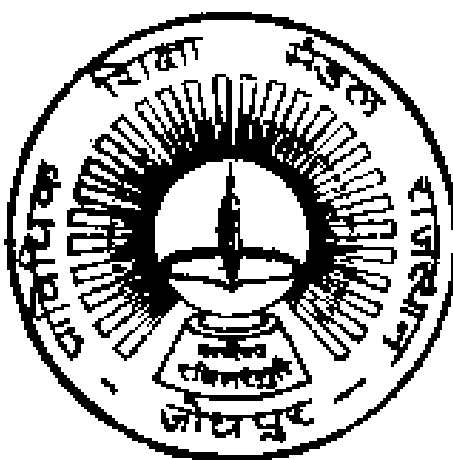


**GOVERNMENT OF RAJASTHAN**  
**BOARD OF TECHNICAL EDUCATION RAJASTHAN**  
**JODHPUR**

**SEMESTER SCHEME-2020-21**

(SESSION 2021-2022 & ONWARDS)



**TEACHING AND EXAMINATION SCHEME  
AND SYLLABUS**

**PETROLEUM ENGINEERING**

**(PE)**

.....  
Curriculum Development Cell  
Board of Technical Education, Rajasthan  
W-6 Residency Road,  
Jodhpur

GOVERNMENT OF RAJASTHAN  
BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR  
**TEACHING AND EXAMINATION SCHEME**  
(SEMESTER SCHEME-2020-21)  
**FOR DIPLOMA III SEMESTER PETROLEUM ENGINEERING (PE)**  
SESSION 2021-2022& ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assi	PR(S)		
PC	PE 3001	Fundamentals of Mechanical Engineering	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	PE 3002	Petroleum Geology	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	PE 3003	Drilling Technology-I	3	1	0	4	60	3	-	-	20	20	-	100	4
PC	PE 3004	Drilling Fluid and Cementing Technology	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	PE 3005	Reservoir Engineering	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	PE 3006	Fundamentals of Geophysics	2	0	0	2	60	3	-	-	20	20	-	100	2
PC	PE 3007	Drilling Fluid and Cementing Technology Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	PE 3008	Reservoir Engineering Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	PE 3009	Petroleum Geology Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	PE 3010	Surveying Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
SI	PE 3011	Summer Internship-I(4 weeks after II Sem.)	0	0	0	0	-	-	100	-	-	-	-	100	2
VS	*PE 3333	Anandam(Joy of Giving)	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	17	1	12	30	300		260		120	120	400	1200	26
Grand Total :														1200	26

- |  |   |
|--|---|
| 1. L : Lecture                                 | 5. PR : Marks for End Semester Exam for Practical                 |
| 2. T : Tutorial                                | 6. CT : Marks for class tests (Internal Assessment)               |
| 3. P : Practical                               | 7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment) |
| 4. TH : Marks for End Semester Exam for Theory | 8. PR(S) : Marks for practical and viva (Internal Assessment)     |

1. <sup>+</sup>PE 3333 is same in all branches of Engineering

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

GOVERNMENT OF RAJASTHAN  
BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR  
**TEACHING AND EXAMINATION SCHEME**  
(SEMESTER SCHEME-2020-21)  
**FOR DIPLOMA IV SEMESTER PETROLEUM ENGINEERING (PE)**  
SESSION 2021-2022& ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assi	PR(S)		
PC	PE 4001	Artificial Lift Techniques	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	PE 4002	Momentum Transfer	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	PE 4003	Drilling Technology-II	3	1	0	4	60	3	-	-	20	20	-	100	4
PE	PE 4004	<b>Programme Elective-I</b> <b>PE 40041-</b> Well Logging Technology <b>PE 40042-</b> Petroleum Formation Evaluation	3	0	0	3	60	3	-	-	20	20	-	100	3
PE	PE 4005	<b>Programme Elective-II</b> <b>PE 40051-</b> Petroleum Refining and Petrochemicals <b>PE 40052-</b> Chemistry of Hydrocarbons	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	PE 4006	Momentum Transfer Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	PE 4007	Heat Tranfser Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	PE 4008	Petroleum Product Testing Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PR	PE 4009	Minor Project	0	0	4	4	-	-	40	3	-	-	60	100	2
AU	*PE 4222	Essence of Indian Knowledge and Tradition	2	0	0	2	--	--	--	--	--	--	--	--	--
VS	*PE 4444	Anandam (Joy of Giving)	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		<b>Total</b>	<b>17</b>	<b>1</b>	<b>14</b>	<b>32</b>	<b>300</b>		<b>160</b>		<b>100</b>	<b>100</b>	<b>340</b>	<b>1000</b>	<b>23</b>
<b>Grand Total</b>														<b>1000</b>	<b>23</b>

- |  |   |
|--|---|
| 1. L : Lecture                                 | 5. PR : Marks for End Semester Exam for Practical                 |
| 2. T : Tutorial                                | 6. CT : Marks for class tests (Internal Assessment)               |
| 3. P : Practical                               | 7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment) |
| 4. TH : Marks for End Semester Exam for Theory | 8. PR(S) : Marks for practical and viva (Internal Assessment)     |

1. +PE 4222 and +PE 4444 are same in all branches of **Engineering**

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

**Note: Students will go for 6 Weeks Summer Internship in the Summer Vacations after Fourth Semester. The assessment of the Summer Internship will be done in Fifth Semester**

GOVERNMENT OF RAJASTHAN  
BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR  
**TEACHING AND EXAMINATION SCHEME**  
(SEMESTER SCHEME-2020-21)  
**FOR DIPLOMA V SEMESTER PETROLEUM ENGINEERING (PE)**  
SESSION 2022-2023 & ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assi	PR(S)		
PC	PE 5001	Natural Gas Engineering	2	0	0	2	60	3	-	-	20	20	-	100	2
PC	PE 5002	Petroleum Production Engineering	3	1	0	4	60	3	-	-	20	20	-	100	4
OE	+PE 5100	Open Elective-I +PE 51001- Economic Policies in India +PE 51002- Engineering Economics & Accountancy	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	PE 5003	Unconventional Hydrocarbon Resources	2	0	0	2	60	3	-	-	20	20	-	100	2
PE	PE 5004	Programme Elective-III PE 50041- Health Safety and Environment PE 50042- Unit Operations for Petroleum Industry	3	0	0	3	60	3	-	-	20	20	-	100	3
PE	PE 5005	Programme Elective-IV PE 50051- Well Test Analysis and EOR PE 50052- Petroleum Transportation and Storage	3	0	0	3	60	3	-	-	20	20	-	100	3
SI	PE 5006	Summer Internship-II(6 weeks after IVSem)	0	0	0	0	-	-	100	-	-	-	--	100	3
PR	PE 5007	Major Project	0	0	2	2	-	-	--	-	-	--	-	--	
VS	+PE 5555	Anandam(Joy of Giving)	0	0	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	0
		Total	16	1	6	23	360		100		120	120	100	800	22
Grand Total :														800	22

1. L : Lecture

2. T : Tutorial

3. P : Practical

4. TH : Marks for End Semester Exam for Theory

5. PR : Marks for End Semester Exam for Practical

6. CT : Marks for class tests (Internal Assessment)

7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)

8. PR(S) : Marks for practical and viva (Internal Assessment)

1. +PE 51001, +PE51002 and +PE 5555 are same in all branches of Engineering

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

**Note:Major Project will be continued and Assesed in VI Semester**

GOVERNMENT OF RAJASTHAN  
BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR  
**TEACHING AND EXAMINATION SCHEME**  
(SEMESTER SCHEME-2020-21)  
**FOR DIPLOMA VI SEMESTER PETROLEUM ENGINEERING (PE)**  
SESSION 2021-2022& ONWARDS SESSION 2022-2023 & ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assi	PR(S)		
PC	+PE 6111	Entrepreneurship and Start-ups	3	1	0	4	60	3	-	-	20	20	-	100	4
OE	+PE 6200	<b>Open Elective-II</b> +PE 62001- Project Management +PE 62002- Renewable Energy Technologies	3	0	0	3	60	3	-	-	20	20	-	100	3
OE	+PE 6300	<b>Open Elective-III</b> +PE 63001- Product Design +PE 63002- Disaster Management	3	0	0	3	60	3	-	-	20	20	-	100	3
AU	+PE 6333	Indian Constitution	2	0	0	2	--	--	--	--	--	--	--	--	--
PC	PE 6001	Offshore Drilling and Production Operation	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	PE 6002	Pipeline Engineering	3	0	0	3	60	3	-	-	20	20	-	100	3
PR	PE 6003	Major Project	0	0	6	6	--	--	40		--	--	60	100	4
SE	PE 6004	Seminar	1	0	0	1	-	-	--	-	-	-	100	100	1
VS	+PE 6666	Anandam (Joy of Giving)	0	0	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	-	-
		<b>Total</b>	<b>18</b>	<b>1</b>	<b>10</b>	<b>29</b>	<b>300</b>		<b>40</b>		<b>100</b>	<b>100</b>	<b>260</b>	<b>800</b>	<b>23</b>
<b>Grand Total</b>														<b>800</b>	<b>23</b>

- |  |   |
|--|---|
| 1. L : Lecture                                 | 5. PR : Marks for End Semester Exam for Practical                 |
| 2. T : Tutorial                                | 6. CT : Marks for class tests (Internal Assessment)               |
| 3. P : Practical                               | 7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment) |
| 4. TH : Marks for End Semester Exam for Theory | 8. PR(S) : Marks for practical and viva (Internal Assessment)     |

1. +PE 6111, +PE 62001, +PE62002, +PE 63001, +PE 63002, +PE 6333 and +PE 6666 are same in all branches of Engineering

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

**GOVERNMENT OF RAJASTHAN**  
**BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR**  
**SEMESTER SCHEME-2020-21**



**III SEMESTER**  
(SESSION 2021-2022 & ONWARDS)

**FUNDAMENTALS OF MECHANICAL ENGINEERING**

Course Code	PE 3001
Course Title	Fundamentals of Mechanical Engineering
Number of Credits	3 (L-3,T-0, P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

To impart knowledge on

- To understand the basic knowledge of thermodynamic systems used in Chemical Engineering operations.
- To understand basic knowledge of heat transfer and system.

**COURSE OUTCOMES**

On completion of the course, the students will be able to

- Understand the conceptual laws of thermodynamics
- Understand and analyze different thermodynamic cycles
- Understand the mode of heat transfer.

**COURSE CONTENTS:****1. BASIC CONCEPT OF THERMODYNAMICS**

- 1.1 Thermodynamics property-Intensive and Extensive, system - open, closed and isolated
- 1.2 Energy - Internal energy, potential energy, kinetic energy, heat, work, specific heat, enthalpy

**2. LAWS OF THERMODYNAMICS**

- 2.1 Zeroth law of thermodynamics
- 2.2 First law of thermodynamics.
- 2.3 Reversible and irreversible processes
- 2.4 Second law of thermodynamics Concept of entropy
- 2.5 Constant volume, constant pressure, isothermal, adiabatic, polytropic processes, work done during these processes.
- 2.6 simple numerical problems

**3. CONDUCTION**

- 3.1 Basic modes of heat transfer
- 3.2 Fourier's law (no derivation)
- 3.3 Heat transfer by conduction through a plane & composite wall
- 3.4 Radial Heat transfer by conduction through a cylinder
- 3.5 Overall Heat transfer coefficient
- 3.6 Critical insulation
- 3.7 simple numerical problems

**4. CONVECTION**

- 4.1 Introduction to convection
- 4.2 Types of convection
- 4.3 Definitions of Dimensionless number for heat transfer and their physical significance

**5. RADIATION**

- 5.1 Absorption, Reflection and transmission
- 5.2 Emissive power
- 5.3 Black body, white body & Grey body
- 5.4 Kirchhoff's law
- 5.5 Wien's displacement law

5.6 Planks law & Stefan Boltzman's law  
5.7 Radiosity

**REFERENCE BOOKS**

1. Nag, P. K., "Engineering Thermodynamics", Tata McGraw Hill Publishing Co. Ltd., New Delhi
2. Arora, C.P., "Thermodynamics", Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. Kumar D.S. Heat and Mass transfer
4. DC. Sikdar, "Process Heat Transfer and Chemical Equipment Design", Revised Ed., Khanna Publishing House
5. Binay K. Dutta, "Heat Transfer Principles and applications" Prentice Hall of India Pvt. Ltd.

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SEMESTER SCHEME 2020-21



**PETROLEUM GEOLOGY**

Course Code	PE 3002
Course Title	Petroleum Geology
Number of Credits	3 (L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- To impart knowledge on the Earth as a planet and its internal structure, particularly different kind of rocks in earth's crust.
- To understand Several kinds of minerals are trapped in crust between different layers of rocks
- To understand different geological exploration methods which are required in major exploration industries will be covered in this subject

**COURSE OUTCOMES:**

On completion of this course, the students will have knowledge on

- General properties of minerals and their classification.
- Various mapping techniques, forms of igneous intrusions - dyke, sill and batholiths.
- Nature of petroleum and natural gas, their origin and occurrence, trapping mechanism.
- Regional structural settings, geochemical surveys.
- Basin Analysis Interpretation of topographic maps.
- Present petroleum provinces in India and future opportunities.

**COURSE CONTENTS:****1. Introduction to Petroleum Geology:**

- 1.1 Types of Rock & Rock Cycle
- 1.2 General Properties of minerals and their classification
- 1.3 Petrology: Texture, Structures, Classification and description of Igneous and metamorphic rocks.
- 1.4 Mode of formation of sedimentary rock,
  - 1.4.1 Texture and its types, grain size, grain shape, sorting & composition.
  - 1.4.2 Mechanically and chemically formed Structures.
  - 1.4.3 Classification of sedimentary rocks and their characteristics
  - 1.4.4 Descriptions of sedimentary rocks.

**2. Source Rock:**

- 2.1 Definition of Source rock,
- 2.2 Organic rich sediments as source rock
- 2.3 Nature and types of source rock; Clay stone/shale
- 2.4 The process of diagenesis, catagenesis and metagenesis in the formation of source rock
- 2.5 Lime stone as source rock

**3. Reservoir Rocks:**

- 3.1 Characteristics of Reservoir rocks,
- 3.2 Classification and nomenclature: Clastic
- 3.3 Reservoir Rocks, Carbonate Reservoir Rocks,
- 3.4 Unconventional, Fractured and Miscellaneous reservoir rocks,
- 3.5 Marine and non-marine reservoir rocks,
- 3.6 Concept of Shale oil.

**4. Entrapment of hydrocarbons:**

- 4.1 Entrapment and accumulation of hydrocarbons,
- 4.2 Classification and types of traps: Structural, stratigraphic and combination type of traps, Traps associated with salt domes.

**5. Sedimentary Basins:**

- 5.1 Sedimentary basins -origin and classification,
- 5.2 Types of basins and their relationship to hydrocarbon prospects,

5.3 Tectonic classification, stratigraphic evolution and hydrocarbon accumulations of the following basins:

5.3.1 Krishna-Godavari basin,

5.3.2 Cambay basin and

5.3.3 Bombay off-shore.

**REFERENCE BOOKS**

1. Geology of Petroleum, A.I. Lavorsen
2. Elements of Petroleum Geology, Richard C.Selley and Stephen A.Sonnenberg
3. Basic Petroleum Geology, Peter.K.Link
4. Mineralogy by Dexter Perkins
5. Igneous and Metamorphic Geology by J.D. Winter

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SEMESTER SCHEME 2020-21

**DRILLING TECHNOLOGY-I**

Course Code	PE 3003
Course Title	Drilling Technology-I
Number of Credits	4 (L-3, T-1, P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES**

- To provide the knowledge of to develop an awareness of the equipment terminology and operations associated with the drilling process in surface mines
- Understand the basic laws governing chemical operations
- To updates the students about the classification of drilling methods, principle of rock tool interaction in drilling

**COURSE OUTCOMES:**

After completion of this course, the students will be able to:

- Understand the concepts and techniques used in well drilling.
- They will learn the design requirements of well planning and construction.
- Learn Drilling Process and Drilling Equipments.
- Optimize the design of a drilling program.
- Understand and analyse impact of drilling and production discharge.
- Understand and apply problems related to drilling and well planning.

**COURSE CONTENTS****1. Well Planning:**

- 1.1. Introduction to oil well drilling
- 1.2. Drilling planning approaches

**2. Rotary Drilling Method:**

- 2.1 Rig parts
- 2.2 Selection and general layout

**3. Drilling Operations & Practices:**

- 3.1 Hoisting, circulation, Rotation
- 3.2 Power plants and Power transmission
- 3.3 Rig wire line system handling & storage

**4. Casing Design:**

- 4.1 Design of casing string, Liner design and setting
- 4.2 Casing landing practices, Casing while drilling
- 4.3 Buckling criteria and Calculation of well head loads.

**5. Drill String:**

- 5.1 Parts function
- 5.2 Design

**6. Drill Bits:**

- 6.1 Classification of drag, rotary, roller, diamond and PDC bits.
- 6.2 Design criteria of drag, rotary, roller, diamond and PDC bits

**REFERENCE BOOKS**

1. Horizontal and Directional Drilling (HDD): Utility and Pipeline Applications (Civil Engineering); David Willough. Mc Graw Hill.
2. Petroleum Engineering Drilling & Well completion, Caryl Gatlin. Prentice Hall.
3. Introduction to Petroleum Production Vol.I, II, III, Dr. Skimmer Distributors.
4. Oil Well Drilling, H. Rabia

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**DRILLING FLUID AND CEMENTING TECHNOLOGY**

Course Code	PE 3004
Course Title	Drilling Fluid and Cementing Technology
Number of Credits	3 (L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- To introduce the basic functions and properties of drilling fluids and cement slurries
- To understand Compositions and related properties of drilling fluids and cement slurries

**COURSE OUTCOMES:**

On completion of this course, the students will have knowledge on

- General properties of drilling fluids and their classification.
- Concepts and applications of drilling fluids.
- Equipments involved in the cementing operations.
- Rheology of drilling fluids, Pressure loss calculations and Rig hydraulics.
- Designing and Factors influencing cement slurry design.

**COURSE CONTENTS****1. Overview of Drilling Fluids:**

- 1.1. Clay chemistry and its application to drilling fluids
- 1.2. Types of clays
- 1.3. Hydration, Flocculation, Aggregation and Dispersion

**2. Classification, Types and applications of drilling fluids:**

- 2.1 Water based, Oil based, Emulsion based, Polymer based
- 2.2 Surfactant based, Foam based and Aerated drilling fluids

**3. Drilling Fluid Characteristics:**

- 3.1 Basic functions, properties
- 3.2 Maintenance and treatments of drilling fluids

**4. Calculations :**

- 4.1 Drilling fluid calculations

**5. Cementing, Cements & cement slurry:**

- 5.1 Objectives of cementing
- 5.2 Oil well cements
- 5.3 Classification of cement
- 5.4 Slurry design, Slurry additives, Factors influencing cement slurry design
- 5.5 Cementing equipments

**6. Cementing Methods:**

- 6.1 Primary cementing, Stage cementing, Liner cementing
- 6.2 Plugging, Squeeze Cementing techniques in practice
- 6.3 Deep well cementing,
- 6.4 Characteristics of good quality cementation.

**REFERENCE BOOKS**

1. Oil Well Drilling, H. Rabia
2. Drilling Engineering, Harriot Watt

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**RESERVOIR ENGINEERING**

Course Code	PE 3005
Course Title	Reservoir Engineering
Number of Credits	3 (L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- To interpret cross plots, well characteristics, classification of crude and its physicochemical properties
- To understand Reservoir Rock Properties, Reservoir estimation and Phase behaviour of hydrocarbon system, ideal & non-ideal system necessary for reserve management

**COURSE OUTCOMES**

After completion of this course, the students will be able to :

- Understand characteristics and classification of crude and its physicochemical properties.
- Different correlations and laboratory measurements, data reduction, evaluation and application.
- Determination of porosity of rock surface tension of various petroleum fractions.
- Analyse different reserve estimation techniques.

**COURSE CONTENTS****1. Introduction:**

- 1.1 Introduction to reservoir engineering
- 1.2 Characteristics of crude oil and natural gas
- 1.3 Classification of crude and its physicochemical properties

**2. Reservoir Rock Properties:**

- 2.1 Porosity and permeability determination and Combination of permeability in parallel & series beds
- 2.2 Fluid saturation determination and significance
- 2.3 Effective and relative permeability
- 2.4 Wettability, capillary pressure characteristics, measurements and uses
- 2.5 Coring and Core Analysis

**3. Reservoir Fluids:**

- 3.1 Phase behavior of hydrocarbon system, ideal & non ideal system
- 3.2 Reservoir fluid sampling
- 3.3 PVT properties determination
- 3.4 Different correlations and laboratory measurements, data reduction, evaluation and application.

**4. Flow of Fluids through Porous Media:**

- 4.1 Darcy's law
- 4.2 Single and multiphase flow
- 4.3 Linear, radial & spherical flow
- 4.4 Steady state & unsteady state flow
- 4.5 GOR, WOR equations

**5. Reservoir Pressure, Drives and estimation :**

- 5.1 Reservoir Pressure Measurements: Techniques of pressure measurement
- 5.2 Reservoir Drives :Reservoir drive mechanics and recovery factors
- 5.3 Reserve estimation, Different reserve estimation techniques:

**6. Multi phase flow:**

- 6.1 Relative permeability-fractional flow
- 6.2 Well performance – inflow performance, tubing performance

**REFERENCE BOOKS**

1. "Petroleum reservoir engineering" – McGraw-hill-1998. Amyx. J. W. et al
2. "Reservoir Engineering", Tarek Ahmed

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**FUNDAMENTALS OF GEOPHYSICS**

Course Code	PE 3006
Course Title	Fundamentals of Geophysics
Number of Credits	2 (L-2, T-0, P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- To give impart knowledge Seismic refraction and interpretation.
- To understand various type of surveys, help in exploring hydrocarbon.

**COURSE OUTCOMES**

After completion of this course, the students will be able to:

- Understand characteristics of wave and seismic tool.
- Different correlations and Seismic data migration.
- Knowledge of Gravity and Magnetic Surveys.

**COURSE CONTENTS****1. Reflection Seismic**

- 1.1 Fundamental of wave theory
- 1.2 Information from seismic trace
- 1.3 Frequency filter,

**2. Seismology and the internal structure of the earth**

- 2.1 Introduction
- 2.2 Elasticity theory
- 2.3 The Seismograph
- 2.4 Seismic wave propagation
- 2.5 Internal structure of the earth

**3. Gravity**

- 3.1 Units of gravity
- 3.2 Gravity measuring instruments
- 3.3 Gravity survey, Gravity anomalies
- 3.4 Gravity data reduction Drift, latitude, Elevation and Free-air correction.

**4. Geo- magnetism**

- 4.1 The geomagnetic field
- 4.2 Magnetic anomalies.
- 4.3 Magnetic survey-instruments
- 4.4 Field method of magnetic surveys
- 4.5 Reduction of magnetic data

**REFERENCE BOOKS****TEXT BOOKS**

1. Fundamentals of Geophysics, Lowri, W., Cambridge University Press. (1997).
2. Applied Geophysics, Telford, W.M., Geldart L.P., Sheriff, R.E., Keys, D.A. (1990).
3. Introduction to Geophysical Prospecting, Dobrin M.B., New York, McGraw-Hill, Inc.

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**DRILLING FLUID AND CEMENTING TECHNOLOGY LAB**

Course Code	PE 3007
Course Title	Drilling Fluid and cementing Technology Lab
Number of Credits	1 (L-0, T-0, P-2)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

Understand and application of the principles & concepts of learned in momentum transfer theory course.

**COURSE OUTCOME:**

After completion of the course, student can able to

- Understand and application of the concept of manometers
- Understand and analyse the laminar and turbulent flow
- Understand the concepts of flow meters, pumps.

**PRACTICALS**

1. Measurement of mud weight
2. Measurement of mud plastic viscosity.
3. Measurement of gel strength.
4. Determination of filtration loss.
5. Determination of Sand content.
6. Determination of consistency of cement slurry.
7. Determination of the setting points of the cement based slurries.

**REFERENCES:**

1. Lab Manual
2. Oil Well Drilling, H. Rabia
3. Drilling Engineering, Hariot Watt

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**RESERVOIR ENGINEERING LAB**

Course Code	PE 3008
Course Title	Reservoir Engineering Lab
Number of Credits	1 (L-0, T-0, P-2)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- To impart hands on experience on different unit operation equipments.
- Apply principles developed in Mechanical Operations

**COURSE OUTCOME:**

After completion of the course, student can able to: -

- Understand the fundamentals involved in the Mechanical operations.
- understand and application of the concept of Particulate properties

**PRACTICALS**

1. Determination of porosity of rock samples by helium porosimeter
2. Determination of porosity of rock samples by Ruska porosimeter.
3. Determination of permeability (using both gas and liquid).
4. Pressure-Temperature phase diagram.
5. Ternary phase diagram with oil fraction/water/alcohol.
6. Study of total gas reserve

**REFERENCES:**

1. Lab Manual
2. "Petroleum reservoir engineering" – McGraw-hill-1998. Amyx.J.W. et al
3. "Reservoir Engineering", Tarek Ahmed

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**PETROLEUM GEOLOGY LAB**

Course Code	PE 3009
Course Title	Petroleum Geology Lab
Number of Credits	1 (L-0, T-0, P-2)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

Understand and properties of minerals and their classification of geology theory course.

**COURSE OUTCOMES**

On completion of this course, the students will have knowledge on

- General properties of minerals and their classification.
- Various mapping techniques, forms of igneous intrusions - dyke, sill and batholiths.
- Nature of petroleum and natural gas, their origin and occurrence, trapping mechanism.

**PRACTICALS**

1. Study of physical properties of the minerals
2. Study of physical properties of the rocks
3. Identification of minerals in hand specimen
4. Structure analysis with stereo net: s-pole diagram, B-pole diagram
5. Study of thin section of important minerals & rocks.
6. Study of topographical features from Geological maps
7. Interpretation of geological structures from surface geological maps
8. Interpretation of different Geological structure (Dip, Strike, etc.) in Contour maps.

Field visits for Geological structures & stratigraphy exposures.

**REFERENCE BOOKS**

1. Lab Manual
2. Geology of Petroleum, A.I. Lavorsen
3. Elements of Petroleum Geology, Richard C.Selley and Stephen A.Sonnenberg
4. Basic Petroleum Geology, Peter.K.Link

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**SURVEYING LAB**

Course Code	PE 3010
Course Title	Surveying Lab
Number of Credits	1 (L-0, T-0, P-2)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- To knowledge of measuring instrument and application.
- Student should be able to measure a irregular field and calculate its area.

**COURSE OUTCOME:**

After completion of the course, student can able to: -

- Understand the fundamentals surveying and plotting of survey data.
- understand and application of the preparation of survey maps and setting out works.

**PRACTICALS**

1. Study of
  - 1.1 Different types of chains and tapes
  - 1.2 Cross staff
  - 1.3 Optical square
  - 1.4 Line ranger
2. Use of Chains:
  - 2.1 Folding and unfolding
  - 2.2 Ranging and chaining on plane and sloping surface
  - 2.3 Setting right angles.
  - 2.4 Setting parallel lines.
  - 2.5 Taking offsets.
3. Chain surveying of small areas
4. Study of prismatic compass
5. Study of surveyor compass
6. Measurements of bearing of lines
7. Transverse by compass and adjustment of error
8. Study of the component parts and handling of
  - 8.1 Dumpy level
  - 8.2 Tilting level
  - 8.3 Staves
9. Temporary adjustments of a dumpy level and a tilting level
10. Use of dumpy level and tilting level in differential levelling and levelling for cross section and longitudinal section. Recording in level book and plotting.
11. Introduction to plane table survey.

**REFERENCES:**

1. Lab Manual
2. Surveying, K. R. Arora
3. Surveying Vol. I B.C. Punmia
4. Surveying Vol. II B.C. Punmia

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**GOVERNMENT OF RAJASTHAN**  
**BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR**  
**SEMESTER SCHEME-2020-21**



**IV SEMESTER**  
(SESSION 2021-2022 & ONWARDS)

**ARTIFICIAL LIFT TECHNIQUES**

Course Code	PE 4001
Course Title	Artificial Lift Techniques
Number of Credits	3 (L-3,T-0, P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- To study the fundamental concepts of heat transfer viz., conduction, convection and radiation.
- To use these fundamentals in typical engineering applications (Heat exchanger and Evaporator).

**COURSE OUTCOMES:**

On completion of the course, the student can able

- To Estimate Steady State Heat Transfer Rates.
- To Use Equations For Different Types Of Convection And Solve For Heat Transfer Rate By Convection
- To Estimate The Rate Of Heat Transfer By Radiation
- To Estimate Steam Economy, Capacity Of Single And Multiple Effect Evaporators.

**COURSE CONTENTS****1. Different types of Artificial lift**

- 1.1 Introduction, definition and purpose of artificial lift.
- 1.2 Gaslift – continuous and intermittent
- 1.3 Chamber lift
- 1.4 Electrical submersible pumping
- 1.4 Sucker rod pumping
- 1.5 Progressive cavity pump
- 1.5 Plunger lift
- 1.6 Hydraulic pump

**2. Reservoir Aspect of Artificial Lift**

- 2.1 Skin, permeability determination,
- 2.2 IPR curves, absolute open flow potential (AOFP) of well
- 2.3 Manipulation of sweep efficiency, mobility ratio, GOR and water cut
- 2.4 Selection of suitable artificial lift method

**3. Gas lift design**

- 3.1 Continuous Gas Lift
- 3.2 Intermittent Gas Lift
- 3.3 Type of Installations,
- 3.4 Gas Lift Mandrel
- 3.5 Surface equipment
- 3.6 Advances in Gas lift
- 3.7 Plunger lift,
- 3.8 Chamber lift.

**4. Sucker Rod pump Design**

- 4.1 Sucker rod pumping system
- 4.2 Pumping units
- 4.3 Sub-surface pump,
- 4.4 Sucker rod string
- 4.5 Gas and tubing anchors
- 4.6 Skinner bar
- 4.7 Well Head Equipment for SRP

**5 ESP**

- 5.1 Centrifugal electric submersible pumping system (ESP)
- 5.2 Surface and sub-surface component of ESP
- 5.3 Downhole components
- 5.4 Trouble shooting

**REFERENCE BOOKS:**

- 1 Principles of Artificial Lift; Niladri Kumar Mitra and Adesh Kumar; Allied Publishers Pvt.Ltd.
2. Production Engineering, Harriot Watt .

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SEMESTER SCHEME 2020-21

**MOMENTUM TRANSFER**

Course Code	PE 4002
Course Title	Momentum Transfer
Number of Credits	3 (L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- To impart the fundamental concepts of fluid
- To nurture the students to solve fluid dynamics problems.
- To enable students to compute friction factor and head loss in pipes and fittings.
- To impart the knowledge of metering and transportation of fluids and fluid moving machinery performance.

**COURSE OUTCOMES:**

On completion of the course, the students would have,

- The knowledge of fundamental concepts in fluids dynamics
- The ability to solve and fluid flow problems
- The ability to analyse frictional flow in pipes and piping networks and to compute the head loss and power requirements for petroleum process equipments.
- The ability to select the metering equipments and fluid moving machinery for appropriate petroleum engineering operations.

**COURSE CONTENTS:****1. PROPERTIES OF FLUIDS AND CONCEPT OF PRESSURE**

- 1.1 Fluid properties- Density, Specific volume, Specific gravity, Viscosity
  - 1.1.1 Newton's law of Viscosity
  - 1.1.2 Dynamic and Kinematic Viscosity
- 1.2 Types of fluids.
- 1.3 Pressure and its measurement by manometers

**2. FLUID KINETICS**

- 2.1 Types of flow
  - 2.1.1 Steady - Non steady
  - 2.1.2 Uniform - Non uniform
  - 2.1.3 Laminar - Turbulent
  - 2.1.4 One, Two, Three dimensional flow
- 2.2 Continuity equation (no proof)
  - 2.2.1 Assumption
  - 2.2.2 Rate of discharge for one dimensional flow

**3. HYDRODYNAMICS AND MEASUREMENT OF FLOW**

- 3.1 Energy of fluid - pressure, kinetic and potential
- 3.2 Bernoulli's theorem (no proof)
  - 3.2.1 Assumptions and its limitation
  - 3.2.2 Conversion of pressure into pressure head, velocity into kinetic head
- 3.3 Applications of Bernoulli's theorem for flow measurements
  - 3.3.1 Venturimeter
  - 3.3.2 Orificemeter
- 3.4 Numerical problems

**4. FLOW THROUGH PIPES**

- 4.1 Types of flow in pipes (Reynold's experiment)
  - 4.1.1 Laminar flow

- 4.1.2 Turbulent flow
- 4.1.3 Transient flow
- 4.2 Loss of head due to friction (No. proof)
  - 4.2.1 Darcy's Weisbach equations
  - 4.2.2 Chezy's formula
  - 4.2.3 Manning formula
- 4.3 Other energy losses in pipe (only expressions)
- 4.4 Pipe arrangement (series and parallel)
- 4.5 Transmission of power through pipes
- 4.6 Numerical problems

## 5. TRANSPORTATION OF FLUID FLOW

- 5.1 Pump classification
- 5.2 Centrifugal pumps
  - 5.2.1 Construction feature and working principle
  - 5.2.2 Mechanical manometric and overall efficiency
  - 5.2.3 Head of a pump - static, manometric
  - 5.2.4 Priming
- 5.2 Reciprocating pumps
  - 5.2.1 Types, construction and working principle
  - 5.2.2 Slip
  - 5.2.2 Air vessel
- 5.3 Advantages and disadvantages of Centrifugal pumps over Reciprocating pumps
- 5.4 Rotary pumps- gear pump and vane pump

## REFERENCE BOOKS

1. Fluid Mechanics & Machines Dr. Jagdish Lal
2. Fluid Mechanics & Machines Dr. R.K.Bansal
3. Fluid Mechanics & Machines R.S.Khurmi.
4. Hydraulics & Pneumatics H.L. Stewart.
5. Fluid Machines S.S. Ratan

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**DRILLING TECHNOLOGY II**

Course Code	PE 4003
Course Title	Drilling Technology -II
Number of Credits	4 (L-3, T-1, P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- To provide the knowledge of to develop an awareness of the equipment terminology and operations associated with the drilling process in surface mines.
- To updates the students about the Classification of drilling methods, Principle of rock tool interaction in drilling.

**COURSE OUTCOME**

After completion of this course, the students will be able to:

- Understand the concepts and techniques used in well drilling.
- They will learn the design requirements of well planning and construction.
- Learn Drilling Process and Drilling Equipments.
- Optimize the design of a drilling program.
- Understand and analyse impact of drilling and production discharge.
- Understand and apply problems related to drilling and well planning.

**CONTENTS****1. Directional Drilling**

- 1.1 Objectives
- 1.2 Types of deflection tools
- 1.3 Tool Orientation
- 1.4 Directional Well Profiles
- 1.5 Well path deflection & correction

**2. Down Hole Motors**

- 2.1 Positive displacement motors
- 2.2 Turbo-drills – motor description
- 2.3 Power calculation and applications
- 2.4 Auto Track System
- 2.5 Rotary Steerable motors
- 2.6 Geo Steering Tools

**3. Horizontal Well Drilling :**

- 3.1 Horizontal well objectives and selection
- 3.1 Different profiles
- 3.2 Drilling techniques
- 3.3 Mud requirements & characteristics
- 3.4 Casing and drill string requirements and completion programs
- 3.5 Slant Hole Drilling
  - 3.5.1 Objectives and selections
  - 3.5.2 Well profiles and applications.

**4. Down the Hole Well Surveying**

- 4.1 Well surveying objectives
- 4.2 Surveying methods
- 4.3 Surveying Analysis methods
- 4.4 Calculations for well coordinates

**5. Measurements While Drilling**

- 5.1 Objectives of MWD/ LWD, MWD tools
- 5.2 Telemetry system and data interpretation
- 5.3 Directional Drilling



**6. Special Methods of Drilling:**

- 6.1 Aerated drilling
- 6.2 Under-balanced drilling
- 6.3 Overbalanced drilling
- 6.4 HPHT Drilling
- 6.5 Variable pressure regime
- 6.6 Plasma drilling
- 6.7 Electrical Drilling
- 6.8 Top drive drilling
- 6.9 Re-entry drilling
- 6.10 Jet Drilling
- 6.11 Extended reach drilling
- 6.12 Multilateral drilling
- 6.13 Slim hole drilling
- 6.14 Coil tubing drilling

**REFERENCE BOOKS**

1. "Drilling & Casing Operations, Jim Short, J.A., Penwell Publishing Company Oklahoma
2. Well Design Drilling & Production, Craft B.C., Prentice Hall 1962
3. Horizontal and Directional Drilling, Carden, R. S., Petroskills, 2007

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**WELL LOGGING TECHNOLOGY**

Course Code	PE 40041
Course Title	Well Logging Technology
Number of Credits	3 (L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PE

**COURSE LEARNING OBJECTIVES:**

- To introduce various well logging techniques and their uses. Student will become familiar with aims and objectives of well logging
- To understand fundamental concepts in borehole geophysics physical properties of reservoir rocks

**COURSE OUTCOMES:**

After completion of this course, the students will be able to:

- Understand the concept of formation evaluation and well logging and techniques involved in it.
- Methods of gathering formation evaluation data from logging techniques.
- Methods of analysis and application of results
- Understand the physical principles of the tools used in logging.
- Characterize the formation based on interpretation of well logs.
- Recording, transmission and processing of log data.

**COURSE CONTENTS****1. Introduction to Well Logging**

- 1.1 Introduction
- 1.2 Preparing a Logging program
- 1.3 Borehole Environment
- 1.4 Resistivity Profile

**2. Logging Operations**

- 2.1 Mud logging, Coring
- 2.2 MWD
- 2.3 Open hole logging
- 2.4 Cased hole logging
- 2.5 Modern logging techniques

**3. Open hole Logging Measurements**

- 3.1 The SP Log,
- 3.2 The Gamma Ray Log
- 3.3 Resistivity Measurements
- 3.4 Induction Logging, Latero log, Micro resistivity Log, Dielectric Logs, Sonic (Acoustic) Logging and Elastic

**4. Analysis of Logs and Cores**

- 4.1 Compatibly Scaled Overlays, Cross plots, Histograms
- 4.2 Porosity Estimation From Neutron
- 4.3 Cross Plots:
  - 4.3.1 Density Logs, Sonic Logs Using Various Cross plot and Overlay Techniques
  - 4.3.2 Lithology Identification From Various Cross plots and Other Types of Plots

**5. Water Saturation and Archie Equation**

- 5.1  $R_w$  Determination Using SP Log, Ratio Techniques, Crossplots,
- 5.2 Archie Equation
- 5.3 Saturation Exponent- $n$  And Formation Factor- $m$  For Clean Formation.

**REFERENCE BOOKS:**

1. Modern Open Hole Log Interpretation, John. T. Dewan
2. Well Logging Data Acquisition and Application O&L Serra TECHNIP.
3. Handbook of Well Log Analysis, S.J. Pirson
4. Log Interpretation Principles and Applications, Schlumberger Educational services.

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SEMESTER SCHEME 2020-21

**PETROLEUM FORMATION EVALUATION**

Course Code	PE 40042
Course Title	Petroleum Formation Evaluation
Number of Credits	3 (L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PE

**COURSE LEARNING OBJECTIVES:**

- It involves detailed and systematic data acquisition, gathering, analysis and interpretation both qualitatively and quantitatively while applying scientific and engineering principles
- It is an ever growing and evolving field of petroleum engineering

**COURSE OUTCOMES**

After completing this course, the student will be able to

- Apply different logging methods for the evaluation of subsurface formations
- Apply principles of mud logging in the recognition of oil and gas show
- Apply principles of physics in the recognition and calculation of different parameters of formations
- Apply quick look interpretation methods in the evaluation of hydrocarbon recognition
- Interpret broad depositional environment from log signatures
- Develop awareness of recent developments in the evaluation of formations.

**COURSE CONTENTS****1. Introduction**

- 1.1 Petrophysical measurements to sub-surface engineering
- 1.2 Mud logging
- 1.3 Core

**2. Open hole Logs**

- 2.1 Principles, Types of tools, Limitation and Applications
  - 2.1.1 SP and resistivity logs
  - 2.1.2 Radioactive logs
  - 2.1.3 Acoustic logs

**3. Cased Hole Logging**

- 3.1 Introduction, type of tools
- 3.2 principles, limitations and applications

**4. Special Type of Logging Tools**

- 4.1 principles, application and limitation : Casing inspection tools
- 4.2 Formation micro scanner (FMS)
- 4.3 NMR logging principles, Logging in high-angle wells

**5. Log Interpretation and Analysis Techniques**

- 5.1 Standard log interpretation methods
- 5.2 Cross-plotting methods: neutron-density, sonic-density and sonic-neutron etc
- 5.3 Clean sand interpretation
- 5.4 Concepts of invasion – RXO, Tornado charts
- 5.5 Shaly sand interpretation

**REFERENCE BOOKS**

1. B.K. Bhaskarao, Bulk Chemicals from Petroleum, Khanna Publishing House
2. B. K. Bhaskara, "Modern Petroleum Refining Processes", Oxford and IBH Publishing Company, New Delhi.
3. W.L. Nelson, "Petroleum Refinery Engineering", McGraw Hill, New York.
4. O.P. Gupta, "Elements of Petroleum Refinery Engineering", Khanna Publishing House
5. Saikat Maitra & O.P. Gupta, "Elements of Petrochemical Engineering", Khanna Publishing House New Delhi

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**PETROLEUM REFINING AND PETROCHEMICALS**

Course Code	PE 40051
Course Title	Petroleum Refining and Petrochemicals
Number of Credits	3 (L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PE

**COURSE LEARNING OBJECTIVES:**

- To interpret the fundamental and methodologies in the petroleum refining processes, concepts of petrochemicals, polymerization and the unit operations involved in it.
- To Student will learn unit process involved in the petroleum refining process and polymerization

**COURSE OUTCOMES**

At the end of this course, the student will be able to:

- Establish the link between the upstream and downstream petroleum industry.
- Know the composition of crude oil, along with its properties and characterization methods.
- Understand the purification and fractionation process of crude oil.
- Get conversant the conversion processes of the various products from distillation.
- Select a good grade of lubricating oil and bitumen.
- Address the issues related to pollution from refineries.

**COURSE CONTENTS****1. Introduction**

- 1.1 Origin, exploration of Petroleum
- 1.2 Types of crudes, composition, characteristics
- 1.3 Crude heating, primary distillation principles
- 1.4 Atmospheric distillation
- 1.5 Vacuum distillation
- 1.6 Types of trays, drawoffs, quality control

**2. Solvant Treatment and Extraction**

- 2.1 Lube oil and wax processing
- 2.2 Solvent extraction, dewaxing desilting
- 2.3 Deasphalting, clay contacting
- 2.4 Types and functions of secondary processing
- 2.5 Cracking, thermal cracking and visbreaking,

**3. Catalytic cracking and reforming**

- 3.1 Fluid catalytic feed stocks and product yields and qualities
  - 3.1.1 Catalyst and operating parameters
- 3.2 Steam Reforming, Hydrogen, Synthesis gas
- 3.3 olefins, Diolefins, Acetylene and Aromatics and their separation

**4. Unit Processes**

- 4.1 Alkylation, dehydrogenation,
- 4.2, Isomerisation

**5. Polymerisation**

- 5.1 Classification of polymers
- 5.2 Production of polyethylene, PVC, Polypropylene, SAN, SBR
- 5.3 Polyacrylonitrile, Polycarbonates, Polyurethanes

**REFERENCE BOOKS:**

1. Modern Petroleum Refining Processes" Edition 3, B.K. Bhaskara Rao
2. Unit Processing in Organic Synthesis" Edition 5, Tata McGraw Hill Groggins
3. Petroleum Refinery Engineering", McGraw Hill Nelson W.L.
4. Petroleum Refinery Distillation, second edition Watkins, R.N.

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**CHEMISTRY OF HYDROCARBONS**

Course Code	PE 40052
Course Title	Chemistry of Hydrocarbons
Number of Credits	3 (L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PE

**COURSE LEARNING OBJECTIVES:**

- To make the students familiar with the Origin and formation of Petroleum to Student will learn unit process involved in the petroleum refining process and polymerization
- To imparted the knowledge of Characterisation and properties of Crude oil and Gaseous fuels,

**COURSE OUTCOMES**

At the end of the course the students will be having:

- 1.Information about the Reserves and deposits of Hydrocarbon in India.
- 2.Characteristics and Classification of Crude oil.
- 3.Chemical Reactions of Hydrocarbons
- 4.Varrious types and characteristics of Gaseous fuels.
- 5.Properties of Crude Oil.

**COURSE CONTENTS****1 Origin and formation of Petroleum**

- 1.1 Reserves and deposits of Hydrocarbon in India
- 1.2 Indian Petroleum Industry.
- 1.3 Composition of crude Oils, ultimate and chemical composition,
- 1.4 Hydrocarbons in petroleum, Asphaltenes and Resins,
- 1.5 Bench mark crudes.

**2 Characterization of crude oils**

- 2.1 TBP and ASTM distillation,
- 2.2 Classification by chemical composition,
- 2.3 Correlation Index. Density, API gravity, Viscosity, UOP characterization factor, etc.
- 2.4 ASTM, TBP, EFV distillation curves.

**3 Properties of crude oil**

- 3.1 Properties of crude oil octane no. etc
- 3.2 Pre-treatment, Electric desalting.
- 3.3 Atmospheric and vacuum distillation,
- 3.4 Petroleum products and their quality control tests.

**4 Value addition of petrochemicals**

- 4.1 From feedstock to consumer end products
- 4.2 Chemical reactions of hydrocarbons
  - 4.2.1 Decomposition (Thermal & Catalytic)
  - 4.2.2 Isomerisation
  - 4.2.3 Hydrogenation
  - 4.2.4 Alkylation

**REFERENCE BOOKS:**

1. Bhaskar Rao,, "Modern Petroleum Refining Processes", Oxford & IBH Co. Pvt. Ltd., New Delhi, 4/e,2002, Reference Books 1. Speight, J.C.; "The Chemistry and Technology of Petroleum", Marcel Dekkar, New York, 3/e1999.
2. Lucas, A.G. (ed.), "Modern Petroleum Technology", Vol. 2, Downstream, John Wiley & Sons Limited, New York, 6/e, 2000.
3. Hobson, G.D., "Modern Petroleum Technology" Vol I & II, John Wiley & Sons, New York, 5/e, 1984 4. Prasad, R., "Petroleum Refining Technology", Khanna Publishers, New Delhi, 2000

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**MOMENTUM TRANSFER LAB**

Course Code	PE 3006
Course Title	Momentum Transfer Lab
Number of Credits	1 (L-0, T-0, P-2)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

Understand and application of the principles & concepts of learned in momentum transfer theory course.

**COURSE OUTCOME:**

After completion of the course, student can able to

- Understand and application of the concept of manometers
- Understand and analyse the laminar and turbulent flow
- Understand the concepts of flow meters, pumps.

**PRACTICALS**

To conduct experiment to study

1. Study of constructional features and working of different types of manometers and pressure gauges
2. Verification of Bernoulli's theorem
3. Measurement of flow by orifice and venturimeter
4. Study of pitot tube and rotameters
5. To determine friction loss in flow through pipes
6. To study constructional features of centrifugal pumps
7. To study constructional features of reciprocating pumps
8. To study constructional features of gear pumps
9. To study Reynolds's apparatus to determine laminar, transition and turbulent flow

**REFERENCES:**

1. Lab Manual
2. Fluid Mechanics & Machines Dr. R.K.Bansal
3. Fluid Mechanics & Machines R.S.Khurmi
4. W. L. McCabe, J.C. Smith and P. Harriott, "Unit operations of Chemical Engineering", McGraw Hill, International Edn.
5. G Chandrasekhar, Laboratory Experiments in Chemical and Allied Engineering, Penram International Publishing (India) Pvt. Ltd.

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**HEAT TRANSFER LAB**

Course Code	PE 4007
Course Title	Heat Transfer Lab
Number of Credits	1 (L-0, T-0, P-2)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

To provide exposure on heat transfer equipments of chemical industry.

**COURSE OUTCOMES**

The students will understand how heat transfer occurs for different equipments and worked out the parameters studied in theory.

**PRACTICALS**

1. To study heat transfer through composite wall
2. To study heat transfer through lagged pipe.
3. To study heat transfer through forced convection apparatus
4. To study the double pipe heat exchanger.
5. To study shell and tube heat exchanger
6. To study plate type heat exchanger
7. To study Stefan-Boltzmann law
8. To study single effect evaporation
9. To study triple effect evaporation
10. To study condensation in vertical condenser

**REFERENCE BOOKS**

1. *Lab Manual*
2. *W. L. McCabe, J.C. Smith and P. Harriott, "Unit operations of Chemical Engineering", McGraw Hill, International Edn.,*
3. *G Chandrasekhar, Laboratory Experiments in Chemical and Allied Engineering:, Penram International Publishing (India) Pvt. Ltd.,*

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**PETROLEUM PRODUCT TESTING LAB**

Course Code	PE 4008
Course Title	Petroleum Product Testing Lab
Number of Credits	1 (L-0, T-0, P-2)
Prerequisites	NIL
Course Category	PC

**PRACTICALS**

1. Measurement of fire point- Flash point
2. Measurement of Cloud point
3. Measurement of pour point.
4. Measurement of Aniline point
5. Measurement of Bromine number
6. Measurement of Reid Vapour Pressure
7. Measurement of Sulphur Content
8. Measurement of Carbon Residue.

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SEMESTER SCHEME 2020-21

**ESSENCE OF INDIAN KNOWLEDGE AND TRADITION**

Course Code	PE 4222(Same in All Branches of Engg.)
Course Title	Essence of Indian Knowledge and Tradition
Number of Credits	0(L-2, T-0, P-0)
Prerequisites	None
Course Category	AU

**COURSE CONTENTS:**

Basic Structure of Indian Knowledge System:

- (i) वेद,
- (ii) उन्नवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थानत्यआदद)
- (iii) वेदधाथांग (शिक्षा, कलत्र, ननरुत, व्याकरण, ज्योनतषछथांद),
- (iv) उन्नथाइग (धर्मशास्त्र, र्ीर्थाथांसथा, नुस्थान, तकरशास्त्र)
  - Modern Science and Indian Knowledge System
  - Yoga and Holistic Health care
  - Case Studies.

**REFERENCES /SUGGESTED LEARNING RESOURCES:**

1. V. Sivarama Krishna, " Cultural Heritage of India- Course Material", Bhartiya Vidya Bhavan, Mumbai, fifth Edition, 2014.
2. Swami Jitatmanand, " Modern Physics and Vedant", Bhartiya Vidya Bhavan.
3. Fritz of Capra, " The wave of Life".
4. Fritz of Capra, " Tao of Physics".
5. V N Jha, " Tarka sangraha of Annam Bhatta, International" Cinmay Foundation, Velliarnad, Amakum.
6. R N Jha, " Science of Consciousness Psychotherapy and Yoga Practices" Vidya nidhi Prakasham, Delhi, 2016.

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**GOVERNMENT OF RAJASTHAN**  
**BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR**  
**SEMESTER SCHEME-2020-21**



**V SEMESTER**  
(SESSION 2021-2022 & ONWARDS)

**NATURAL GAS ENGINEERING**

Course Code	PE 5001
Course Title	Natural Gas Engineering
Number of Credits	2 (L-2, T-0, P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- To take a comprehensive look at several aspects of gas reservoir engineering.
- To includes various techniques, including basic gas reservoir engineering, properties of natural gas, material balance, and gas reserve determination.

**COURSE OUTCOMES:**

After completion of this course, the students will be able to :

- Understand the basic concept and applications of Natural Gas Engineering.
- Understand the Natural gas processing, Gas Compression, Gas
- Analyze Gathering and Transport Installation.
- Operation and trouble shooting of natural gas pipelines.
- Understand the Current Technology for Shale Gas and Tight Gas Exploration and Production .
- Understand various treatment process of natural gas like : sweetening.

**COURSE CONTENTS****1. Introduction**

- 1.1. Composition of Natural Gas
- 1.2. Utilization of Natural Gas, Natural Gas Industry
- 1.3. Natural Gas Reserves, Types of Natural Gas Resources
- 1.4. Future of the Natural Gas Industry

**2. Properties of Natural Gas**

- 2.1 Physical properties of natural gas and hydrocarbon liquids associated with natural gas
- 2.1 Reservoir aspects of natural gas

**3. Gas Compression**

- 3.1 Types of Compressors, Selection
- 3.2 Heat and Mass Transfer Principles and Applications in Natural Gas Engineering

**4. Natural Gas Processing**

- 4.1 Field separation and oil absorption process
- 4.2 Liquefaction Process, Dehydration of Natural Gas
- 4.3 Sweetening of Natural gas and sulphur recovery
- 4.4 Processing for LPG, CNG, system,

**5. Gas Gathering, Transport and Storage**

- 5.1 Gas Gathering System. Steady Flow in Simple Pipeline System
- 5.2 Steady State and non Steady State Flow in Pipelines
- 5.3 Solution for Transient Flow
- 5.4 Transmission of Natural Gas, Specifications. Underground Storage and Conservation of Natural Gas

**REFERENCE BOOKS**

1. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing
2. Natural Gas Engineering, Sanjay Kumar

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**PETROLEUM PRODUCTION ENGINEERING**

Course Code	PE 5002
Course Title	Petroleum Production Engineering
Number of Credits	4 (L-3, T-1,P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- to provide knowledge of production operations in the oil and gas wells such as Surface and subsurface equipments.
- Basics of oil and gas production engineering techniques will be covered in this subject.

**COURSE OUTCOMES:**

After completion of this course, the students will be able to:

- Demonstrate working principle and design of separators.
- Illustrate various equipment and processes for the treatment on produced emulsion.
- Understand mechanism and factors of oil field corrosion and methods for prevention.
- Understand and apply production logging operations.
- Do problem well analysis and apply new techniques to sustain production rates.

**COURSE CONTENTS:****1. Well Equipment**

- 1.1 Well Head Equipments
- 1.2 Christmas tree, valves, hangers
- 1.3 Flow control devices
- 1.4 Packers
- 1.5 Tubular and flow lines.

**2. Field Processing of Oil & Gas**

- 2.1 Flash and stage separation of oil & gas
- 2.2 oil & gas separators, mist extractor
- 2.3 fluid level and pressure control system, Control valve sizing
- 2.4 Vertical and horizontal separators, metering separators, Spherical Separator
- 2.5 Working pressure and safety feature in oil & gas separators
- 2.7 Removal of suspended solid & water from oil & gas
- 2.8 Scrubbers and wash tank
- 2.9 Demulsification and desalting

**3. Well Completion and Servicing**

- 3.1 Well Completion Types
  - 3.1.1 Open Hole
  - 3.1.2 Cased Hole
  - 3.1.3 Liner Completion
- 3.2 Completion Equipment
  - 3.2.1 SSV
  - 3.2.2 SSSV
  - 3.2.3 Mandrels
- 3.3 Workover Rig and types
- 3.4 Workover Planning
- 3.5 Well Problem requiring Workover
- 3.6 Workover and Completion Fluid, types and Selection

**4. Well Production Problems and mitigation**

- 4.1 Scale formation
- 4.2 Paraffin deposition
- 4.3 Formation damage

**5. Designing Gravel Pack for Sand Control**

- 5.1 Sand Control Techniques

- 5.2 Formation Sand Size Analysis
  - 5.2.1 Optimum gravel - sand ratio
  - 5.2.2 Gravel pack thickness
  - 5.2.3 Gravel selection
- 5.3 Gravel packing fluid & gravel pack techniques

**REFERENCE BOOKS:**

1. Surface Production Operations Ken Arnold
2. Petroleum Production systems Michalle J. Economides,A. Denniel Hill Christine Ehlig-Economides and Ding Zhu
3. Petroleum Production Operations Lewis W. Hall and Jodie Leecraft
4. Production Operations , T.O. Allen

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SEMESTER SCHEME 2020-21

**ECONOMIC POLICIES IN INDIA**

Course Code	PE 51001(Same in All Branches of Engg.)
Course Title	Economic Policies in India
Number of Credits	3 (L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

**COURSE LEARNING OBJECTIVES:**

The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy.

CO1	Understand Indian economics policy, planning strategies
CO2	It will enable to students to comprehend theoretical and empirical development across countries and region for policy purposes
CO3	Development Economics as a discipline encompasses different approaches to the problems of unemployment, poverty, income generation, industrialization from different perspectives
CO4	Able to identify the problems and capable to decide the application for future development
CO5	Analyse economic issues and find solutions to complex economic problems and take correct economic judgment.

**COURSE CONTENTS:****1. BASIC FEATURES AND PROBLEMS OF INDIAN ECONOMY:**

- 1.1. Economic History of India;
- 1.2. Nature of Indian Economy
- 1.3. Demographic features and Human Development Index,
- 1.4. Problems of Poverty, Unemployment, Inflation, income inequality, Blackmoney in India.

**2. SECTORAL COMPOSITION OF INDIAN ECONOMY:**

- 2.1. Issues in Agriculture sector in India,
- 2.2. land reforms
- 2.3. Green Revolution
- 2.4. agriculture policies of India,
- 2.5.

**3. INDUSTRIAL DEVELOPMENT,**

- 3.1. Small scale and cottage industries,
- 3.2. Industrial Policy,
- 3.3. Public sector in India,
- 3.4. Service sector in India.

**4. ECONOMIC POLICIES:**

- 4.1. Economic Planning in India,
- 4.2. Planning commission v/s NITI Aayog,
- 4.3. Five Year Plans,
- 4.4. Monetary policy in India,
- 4.5. Fiscal Policy in India,
- 4.6. Centre state Finance Relations,
- 4.7. Finance commission in India
- 4.8. LPG policy in India

**5. EXTERNAL SECTOR IN INDIA**

- 5.1. India's foreign trade value composition and direction,
- 5.2. India Balance of payment since 1991,
- 5.3. FDI in India,
- 5.4. Impact of Globalization on Indian Economy,

5.5. WTO and India.

**REFERENCE BOOKS:**

1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy .S Chand & Co.Ltd. New Delhi.
2. Mishra S. K & V. K Puri (2017). Indian Economy and Its Development Experience. Himalaya Publishing House.
3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, NewDelhi
6. Kaushik Basu (2007): The Oxford Companion to Economics of India ,Oxford University Press.

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SEMESTER SCHEME 2020-21



**ENGINEERING ECONOMICS & ACCOUNTANCY**

Course Code	PE 51002(Same in All Branches of Engg.)
Course Title	Engineering Economics & Accountancy
Number of Credits	3 (L:3,T:0,P:0)
Prerequisites	NIL
Course Category	OE

**COURSE OBJECTIVES**

- To acquire knowledge of basic economics to facilitate the process of economic decision making.
- To acquire knowledge on basic financial management aspects.
- To develop the basic skills to analyse financial statements.

**COURSE OUTCOMES:**

At the end of the course, the student will be able to:

CO1	Understand the macro-economic environment of the business and its impact on enterprise
CO2	Understand cost elements of the product and its effect on decision making
CO3	Prepare accounting records and summarize and interpret the accounting data for managerial decisions
CO4	Understand accounting systems and analyze financial statements using ratio analysis
CO5	Understand the concepts of financial management and investment

**COURSE CONTENTS****1. INTRODUCTION:**

- 1.1. Managerial Economics;
- 1.2. Relationship with other disciplines;
- 1.3. Firms: Types, objectives and goals;
- 1.4. Managerial decisions;
- 1.5. Decision analysis.

**2. DEMAND & SUPPLY ANALYSIS:**

- 2.1. Demand;
  - 2.1.1. Types of demand;
  - 2.1.2. Determinants of demand;
  - 2.1.3. Demand function;
  - 2.1.4. Demand elasticity;
  - 2.1.5. Demand forecasting;
- 2.2. Supply;
  - 2.2.1. Determinants of supply;
  - 2.2.2. Supply function;
  - 2.2.3. Supply elasticity.

**3. PRODUCTION AND COST ANALYSIS:**

- 3.1. Production function;
- 3.2. Returns to scale;
- 3.3. Production optimization;
- 3.4. Least cost input; Iso quants;
- 3.5. Managerial uses of production function;
- 3.6. Cost Concepts;
  - 3.6.1. Cost function;
  - 3.6.2. Types of Cost;
  - 3.6.3. Determinants of cost;
  - 3.6.4. Short run and Long run cost curves;
  - 3.6.5. Cost Output Decision;
  - 3.6.6. Estimation of Cost.

**4. PRICING:**

- 4.1. Determinants of Price;
- 4.2. Pricing under different objectives and different market structures;
- 4.3. Price discrimination;
- 4.4. Pricing methods in practice;
- 4.5. Role of Government in pricing control.

**5. FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT):**

- 5.1. Balance sheet and related concepts;
- 5.2. Profit & Loss Statement and related concepts;
- 5.3. Financial Ratio Analysis;
- 5.4. Cash flow analysis;
- 5.5. Funds flow analysis;
- 5.6. Comparative financial statements;
- 5.7. Analysis & Interpretation of financial statements;
- 5.8. Investments;
- 5.9. Risks and return evaluation of investment decision;
- 5.10. Average rate of return;
- 5.11. Payback Period;
- 5.12. Net Present Value;
- 5.13. Internal rate of return,

**REFERENCE BOOKS:**

1. Mc Guigan, Moyer and Harris, 'Managerial Economics; Applications, Strategy and Tactics', Thomson South Western, 10<sup>th</sup> Edition, 2005.
2. Prasanna Chandra. 'Fundamentals of Financial Management', Tata Mcgraw Hill Publishing Ltd., 4<sup>th</sup> edition, 2005.
3. Samuelson. Paul A and Nordhaus W. D., 'Economics', Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.
4. Paresh Shah, 'Basic Financial Accounting for Management', Oxford University Press, New Delhi, 2007.
5. Salvatore Dominick, 'Managerial Economics in a global economy'. Thomson South Western, 4<sup>th</sup> Edition, 2001.

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**UNCONVENTIONAL HYDROCARBON RESOURCES**

Course Code	PE 5003
Course Title	Unconventional Hydrocarbon Resources
Number of Credits	2(L-2, T-0, P-0)
Prerequisites	NIL
Course Category	PC

**COURSE LEARNING OBJECTIVES:**

- to provide an overview of unconventional hydrocarbon resources.
- To impart knowledge of Non conventional Oil, Gas ,Thermodynamics of Coal bed Methane.

**COURSE OUTCOMES:**

After completion of this course, the students will be able to:

- Differentiate the characteristic and use of Oil, Gas Coal etc
- Understand about the Thermodynamics of coal bed methane.
- Understand about Non conventional Gas
- Development and production of non conventional Oil

**COURSE CONTENTS****1. Non Conventional Oil:**

- 1.1 Heavy oil
- 1.2 Extra heavy oil and Bituminous
- 1.3 Oil Shales
- 1.4 Geology of Non Conventional Oil
- 1.5 Exploration and Evaluation
- 1.6 Thermal and non thermal method of oil recovery

**2. Non conventional Gas:**

- 2.1 Introduction to shale gas and basin centred gas
- 2.2 Coal bed methane
- 2.3 Tight Reservoirs
- 2.4 Formation and properties of coal bed methane.

**3. Thermodynamics of coal bed methane.**

- 3.1 Introduction
- 3.2 Importance of shale gas
- 3.3 Shale gas geology
- 3.4 Important occurrences in India,
- 3.5 Properties of shale gas
- 3.6 Petro physical properties.
- 3.7 Introduction formation and properties of gas hydrates

**4. Coal and Gas conversions to oil:**

- 4.1 Introduction
- 4.2 Classification and principles
- 4.3 Pyrolysis
- 4.4 Theoretical aspect of processes involved in conversion

**5. Development and Production of Non conventional gas:**

- 8.1 Nature of CBM reservoirs
- 8.2 Hydro-fracturing of coal seam
- 8.3 Well operation
- 8.4 Production equipment
- 8.5 Treating and disposing produced water.

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**HEALTH SAFETY AND ENVIRONMENT**

Course Code	PE 50041
Course Title	Health Safety and Environment
Number of Credits	3(L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PE

**COURSE LEARNING OBJECTIVES:**

- To provide an overview of Safety and Environmental issues in offshore and petroleum industries.
- To provide detailed understanding of methods for resolving key issues in petroleum production and processing
- To identify and assess hazards in any stage of operation and to quantify and manage risks and hazards.

**COURSE OUTCOMES:**

After completion of this course, the students will be able to:

- Comprehend different industry hazards and plane safety.
- Apply different methods of waste disposal and treatment for clean environment.
- Understand Environmental Impact of various exploration processes.
- Realize procedure of safety auditing and prepare safety reports.
- Understand offshore oil spill and oil spill control
- Apply concepts of risk analysis to develop probabilistic assessment.
- Understand consequences of accidents.

**COURSE CONTENTS****1. Health Hazards in Petroleum Production Refining and Utilization**

- 1.1 Toxicity, Physiological, Asphyxiation
- 1.2 Respiratory and Skin effect of Petroleum Hydrocarbons (including mixtures)
- 1.3 Sour gases (eg Hydrogen sulphide and carbon monoxide etc) with their thresh-hold limits

**2. Safety System**

- 2.1 Hazards analysis, developing a safe process, failure mode analysis
- 2.2 Safety analysis (API-14C) safety analysis function evaluation chart (synergic approach)
- 2.3 Manual & automatic shutdown system, blow down systems
- 2.4 Gas detection system
- 2.5 Disaster & crisis management

**3. Environment**

- 3.1 Environment concepts, impact on eco-system, air, water and soil
- 3.2 The impact of drilling & production operations on environment
- 3.3 Environmental transport of petroleum wastes
- 3.3 Offshore environmental studies, offshore oil spill and oil spill control
- 3.4 Oil mines regulations and other environmental legislations
- 3.5 Environmental impact assessment
- 3.6 Waste treatment methods, waste disposal method, remediation of contaminated sites
- 3.7 Air & noise pollution

**REFERENCE BOOKS:**

- 1. Environmental Hazards: Assessing Risk and Reducing Disaster. Third Edition.
- 2., The Environment as Hazard, Second Edition. Burton, I, R.W. Kates, & G.F. White

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**UNIT OPERATIONS FOR PETROLEUM INDUSTRY**

Course Code	PE 50042
Course Title	Unit Operations for Petroleum Industry
Number of Credits	3(L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PE

**COURSE LEARNING OBJECTIVES:**

- To identify different types of fuel sources for energy production.
- To appreciate the advantages of energy production from renewable energy resources.

**COURSE OUTCOMES:**

On completion of the course, the students will be able:

- To understand the energy production from conventional fuels and renewable energy resources,
- To familiar with information on renewable energy technologies.

**COURSE CONTENTS****1. INTRODUCTION**

- 1.1 Introduction to unit operations
- 1.2 Application in petroleum engineering

**2 . HEAT EXCHANGER**

- 2.1 Heat Exchangers
  - 2.1.1 Double Pipe heat exchanger
  - 2.1.2 Shell and tube heat exchanger
  - 2.1.3 Plate type heat exchanger
- 2.2 LMTD

**3. MASS TRANSFER**

- 3.1 Mass Transfer and its application
  - 3.1.1 Introduction to phase equilibrium
  - 3.1.2 Basic concept of diffusion and interphase mass transfer
- 3.2 Mass Transfer Operations
  - 3.2.1 Distillation; absorption
  - 3.2.2 Liquid-liquid extraction, adsorption
- 3.3 Introduction to stage and continuous contact mass transfer units
  - 3.3.1 Plate column
  - 3.3.2 Packed bed
  - 3.3.3 Fluidized bed

**4 DRYING**

- 4.1 Equilibrium Mechanism Theory of Drying
- 4.2 Drying Rate Curve

**5. MECHANICAL OPERATIONS**

- 5.1 Operations involving particulate solid
  - 5.1.1 Introduction to filtration
  - 5.1.2 Sedimentation
  - 5.1.3 Settling

**REFERENCE BOOKS:**

1. Mass Transfer Operation Treybel
2. Heat Transfer Kern. D.Q.
3. Fluid Mechanics & Machines Dr. R.K.Bansal

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**WELL TEST ANALYSIS AND EOR**

Course Code	PE 50051
Course Title	Well Test Analysis and EOR
Number of Credits	3(L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PE

**COURSE LEARNING OBJECTIVES:**

- To enable the students to understand the process Well Testing
- To enable the students to understand the Enhance oil recovery after depletion primary recovery.

**COURSE OUTCOMES:**

At the end of this course, the students will be able to understand:

- understand the Various type of well test.
- Describe the different method of to enhance recovery.

**COURSE CONTENTS****1. Oil Well testing**

- 1.1 Introduction and Principle of Superposition
- 1.2 Pressure Build up Test
- 1.3 Pressure Draw down test
- 1.4 Multi rate test

**2. Gas Well Testing**

- 2.1 Flow after flow test
- 2.2 Isochronal Test
- 2.3 Modified Isochronal Test

**3. Additional well test**

- 3.1 Interference Testing
- 3.2 Pulse Testing
- 3.3 Drill steam Test

**4. Introduction to EOR.**

- 4.1 Reservoir engineering aspects of enhanced recovery methods
- 4.2 Water flooding concepts
- 4.3 Well spacing for fluid injection.
- 4.4 Polymer flooding
- 4.5 Surfactant flooding
- 4.6 Caustic flooding;
- 4.7 ASP flooding

**5. Miscible Flooding:**

- 5.1 Principles and applications of CO<sub>2</sub> flooding
- 5.2 Dry and enriched gas
- 5.3 Flooding
- 5.4 Inert gas flooding
- 5.5 Thermal Recovery Techniques
- 5.6 Steam stimulation
  - 5.6.1 hot water flooding
  - 5.6.2 steam flooding
  - 5.6.3 in-situ combustion process

**REFERENCE BOOKS:**

1. Pressure Build Up and Flow Tests in Wells, Mathews, C.S. & Russell, D. G., SPE
2. Modern Well Test Analysis, Horne, R.N., Petroway
3. Well Testing, Lee, J.,

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**PETROLEUM TRANSPORTATION AND STORAGE**

Course Code	PE 50052
Course Title	Petroleum Transportation and Storage
Number of Credits	3(L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PE

**COURSE LEARNING OBJECTIVES:**

- To bring together the entire spectrum of hydraulics, design, and operating requirements for pipeline transportation and storage of hydrocarbon liquids, the essence of our energy supply.
- cover the basics of fluid hydraulics, transportation of oil by tankers and pipeline, pipeline transportation of natural gas, measurement of hydrocarbon at fields, storage and terminal designs for hydrocarbons and various pipeline operations

**COURSE OUTCOMES:**

After completion of this course, the students will be able to :

- Understand the fundamental concepts of transportation equipment and machinery design.
- Aware of different equipment and machineries used in petroleum industry.
- Analyse and understand the working of different pumps and rotary devices.
- Familiarise with design of PRESSURE VESSEL, flanges, nozzles
- Analyse and trouble shoot the infield situations of rotary devices.

**COURSE CONTENTS****1. FUNDAMENTALS OF DESIGN**

- 1.1 Steps in design activity. Selection of material
- 1.2 Stress concentration and factor of safety
- 1.3 Creativity in design activity
- 1.4 Design considerations of shaft, keys and coupling (No numerical)

**2. DESIGN OF MECHANICAL DRIVE COMPONENTS APPLIED TO PETROLEUM EQUIPMENTS**

- 2.1 Design consideration of belt drives, Types of pulleys (No numerical)
- 2.2 advantages construction, classification of Wire ropes
- 2.4 stresses in wire ropes (No numerical)
- 2.5 Classification of chains
- 2.6 Design considerations for chain and gear drives (No numerical)

**3. PUMPS & COMPRESSOR**

- 3.1 Selection of pumps and valves
- 3.2 Specification of pumps, valves
- 3.4 Types of compressors
- 3.4.1 Reciprocating, rotary and Centrifugal

**4. PRESSURE VESSEL**

- 4.4 Classification of Pressure Vessels
- 4.5 Design considerations of Pressure Vessel

**5. STORAGE SYSTEM**

- 5.1 Storage of hydrocarbon fluids
- 5.2 Introduction to oil and gas storage facility
- 5.3 Types of storage tank
- 5.4 Fixed roof cylindrical storage tank.

**REFERENCE BOOKS:**

1. Surface Production Operations volume -I, Design of Oil Handling Systems and Facilities; Gulf Publishing Company, Houston, Texas. Arnold Ken and Stewart Maurice
2. Design of Machine Elements; Tata McGraw Hill. Bhandari V. B.
3. Process Equipment Design; MacMillan Joshi M. V.

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SEMESTER SCHEME 2020-21



**GOVERNMENT OF RAJASTHAN**  
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**SEMESTER SCHEME-2020-21**



**VI SEMESTER**  
(SESSION 2021-2022 & ONWARDS)

**ENTREPRENEURSHIP AND START-UPS**

Course Code	PE 6111(Same in All Branches of Engg.)
Course Title	Entrepreneurship and Start-ups
Number of Credits	4 (L-3 ,T-1, P-0)
Prerequisites (Course code)	None
Course Category	HS

**COURSE LEARNING OBJECTIVES:**

1. Acquiring Entrepreneurial spirit and resourcefulness.
2. Familiarization with various uses of human resource for earning dignified means of living.
3. Understanding the concept and process of entrepreneurship-its contribution and role in the growth and development of individual and the nation.
4. Acquiring entrepreneurial quality, competency, and motivation.
5. Learning the process and skills of creation and management of entrepreneurial venture.

**LEARNING OUTCOME:**

Upon completion of the course, these student will be able to demonstrate knowledge of the following topics:

1. Understanding the dynamic role of entrepreneurship and small businesses
2. Organizing and Managing a Small Business
3. Financial Planning and Control
4. Forms of Ownership for Small Business
5. Strategic Marketing Planning
6. New Product or Service Development
7. Business Plan Creation

**COURSE CONTENTS:****1. INTRODUCTION TO ENTREPRENEURSHIP AND START-UPS**

- 1.1. Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation
- 1.2. Types of Business Structures,
- 1.3. Similarities / differences between entrepreneurs and managers.

**2. BUSINESS IDEAS AND THEIR IMPLEMENTATION**

- 2.1. Discovering ideas and visualizing the business
- 2.2. Activity map
- 2.3. Business Plan

**3. IDEA TO START-UP**

- 3.1. Market Analysis– Identifying the target market,
- 3.2. Competition evaluation and Strategy Development,
- 3.3. Marketing and accounting,
- 3.4. Risk analysis

**4. MANAGEMENT**

- 4.1. Company's Organization Structure,
- 4.2. Recruitment and management of talent.
- 4.3. Financial organization and management

**5. FINANCING AND PROTECTION OF IDEAS**

- 5.1. Financing methods available for start-ups in India
- 5.2. Communication of Ideas to potential investors– Investor Pitch
- 5.3. Patenting and Licenses

**6. EXIT STRATEGIES FOR ENTREPRENEURS , BANKRUPTCY, AND SUCCESSION AND HARVESTING STRATEGY**

**SUGGESTED LEARNING RESOURCES:**

S.No.	Title of Book	Author	Publication
1.	The Startup Owner's Manual: The Step by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf	K & S Ranch ISBN-978-0984999392
2.	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries	Penguin UK ISBN-978-0670921607
3.	Demand: Creating What People Love Before They Know They Want It	Adrian J. Slywotzky with Karl Weber	Headline Book Publishing ISBN-978-0755388974
4.	The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business	Clayton M. Chris Tensen	Harvard business ISBN:978-142219602

**SUGGESTED SOFTWARE/LEARNING WEBSITES:**

- <https://www.fundable.com/learn/resources/guides/startup>
- <https://corporatefinanceinstitute.com/resources/knowledge/finance/corporatestructure/>
- <https://www.finder.com/small-business-finance-tips>
- <https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/>

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**PROJECT MANAGEMENT**

CourseCode	PE 62001(Same in All Branches of Engg.)
CourseTitle	Project Management
NumberofCredits	3(L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

**COURSE LEARNING OBJECTIVES**

- To develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.
- To develop an understanding of key project management skills and strategies.

**COURSE OUTCOMES**

At the end of the course, the student will be able to:

CO1	Understand the importance of projects and its phases.
CO2	Analyze projects from marketing, operational and financial perspectives.
CO3	Evaluate projects based on discount and non-discount methods.
CO4	Develop network diagrams for planning and execution of a given project.
CO5	Apply crashing procedures for time and cost optimization.

**COURSE CONTENTS****1. CONCEPT OF A PROJECT:**

- 1.1. Classification of projects
- 1.2. Importance of project management
- 1.3. The project Life cycle
- 1.4. Establishing project priorities (scope-cost-time)
- 1.5. Project priority matrix
- 1.6. Work break down structure.

**2. CAPITAL BUDGETING PROCESS:**

- 2.1. Planning -Analysis-Selection-Financing-Implementation-Review.
- 2.2. Generation and screening of project ideas
- 2.3. Market and demand analysis
- 2.4. Demand forecasting techniques.
- 2.5. Market planning and marketing research process
- 2.6. Technical analysis

**3. FINANCIAL ESTIMATES AND PROJECTIONS:**

- 3.1. Cost of projects
- 3.2. Means of financing
- 3.3. Estimates of sales and production-cost of production
- 3.4. Working capital requirement and its financing
- 3.5. Profitability project , cash flow statement and balance sheet.
- 3.6. Breakeven analysis.

**4. BASIC TECHNIQUES IN CAPITAL BUDGETING:**

- 4.1. Non discounting and discounting methods
- 4.2. pay-back period
- 4.3. Accounting rate of return
- 4.4. Net present value

- 4.5. Benefit cost ratio
- 4.6. Internal rate of return.
- 4.7. Project risk.
- 4.8. Social cost benefit analysis and economic rate of return.
- 4.9. Non-financial justification of projects.

#### 5. PROJECT ADMINISTRATION:

- 5.1. Progress payments,
- 5.2. Expenditure planning,
- 5.3. Project scheduling and network planning,
- 5.4. Use of Critical Path Method(CPM),
- 5.5. Schedule of payments and physical progress,
- 5.6. time-cost trade off.
- 5.7. Concepts and uses of PERT
- 5.8. Cost as a function of time,
- 5.9. Project Evaluation and Review Techniques
- 5.10. Cost mechanisms.
- 5.11. Determination of least cost duration.
- 5.12. Post project evaluation.
- 5.13. Introduction to various Project management softwares.

#### REFERENCE BOOKS

- 1. Project planning, analysis, selection, implementation and review –Prasannachandra–Tata McGraw Hill
- 2. Project Management – the Managerial Process– Clifford F. Gray & Erik W. Larson-McGrawHill
- 3. Project management- David I Cleland- McGraw Hill International Edition, 1999
- 4. Project Management– Gopala krishnan– Mcmillan India Ltd.
- 5. Project Management- Harry – Maylor – Peason Publication.

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**RENEWABLE ENERGY TECHNOLOGIES**

Course Code	PE 62002(Same in All Branches of Engg.)
Course Title	Renewable Energy Technologies
Number of Credits	3 (L:3, T:0, P:0)
Prerequisites	NIL
Course Category	OE

**COURSE LEARNING OBJECTIVES**

- To understand present and future scenario of world energy use.
- To understand fundamentals of solar energy systems.
- To understand basics of wind energy.
- To understand bio energy and its usage in different ways.
- To identify different available non-conventional energy sources.

**COURSE OUTCOMES**

At the end of the course, the student will be able to:

CO1	Understand present and future energy scenario of the world.
CO2	Understand various methods of solar energy harvesting.
CO3	Identify various wind energy systems.
CO4	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO5	Identify suitable energy sources for a location.

**COURSE CONTENTS****1. INTRODUCTION:**

- 1.1. World Energy Use;
- 1.2. Reserves of Energy Resources;
- 1.3. Environmental Aspects OF Energy Utilisation;
- 1.4. Renewable Energy Scenario in India and around the World;
- 1.5. Potentials; Achievements/ Applications;
- 1.6. Economics of renewable energy systems.

**2. SOLAR ENERGY:**

- 2.1. Solar Radiation;
- 2.2. Measurements of Solar Radiation;
- 2.3. Flat Plate and Concentrating Collectors;
- 2.4. Solar direct Thermal Applications;
- 2.5. Solar thermal Power Generation
- 2.6. Fundamentals of Solar Photo Voltaic Conversion;
- 2.7. Solar Cells;
- 2.8. Solar PV Power Generation;
- 2.9. Solar PV Applications.

**3. WIND ENERGY:**

- 3.1. Wind Data and Energy Estimation;
- 3.2. Types of Wind Energy Systems;
- 3.3. Performance; Site Selection;
- 3.4. Details of Wind Turbine Generator;
- 3.5. Safety and Environmental Aspects.

**4. BIO-ENERGY:**

- 4.1. Bio mass direct combustion;
- 4.2. Bio mass gasifiers;
- 4.3. Bio gas plants;
- 4.4. Digesters;
- 4.5. Ethanol production;
- 4.6. Bio diesel;
- 4.7. Cogeneration;
- 4.8. Bio mass Applications.

#### 5. OTHER RENEWABLE ENERGY SOURCES:

- 5.1. Tidal energy;
- 5.2. Wave Energy;
- 5.3. Open and Closed OTEC Cycles;
- 5.4. Small Hydro Geothermal Energy;
- 5.5. Hydrogen and Storage;
- 5.6. Fuel Cell Systems;
- 5.7. Hybrid Systems.

#### REFERENCE BOOKS

- 1. Non-Conventional Energy Sources, Rai. G. D., Khanna Publishers, New Delhi, 2011.
- 2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN SponLtd.,UK,2 006.
- 3. Solar Energy, Sukhatme. S. P., Tata Mc Graw Hill Publishing CompanyLtd. ,New Delhi, 1997.
- 4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
- 5. Fundamental of Renewable Energy Sources, G N Tiwari and M K Ghoshal, Narosa, New Delhi, 2007.
- 6. Renewable Energy and Environment A Policy Analysis for India ,NH Ravindranath, U K Rao, B Natarajan, P Monga, Tata McGraw Hill.
- 7. Energy and The Environment, R A Ristinen and J J Kraushaar, second edition, John Willey & Sons, New York, 2006.
- 8. Renewable Energy Resources, J W T widell and A D Weir, ELBS, 2006.

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**PRODUCT DESIGN**

CourseCode	PE 63001(Same in All Branches of Engg.)
CourseTitle	Product Design
NumberofCredits	3 (L:3, T:0, P:0)
Prerequisites	NIL
CourseCategory	OE

**COURSE LEARNING OBJECTIVES**

- To acquire the basic concepts of product design and development process
- To understand the engineering and scientific process in executing a design from concept to finished product
- To study the key reasons for design or redesign.

**COURSE OUTCOMES**

At the end of the course, the student will be able to:

CO1	Understand the basic concepts of product design and development process.
CO2	Illustrate the methods to define the customer needs.
CO3	Describe an engineering design and development process.
CO4	Understand the intuitive and advanced methods used to develop and evaluate a concept.
CO5	Apply modelling and embodiment principles in product design and development process.

**COURSE CONTENTS****1. DEFINITION OF A PRODUCT**

- 1.1. Types of product;
- 1.2. Levels of product;
- 1.3. Product-market mix;
- 1.4. New product development (NPD) process;
- 1.5. Idea generation methods;
- 1.6. Creativity;
  - 1.6.1. Creative attitude;
  - 1.6.2. Creative design process;
- 1.7. Morpho logical analysis;
- 1.8. Analysis of inter-connected decision areas;
- 1.9. Brain storming.

**2. PRODUCT LIFECYCLE;**

- 2.1. The challenges of Product development;
- 2.2. Product analysis;
- 2.3. Product characteristics;
- 2.4. Economic considerations;
- 2.5. Production and Marketing aspects;
- 2.6. Characteristics of successful Product development;
- 2.7. Phases of a generic product development process;
- 2.8. Customer need identification;
- 2.9. Product development practices and industry-product strategies.

**3. PRODUCT DESIGN**

- 3.1. Design by evolution;
- 3.2. Design by innovation;
- 3.3. Design by imitation;
- 3.4. Factors affecting product design;
- 3.5. Standards of performance and environmental factors;
- 3.6. Decision making and iteration;



- 3.7. Morphology of design (different phases);
- 3.8. Role of aesthetics in design.

#### 4. INTRODUCTION TO OPTIMIZATION IN DESIGN

- 4.1. Economic factors in design;
- 4.2. Design for safety and reliability;
- 4.3. Role of computers in design;
- 4.4. Modeling and Simulation;
- 4.5. The role of models in engineering design;
- 4.6. Mathematical modeling;
- 4.7. Similitude and scale models;
- 4.8. Concurrent design;
- 4.9. Six sigma and design for six sigma;
- 4.10. Introduction to optimization in design;
- 4.11. Economic factors and financial feasibility in design;
- 4.12. Design for manufacturing;
- 4.13. Rapid Proto typing (RP);
- 4.14. Application of RP in product design;
- 4.15. Product Development versus Design.

#### 5. DESIGN OF SIMPLE PRODUCTS DEALING WITH VARIOUS ASPECTS OF PRODUCT DEVELOPMENT;

- 5.1. Design Starting from need till the manufacture of the product

#### REFERENCE BOOKS

- 1.Product Design and Development, Karl T.Ulrichand Steven D.Eppinger, TataMc Graw–Hill edition.
- 2.Engineering Design– George E. Dieter.
- 3.An Introduction to Engineering Design methods Vijay Gupta.
- 4.Merie Crawford: New Product management, McGraw-Hill Irwin.
- 5.Chitale A K and Gupta R C,“ Product Design and Manufacturing”, Prentice Hall of India, 2005.
- 6.Kevin Otto and Kristin Wood, Product Design, Techniques in Reverse Engineering and New Product Development, Pears on education.

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**DISASTER MANAGEMENT**

Course Code	PE 63002(Same in All Branches of Engg.)
Course Title	Disaster Management
Number of Credits	3 (L: 3, T: 0, P :0)
Prerequisites	NIL
Course Category	OE

**COURSE LEARNING OBJECTIVES**

Following are the objectives of this course:

- To learn about various types of natural and man-made disasters.
- To know pre and post-disaster management for some of the disasters.
- To know about various information and organizations in disaster management in India.
- To get exposed to technological tools and their role in disaster management.

**COURSE OUTCOMES:**

- 1.1. After completing this course, student will be:
- 1.2. Acquainted with basic information on various types of disasters
- 1.3. Knowing the precautions and awareness regarding various disasters
- 1.4. Decide first action to be taken under various disasters
- 1.5. Familiarised with organization in India which are dealing with disasters
- 1.6. Able to select IT tools to help in disaster management

**COURSE CONTENTS****1. UNDERSTANDING DISASTER**

- 1.1. Understanding the Concepts and definitions of Disaster,
- 1.2. Hazard,
- 1.3. Vulnerability,
- 1.4. Risk,
- 1.5. Capacity–Disaster and Development,
- 1.6. Disaster management.

**2. TYPES, TRENDS, CAUSES, CONSEQUENCES AND CONTROL OF DISASTERS**

- 2.1. Geological Disasters (earth quakes, land slides,tsunami, mining);
- 2.2. Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hailstorms, avalanches, droughts, cold and heat waves)
- 2.3. Biological Disasters (epidemics, pest attacks, forest fire);
- 2.4. Technological Disasters (chemical, industrial, radiological, nuclear)
- 2.5. Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters)
- 2.6. Global Disaster Trends
- 2.7. Emerging Risks of Disasters
- 2.8. Climate Change and Urban Disasters.

**3. DISASTER MANAGEMENT CYCLE AND FRAME WORK**

- 3.1. Disaster Management Cycle
- 3.2. Paradigm Shift in Disaster Management.
- 3.3. Pre-Disaster
- 3.4. Risk Assessment and Analysis,
- 3.5. Risk Mapping,
- 3.6. Zonation and Micro zonation,
- 3.7. Prevention and Mitigation of Disasters,
- 3.8. Early Warning System
  - 3.8.1. Preparedness,
  - 3.8.2. Capacity Development;
  - 3.8.3. Awareness.

- 3.9. During Disaster
  - 3.9.1. Evacuation
  - 3.9.2. Disaster Communication
  - 3.9.3. Search and Rescue
  - 3.9.4. Emergency Operation Centre
  - 3.9.5. Incident Comm and System
  - 3.9.6. Relief and Rehabilitation
- 3.10. Post-disaster
  - 3.10.1. Damage and Needs Assessment,
  - 3.10.2. Restoration of Critical Infra structure
  - 3.10.3. Early Recovery Reconstruction and Redevelopment;
  - 3.10.4. IDNDR, Yokohama Strategy, Hyogo Frame-work of Action.

#### **4. DISASTER MANAGEMENT IN INDIA**

- 4.1. Disaster Profile of India
- 4.2. Mega Disasters of India and Lessons Learnt.
- 4.3. Disaster Management Act 2005
- 4.4. Institutional and Financial Mechanism,
- 4.5. National Policy on Disaster Management,
- 4.6. National Guidelines and Plans on Disaster Management;
- 4.7. Role of Government (local, state and national),
- 4.8. Non-Government and Inter Governmental Agencies

#### **5. APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT**

- 5.1. Geo informatics in Disaster Management (RS, GIS, GPS and RS).
- 5.2. Disaster Communication System (Early Warning and Its Dissemination).
- 5.3. Land Use Planning and Development Regulations,
- 5.4. Disaster Safe Designs and Constructions,
- 5.5. Structural and Non Structural Mitigation of Disasters
- 5.6. S & T Institutions for Disaster Management in India

#### **REFERENCES**

- 1.Publications of National Disaster Management Authority (NDMA) on Various Templates and Guide lines for Disaster Management
- 2.Bhandani, R. K., An over view on natural & man-made disasters and their reduction, CSIR, New Delhi
- 3.Srivastava, H. N., and Gupta G. D. , Management of Natural Disasters in developing countries, Daya Publishers, Delhi
- 4.Alexander, David, Natural Disasters, Kluwer Academic London
- 5.Ghosh, G .K. ,Disaster Management, APH Publishing Corporation
- 6.Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.

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**INDIAN CONSTITUTION**

CourseCode	PE 6333(Same in All Branches of Engg.)
CourseTitle	Indian Constitution
NumberOfCredits	0 (L:2,T:0;P:0)
Prerequisites(Coursecode)	None
CourseCategory	AU

**COURSE CONTENT****1. THE CONSTITUTION –**

- 1.1. Introduction
- 1.2. The History of the Making of the Indian Constitution
- 1.3. Preamble and the Basic Structure, and its interpretation
- 1.4. Fundamental Rights and Duties and their interpretation
- 1.5. State Policy Principles

**2. UNION GOVERNMENT**

- 2.1. Structure of the Indian Union
- 2.2. President– Role and Power
- 2.3. Prime Minister and Council of Ministers
- 2.4. Lok Sabha and Rajya Sabha

**3. STATE GOVERNMENT**

- 3.1. Governor– Role and Power
- 3.2. Chief Minister and Council of Ministers
- 3.3. State Secretariat

**4. LOCAL ADMINISTRATION**

- 4.1. District Administration
- 4.2. Municipal Corporation
- 4.3. Zila Panchayat

**5. ELECTION COMMISSION**

- 5.1. Role and Functioning
- 5.2. Chief Election Commissioner
- 5.3. State Election Commission

**SUGGESTED LEARNING RESOURCES:**

S.No.	Title of Book	Author	Publication
1.	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi, 2008
2.	The Constitution of India	B.L.Fadia	Sahitya Bhawan; New edition(2017)
3.	Introduction to the Constitution of India	D D Basu	Lexis Nexis; Twenty-Third 2018 edition

**SUGGESTED SOFTWARE / LEARNING WEBSITES:**

1. <https://www.constitution.org/cons/india/const.html>
2. <http://www.legislative.gov.in/constitution-of-india>
3. <https://www.sci.gov.in/constitution>
4. <https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/>

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**OFFSHORE DRILLING AND PRODUCTION OPERATIONS**

Course Code	CH 6001
Course Title	Offshore Drilling and Production Operation
Number of Credits	3 (L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PC

**Course Learning Objectives:**

The learning objective of this subject is to enable the students:

- to gain knowledge of offshore environment.
- design and operation of offshore platforms.

**COURSE OUTCOMES**

On completion of this course the students will be able to:

- Understand Ocean Environment.
- Understand the Offshore field operations
- Knowledge of offshore drilling and production operations.

**COURSE CONTENTS****1. Physical Environment**

- 1.1 Overview of physical ocean environment
- 1.2 Composition and properties of sea water
- 1.3 Wind, wave, current and other forces acting on offshore structures

**2. Offshore rigs**

- 2.1 Bottom Supported vessels
- 2.2 Floating drilling vessels

**3 Field Operations**

- 3.1 Station keeping
  - 3.1.1 conventional mooring system,
  - 3.1.2 spread mooring system
- 3.2 Dynamic positioning system,
  - 3.2.1 components
  - 3.2.2 working.

**4 Deepwater Drilling**

- 4.1 Riser system and its components
- 4.2 Riser tensioners
- 4.3 Heave compensator,
- 4.4 Emergency disconnect and hang off.
- 4.5 Horizontal deep water drilling
- 4.6 ROV( Remote operated vehicle)

**5. Production Operations**

- 5.1 Risers for Production
- 5.2 Production Operations
- 5.3 Deepwater completion

**REFERENCE BOOKS:**

1. Handbook of offshore engineering volume I and II, Chakraborty S.K, Elsevier, 2006, 1213 pp.
2. IADC deepwater control guidelines.
3. Exxon Mobil, Floating Drilling School, Deepwater, 2002, 992 pp.

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**PIPELINE ENGINEERING**

Course Code	PE 6002
Course Title	Pipeline Engineering
Number of Credits	3(L-3, T-0, P-0)
Prerequisites	NIL
Course Category	PC

**Course Learning Objectives:**

This course is useful for chemical engineering students as

- To detailed knowledge flow through pipes, Material and construction of Pipelines
- Understand Corrosion and Protection of Corrosion.

**COURSE OUTCOMES**

On completion of this course the students will be able to:

- Objective and Scope of Pipeline as a means of Fluid flow.
- Design the pipe line
- Differentiate between Oil and Gas pipe line.
- The Corrosion and Protection of pipes from corrosion

**COURSE CONTENTS****1. Objective and scope of pipeline**

- 1.1 Pipe as a means of fluid transportation with special reference to crude oil/gas/refined products.
- 1.2 Design of Pipeline: Factors influencing oil, gas and refined products as pipeline design
- 1.3 Differentiate between oil and gas pipe line

**2. Hydraulic surge and water hammer**

- 2.1 Specific heat of liquids;
- 2.2 River crossing, pipe size and station spacing etc.

**3. Pigging**

- 3.1 Pigging technology
- 3.2 Pig launcher and receiver
- 3.3 Intelligent pigging
- 3.4 Types of pigs

**4. Offshore Pipeline**

- 4.1 Design and control of Sag and over bend
- 4.2 Description of stinger and riser, articulated stinger
- 4.3 Construction of offshore pipeline; method of underwater welding

**5. Corrosion**

- 5.1 Types
- 5.2 Protection and control
- 5.3 Cathodic protection.

**REFERENCE BOOKS:**

1. Pipeline and Risers: Young Boi, Elsevier Ocean Engineering Book series 2001 Volume 3
2. Pipe Line Corrosion, Cathodic Protection: Parker M E and Peattie E G, Elsevier USA
3. Pipe line Engineering by Henry Liu, Lewis Publishers

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