (1991) Horizontal Well Technology, Penn Well Publishing.
- Adam, N. J. (1980) Well control Problems and Solutions. Petroleum Publishing Company
- Baker, R. (1998) A Premier of Offshore Operations Petroleum Extension Service, Division of Continuing Education, University of Texas at Austin in cooperation with International Association of Drilling Contractors, Houston, Texas.

(3)

a) Course Name: Production Engineering II

b) Course Code: 03011704PC05

c) Prerequisite: This subject requires the basic Knowledge of Surface operation and artificial lift.

d) Rationale: This course is an advanced treatment of modern petroleum production engineering encompassing flow assurance; well deliverability; and diagnosis of well performance. Production and distribution of hydrocarbons from petroleum reservoirs require knowledge of flow of multiphase fluids and heat transfer between the fluids and their surroundings. The course provides basic theoretical framework for multiphase flow and heat transfer in wellbores, production logging and well performance diagnosis by downhole sensors, and artificial lift

e) Course Learning Objective:

CLOBJ 1	Understand the principles of oil and gas field development including development planning, production forecasting, recovery mechanisms, and economic considerations.

CLOBJ 2	Apply economic evaluation techniques for analyzing field development projects using capital investment, payout period, IRR, economic life, and profitability indices.
CLOBJ 3	Develop knowledge of petroleum storage, metering, and measurement systems including storage tank design, flow measurement techniques, and crude oil testing procedures.
CLOBJ 4	Understand the operating principles and applications of artificial lift methods including gas lift, sucker rod pumping, hydraulic pumping, and electric submersible pumping systems.
CLOBJ 5	Analyze and perform basic design calculations for artificial lift systems to optimize production performance and improve hydrocarbon recovery efficiency

f) Course Learning Outcomes:

CLO 1	Evaluate the economic aspects involved in the development of oil and gas fields.
CLO 2	Design two-phase and three-phase separators for oil and gas separation.
CLO 3	Understand the principles of gas-lift techniques including continuous and intermittent methods.
CLO 4	Analyze working of gas lift and and sucker rod pumping

g) Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
L	**T**	**P**	**C**	**T**	**CE**	**P**	**Theory**	**P**	**Total**
3	**0**	**2**	**4**	**20**	**20**	**0**	**60**	**0**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	Development of Oil & Gas Fields Selection of development scheme, economic aspect of development of oil and gas fields. Production variants, performance prediction, Recovery factor, Stages of preparation of development plans. Computation of economic indices viz. Capital investment, payout	**12**	**26**

	period, IRR, Profile, Economic life etc. Analysis of different variants based on technical and economic considerations. Economic development of Marginal fields.		
2	Storage of Petroleum and Petroleum Products: Types of storage system, Design of storage tanks as per API and ASTM codes, Metering and Measurements: Metering of oil & gas, Orifice and other metering devices and systems. Multiphase flowmeter. Sampling and Testing of crude oil. Water and sediment determination.	**12**	**26**
3	Basic principles and descriptions of Artificial lift techniques Gas-lift - continuous and intermittent, chamber lift, plunger lift/sucker rod pumping, and hydraulic pumping – piston & jet type, Design of Continuous gas lift system (pressure operated valves) - graphical and analytical methods	**10**	**24**
4	Design of Intermittent gas lift system single point injection standard tubing installation (Pressure operated valves) - graphical and analytical methods. Design of Sucker rod pumping system, Characteristics and Selection of electric submersible pumping/PCP systems	**11**	**24**

i) Text Book and Reference Book:

- Arnold Ken and Stewart Maurice, Surface Production Operations Vol-I and II.
- Chillangarian G V, Surface Operations in Petroleum Production.
- Huges J R and Swindles,Storage and Handling of Petroleum Liquids.
- Alex Marks, Petroleum Storage Principles.

(4)

a) Course Name: Formation Evaluation

b) Course Code: 03011704PC07

c) Prerequisite: This subject requires an understanding of Geology, Geophysics and Drilling Engineering

d) Rationale: Understanding basic concepts of petroleum formation evaluation. Learning about direct methods such as mud logging, hydrocarbon staining, and coring techniques. Familiarizing with indirect methods like LWD/MWD and wireline logging. Understanding the physics and principles of open hole logging tools

e) Course Learning Objective:

CLOBJ 1	Understand the fundamentals of petroleum formation evaluation including mud logging, coring techniques, and the role of direct and indirect methods in reservoir characterization.
CLOBJ 2	Develop knowledge of logging tools and measurement principles including LWD/MWD, wireline logging systems, and methods of log recording and interpretation.
CLOBJ 3	Analyze open-hole logging data using electrical, radioactive, sonic, and nuclear logging techniques for qualitative and quantitative reservoir evaluation.
CLOBJ 4	Apply quantitative formation evaluation methods to determine lithology, shale volume, porosity, and fluid saturation from integrated logging data.
CLOBJ 5	Understand cased-hole and production logging techniques and evaluate their applications in well integrity assessment, reservoir monitoring, and production analysis.

f) Course Learning Outcomes:

CLO 1	Develop a foundational understanding of the basic concepts and methods used in petroleum formation evaluation
CLO 2	Learn techniques to correlate core data with logging data to enhance the understanding of subsurface formations
CLO 3	Understand about the principles and types of production logging tools and their applications
CLO 4	Gain knowledge of coring techniques and learn to analyze core samples for lithology and texture

g) Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**T**	**CE**	**P**	**Theory**	**P**	
3	0	0	**3**	**20**	**20**	**0**	**60**	**0**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction to Formation Evaluation, Mud Logging and Coring Introduction to petroleum formation evaluation: Basic concepts, direct Methods: Mud logging, Hydrocarbon staining on the cuttings, Lithology and texture of cutting samples, Evaluation of geopressurized zone by mud logging, Coring techniques and analysis; Indirect Methods: LWD/MWD & Wireline Logging, Instruments/Tools details, Processes of recording and representation (Log charts) Open Hole Logging Tool physics, measurement principles and data interpretation of the following including quantitative and qualitative analysis techniques: Caliper log; Electrical logs – SP and Resistivity logs (conventional, induction and micro devices), Radioactive Logs – Gamma Ray (natural and spectral), Neutron, Density and Elemental capture spectroscopy logs; Sonic Logs including Dipole shear sonic, Nuclear magnetic resonance (NMR).	**15**	**33**
2	Data Integration and Formation Evaluation Quantitative Analysis methods for lithology, shale volume, saturation from various logs. Cased Hole Logging and Production Logging CBL /VDL logs, Advance Logging tools including Casing Inspection tools, Formation micro imaging tool, , Proppant Tracer Log, Ultra sonic imaging tool; Production Logging: Introduction, type of tools, principles, limitations & applications	**8**	**18**
3	Introduction to Formation Evaluation, Mud Logging and Coring Introduction to petroleum formation evaluation: Basic concepts, direct Methods: Mud logging, Hydrocarbon staining on the cuttings, Lithology and texture of cutting samples, Evaluation of geopressurized zone by mud logging, Coring techniques and analysis; Indirect Methods: LWD/MWD & Wireline Logging, Instruments/Tools details, Processes of recording and representation (Log charts with tracks). Correlation of core and logging data.	**15**	**33**
4	Data Integration and Formation Evaluation Quantitative Analysis methods for lithology, shale volume, saturation from various logs	**7**	**16**

i) Text Book and Reference Book:

- Well Logging and Formation Evaluation" by Toby Darling:
- Formation Evaluation: Geological Well Logging" by M.M. Backus and R.A. Bowler
- "Cased Hole and Production Log Evaluation" by James J. Smolen
- Malcom Rider, Second Edition, 2002: The Geological Interpretation of well logs, RiderFrench Consulting limited

(5)

a) Course Name: Transport Phenomena

b) Course Code: 03011704PE01

c) Prerequisite: Understanding of the Petroleum engineering problems and phenomena

d) Rationale: To give an introduction to the Petroleum Engineering foundation that requires analysis of Transport Phenomena. It helps in formulation of a given physical problem in terms of appropriate conservation equations

e) Course Learning Objective:

CLOBJ 1	Understand the fundamental concepts of fluid mechanics including fluid properties, fluid statics, kinematics, and dynamics relevant to engineering applications.
CLOBJ 2	Explain fluid flow behavior and governing principles including continuity equations, Bernoulli's equation, and various flow classifications.
CLOBJ 3	Develop an understanding of momentum transport mechanisms and analyze velocity and pressure distributions in different flow systems.
CLOBJ 4	Understand the principles of energy transport and heat transfer including thermal conductivity, heat conduction, and energy balance applications.
CLOBJ 5	Apply mass transport principles involving diffusion mechanisms, Fick's law, concentration distribution, and transport equations in engineering systems.

f) Course Learning Outcomes:

CLO 1	Explain the fundamental principles of fluid mechanics including fluid properties, fluid statics, fluid kinematics, and fluid dynamics concepts.
CLO 2	Analyze fluid flow behavior by applying Bernoulli's equation, continuity equations, and motion equations under different flow conditions.
CLO 3	Apply momentum transport principles to determine viscosity effects, velocity distributions, and momentum transfer mechanisms in fluid systems.
CLO 4	Evaluate heat transfer phenomena using Fourier's law, energy balance equations, and heat conduction principles for different geometries and flow systems.

g) Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	1	0	4.00	20	20	0	60	40	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction: Continuum, Force, Stress, Strain, Solids vs. Fluids, Types of fluids, Fluid Properties, Newton's law of viscosity, Stokes' theorem, Fundamental Concepts: Fluid flow definition (Eulerian vs. Langrangian), System vs. Control Volume, Fluid Statics: Hydrostatic law, Pascal's law, Pressure at a point, Total Pressure, Barometric Equation. Fluid Kinematics: Types of flow (steady vs. unsteady, uniform vs. non uniform, laminar vs. turbulent, One, Two and Three dimensional, compressible vs. incompressible, rotational vs. Irrotational), Stream lines, path lines, streak lines, velocity components, stream function. Fluid Dynamics: Bernoulli's equation, Application of Bernoulli's equation	15	35
2	Viscosity, temperature effect on viscosity of gases and liquids, Mechanism of momentum transport, shell momentum balance, pressure and velocity distributions in falling film, circular tube, annulus, slit. Equations of Continuity and Motion.	9	20
3	Thermal conductivity, temperature and pressure effect on thermal conductivity of gases and liquids, Fourier's law, mechanism of energy transport, shell energy balance, temperature distribution in solids and laminar flow with different types of heat source, heat conduction through composite walls, cylinders, spheres, fins, slits.	9	20
4	Diffusivity, temperature and pressure effect, Fick's law, mechanism of mass transport, theory of diffusion in gases and liquids, shell mass balances, concentration distribution in solids and in laminar flow: stagnant gas film, heterogeneous and homogeneous chemical reaction systems, The	12	25

	equation of continuity, summary of equations of change and flux		

i) Text Book and Reference Book:

- . R.B. Bird, W.E. Stewart and E.W. Lightfoot, "Transport Phenomena", John Wiley, II Edition 2006.
- R.W.Fahien, "Elementary Transport Phenomena", McGraw-Hill, New York, 1983
- Robert, S Brodkey, Harry C. Hershey, "Transport Phenomena A Unified Approach", Brodkey Publishing 2003.
- L.S.Sissom, and D.R.Pitts, "Elements of Transport Phenomena", McGraw-Hill, New York, 1972. 4.
- J.R. Welty, R.W. Wilson, and C.W.Wicks, Rorer G.E, Wilson R.W. "Fundamentals of Momentum Heat and Mass Transfer", V Edn. John Wiley, New York, 2007

(6)

a) Course Name: Transport through Porous Media

b) Course Code: 03011704PE03

c) Prerequisite: Basics of Physics and Maths and in addition to the concepts of transport in porous media.

d) Rationale: The objective of this course is to impart knowledge on the concepts that governs the flow and transport processes in porous media. Also, this course aims to introduce about the basic concepts and techniques that are involved I computational modelling of flow and transport processes in porous media

e) Course Learning Objective:

CLOBJ 1	Understand the fundamental properties of porous media including pore structure, porosity, permeability, tortuosity, and characterization techniques used in engineering applications.
CLOBJ 2	Explain the governing principles of fluid flow in porous media and apply mass balance and momentum equations for steady and transient flow systems.
CLOBJ 3	Develop an understanding of multiphase flow behavior in porous media including relative permeability, wettability, capillary pressure, and interfacial phenomena.
CLOBJ 4	Analyze mass and heat transport mechanisms in porous media involving advection, diffusion, reactive transport processes, and energy balance concepts.
CLOBJ 5	Apply computational and numerical modeling techniques for simulating fluid flow and transport phenomena in porous and fractured media systems.

f) Course Learning Outcomes:

CLO 1	Have a detailed understanding on the fundamental concepts that defines porous media and its properties

CLO 2	Have developed conceptual and theoretical knowledge on single phase and multiphase fluid flow process in
CLO 3	Have acquired conceptual and theoretical knowledge on solute and heat transport processes that occurs in porous media
CLO 4	Have acquired conceptual and theoretical knowledge on solute and heat transport processes that occurs in porous media

g) Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	1	0	4	20	20	0	60	0	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Properties of Porous Media:** Industrial application of porous media; pore structure; volume averaging and Representative Elementary Volume (REV); single and multiple continuum; porosity, tortuosity, permeability, Kozeny-Carmen equation; Mercury porosimetry, helium pycnometry, BET analysis.	20	9
2	**Fluid flow in porous media:** Continuity/mass balance equation for porous media; momentum equation Darcy equation, Darcy-Brinkman equation, Darcy-Forchheimer equation. Steady state fluid flow in porous media; transient single phase fluid flow equation in porous media.	20	9
3	**Transport in porous media:** Transport of solute in porous media by advection and diffusion process; sorption; straining; coupled advection dispersion-reactive transport processes in porous media and its governing equation; Tracer analysis. Heat transport in porous media by conduction, convection, and radiation processes; Energy balance equation. Introduction to solute and heat transport in fractured porous media	42	16

4	**Computational modeling of flow and transport in porous media**: Introduction to numerical modelling by finite difference discretization and Lattice Boltzmann model. IMPES method for simulating multiphase flow; Methodology for simulating coupled flow and transport process in porous media	**12**	**18**

i) Text Book and Reference Book:

- Dynamics of Fluids in Porous Media: Jacob Bea
- Porous media Transport Phenomena: Faruk Civian
- Modeling Phenomena of Flow and Transport in Porous Media: Jacob Bear
- Essential of Heat and Fluid Flow in Porous Media: Arunn Narasimha

(7)

a) Course Name: Pipeline Engineering

b) Course Code: 03011704PE05

c) Prerequisite: This subject requires the basic Knowledge of Production Engineering and Mathematics

d) Rationale: These objectives aim to provide students with a comprehensive understanding of the transportation of petroleum products through pipelines, including the technical, economic, and environmental aspects involved in pipeline design, construction, and operation

e) Course Learning Objective:

CLOBJ 1	Understand different modes of petroleum transportation and compare their advantages, limitations, economics, and applications in the oil and gas industry.
CLOBJ 2	Develop knowledge of pipeline engineering fundamentals including pipeline projects, design standards, codes, and factors influencing onshore and offshore pipeline design.
CLOBJ 3	Apply hydraulic principles for the design of liquid and gas pipelines including pressure loss analysis, pipeline sizing, wall thickness determination, and power requirement calculations.
CLOBJ 4	Understand the construction and commissioning processes of pipelines for both onshore and offshore applications.
CLOBJ 5	Analyze pipeline operation and integrity management techniques including pigging, corrosion control, cathodic protection, instrumentation, and SCADA-based monitoring systems.

f) Course Learning Outcomes:

CLO 1	Design and construction principles of onshore and offshore pipelines, including compliance with pipeline codes

CLO 2	Able to integrate theoretical concepts with practical applications to analyze, design, and manage pipeline transportation systems effectively
CLO 3	Understand the factors influencing gas pipeline design, pressure loss calculations, hydraulic calculations specific to gas pipelines.
CLO 4	Gain awareness of safety protocols, environmental regulations, and mitigation measures associated with pipeline transportation and construction.

g) Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	1	0	4	20	20	0	60	0	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Modes and comparison among different modes of transportation** Modes and comparison among different modes of transportation of petroleum products, Advantages and limitations of pipelines modes, Introduction to pipeline project, Economics and cost structure of Pipeline project, Economic pipe diameter.	14	22
2	**Introduction to outline for Design & construction of onshore-offshore pipelines** Introduction to outline for Design & construction of onshore-offshore pipelines, Pipeline codes and standards, Overview of O & G field Processes, Types of Onshore/ Offshore Pipelines, Factors affecting pipeline design (External, fluid properties, pipeline parameters, and Fluid flow considerations. Loop- lines	15	26
3	**Design of Liquid pipelines** Hydraulic Analysis, Relevant Pipeline Parameters, Types of fluids, Pressure Loss calculations, Maximum allowable operating Pressure, Pipeline sizing, Diameter sizing, Determination of wall Thickness, Station Spacing Pumping Power calculations, Design of Gas Pipelines: Factors affecting Gas Pipeline Design, Pressure Loss calculations, Gas pipeline	16	26

	Hydraulic Calculations, Gas Compression / Power requirement		
4	**Construction of pipelines** Introduction, Onshore & Offshore pipeline Construction. Commissioning of pipeline. Pipeline Operations, Pigging, integrity assessment by Intelligent pigging and Instrumentation, Monitoring and Control Thru SCADA application, Corrosion, and control/ Cathodic Protection.	**15**	**26**

i) Text Book and Reference Book:

- Fundamentals of Pipeline Engineering, By Vincent, Jecqes (2010) | Gulf Publishing
- A quick guide to pipeline engineering By Alkazraji Duraid, (2008) | Woodhead Publishing Limite
- Piping and Pipeline Engineering, By Antaki, G. A. (2003) | Marcell Dekker.

(8)

a) Course Name: Petroleum Management, Marketing and Finance

b) Course Code: : 03011704PE07

c) Prerequisite: This subject requires the basic Knowledge of Production Engineering and Mathematics

d) Rationale: To introduce management principles applicable to the petroleum and energy industry, understand petroleum product marketing, pricing, and supply chain dynamics, develop financial decision-making skills for upstream, midstream, and downstream projects, and analyze economic feasibility and risk in oil and gas investments

e) Course Learning Objective:

CLOBJ 1	Understand the structure and operations of the petroleum industry including upstream, midstream, and downstream sectors, management functions, and organizational practices in oil and gas companies.
CLOBJ 2	Develop knowledge of petroleum marketing and supply chain systems including petroleum product classification, pricing mechanisms, distribution networks, logistics, and city gas distribution systems.
CLOBJ 3	Apply economic principles and cost analysis techniques for evaluating petroleum projects using cash flow analysis, cost estimation, depreciation, taxation, and economic indicators.
CLOBJ 4	Understand financial management concepts in the petroleum industry including sources of finance, financial statement analysis, and project financing approaches.
CLOBJ 5	Analyze investment decisions and risk factors in petroleum projects using decision-making tools such as sensitivity analysis, scenario analysis, and basic concepts of energy trading and hedging.

f) Course Learning Outcomes:

CLO 1	Explain management concepts and organizational structures in the petroleum industry.
CLO 2	Analyze petroleum product markets, pricing mechanisms, and distribution systems.
CLO 3	Apply financial and economic evaluation techniques to oil and gas projects.
CLO 4	Evaluate investment decisions considering risk, uncertainty, and energy market dynamics.

g) Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	**T**	**P**	**C**	**T**	**CE**	**P**	**Theory**	**P**	
3	**1**	**0**	**4**	**20**	**20**	**0**	**60**	**0**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h) Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Petroleum Industry Overview & Management Principles** Overview of the global and Indian petroleum industry, understanding of upstream, midstream, and downstream sectors, functions of management including planning, organizing, staffing, directing, and controlling, organizational structures in oil and gas companies, and fundamentals of project management in petroleum operations.	**14**	**22**
2	**Petroleum Marketing and Supply Chain Management** Petroleum products and their classification, oil and gas value chain, crude oil and petroleum product markets, pricing of crude oil and petroleum products, petroleum marketing channels and distribution	**15**	**26**

	networks, storage, transportation, and logistics systems, and an overview of City Gas Distribution (CGD) along with LNG and LPG marketing		
3	**Petroleum Economics and Cost Analysis** Time value of money, cash flow analysis for oil and gas projects, capital and operating costs in petroleum projects, depreciation, taxation, and royalties, break-even analysis, and evaluation of economic indicators such as Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period, and Profitability Index.	**16**	**26**
4	**Petroleum Finance, Risk, and Decision Analysis** Sources of finance in the petroleum industry, financial statements and ratio analysis, project financing and joint ventures, risk and uncertainty in oil and gas investments, sensitivity and scenario analysis, and an introduction to energy trading, hedging, and futures markets.	**15**	**26**

i) Text Book and Reference Book:

- Johnston, D., International Petroleum Fiscal Systems and Production Sharing Contracts.
- T. A. Ogunye, Petroleum Economics and Engineering.
- James l. smith petroleum economics.