Four-Year Undergraduate Programme

(2022-23)

Bachelor of Technology

Petroleum Engineering

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

1. VISION OF THE DEPARTMENT

To develop a department of international and national repute in field of petroleum engineering known for its academic excellence with preference to industry-oriented outcomes.

2. MISSION OF THE DEPARTMENT

- To be a centre of quality education in the field of engineering to produce skilled professionals.
- To create a focused and carrier oriented environment amongst students which can create them not only for job seekers but job creators also.
- To develop innovation led environment in thrust areas and creation of intellectual properties.

3. PROGRAMME EDUCATIONAL OBJECTIVES

The statements below indicate the career and professional achievements that the B.Tech. Petroleum engineering curriculum enables graduates to attain.

PEO 1	To pursue successful career in engineering involving professional knowledge and skills for analysis, design education and research.
PEO 2	To excel in professional career with sound fundamental knowledge and pursue life-long learning including higher education and research.
PEO 3	To provide an environment where they can adopt interpersonal skills, leadership ability and team building to achieve organization goals and serve society with professional ethics and integrity.

4. PROGRAMME LEARNING OUTCOME

Program Learning outcomes are statements conveying the intent of a program of study.

PLO 1	**Engineering knowledge:**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PLO 2	**Problem analysis:**	Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
PLO 3	**Design/development of solutions:**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PLO 4	**Conduct investigations of complex problems:**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PLO 5	**Modern tool usage:**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PLO 6	**The engineer and society:**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PLO 7	**Environment and sustainability:**	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
PLO 8	**Ethics:**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PLO 9	**Individual and team work:**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PLO 10	**Communication:**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PLO 11	**Project management and finance:**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PLO 12	**Life-long learning:**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. PROGRAMME SPECIFIC LEARNING OUTCOMES

The statements below indicate the career and professional achievements that the B.Tech. Petroleum engineering curriculum enables graduates to attain.

PSO 1	Apply the concepts of Mathematics, fluid mechanics and basic engineering principles for concept building techniques related to petroleum industry
PSO 2	Understand and utilize the upstream sector practices for building of concepts related to oil and gas industry.

1. Credit Framework

Semester wise Credit distribution of the programme	
Semester-1	22
Semester-2	20
Semester-3	25
Semester-4	22
Semester-5	22
Semester-6	18
Semester-7	20
Semester-8	18
Total Credits:	**167**

Category wise Credit distribution of the programme	
Category	**Credit**
Major Core	82
Minor Stream	30
Multidisciplinary	17
Ability Enhancement Course	9
Skill Enhancement Courses	7
Value added Courses	4
Summer Internship	4
Research Project/Dissertation	14
Total Credits:	**167**

2. Program Curriculum

Semester 1						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303104101	Elements of Civil Engineering	4	3	2	0
2	303106101	Basic Electrical Engineering	4	3	2	0
3	303109102	Elements of Mechanical Engineering	4	3	2	0
4	303191101	Mathematics-I	4	4	0	0
5	303192101	Engineering Physics-I	4	3	2	0
6	303193103	Communication Skills	2	0	0	2
		Total	**22**	**16**	**8**	**2**
Semester 2						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
7	303100101	Workshop	2	0	4	0
8	303104105	Environmental Science	0	1	0	0
9	303105102	Programming for Problem Solving	4	3	2	0
10	303109101	Engineering Graphics	4	2	4	0
11	303120101	Chemistry	4	3	2	0
12	303191151	Mathematics-II	4	4	0	0
13	303193152	Advance Communication & Technical Writing	2	0	0	2
		Total	**20**	**13**	**12**	**2**
Semester 3						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
14	303120201	Introduction to Petroleum Geology	3	3	0	0
15	303120202	Drilling Engineering Lab	1	0	2	0
16	303120203	Drilling Engineering – I	4	3	0	1
17	303120204	Fluid Flow Operations Lab	1	0	2	0
18	303120205	Fluid Flow Operations	3	3	0	0
19	303120206	Product Realization	1	0	2	0
20	303120207	Petroleum Exploration	3	3	0	0

21	303120209	Thermodynamics	3	3	0	0
22	303191201	Complex Variables and PDE	4	4	0	0
23	303193203	Professional Communication Skills	2	0	0	2
		Total	**25**	**19**	**6**	**3**

Semester 4

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
24	303120251	Heat and Mass Transfer	3	3	0	0
25	303120252	Heat and Mass Transfer Lab	1	0	2	0
26	303120253	Drilling Engineering-II	4	3	0	1
26	303120254	Elements of Reservoir Engineering Lab	1	0	2	0
27	303120255	Elements of Reservoir Engineering	4	3	0	1
28	303120257	Production Operations-I	4	3	0	1
29	303191251	Probability, Statistics and Numerical Methods	4	4	0	0
30	303193252	Professional Grooming and Personality Development	1	0	0	1
		Total	**22**	**16**	**4**	**4**

Semester 5

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
31	303120301	Applied Petroleum Reservoir Engineering	3	3	0	0
32	303120302	Petroleum Geochemistry Lab	1	0	2	0
33	303120303	Petroleum Geochemistry	3	3	0	0
34	303120304	Internship	2	0	4	0
35	303120305	Natural Gas Engineering	2	2	0	0
36	303120307	Offshore Engineering	3	3	0	0
37	303193304	Professionalism & Corporate Ethics	1	0	0	1
38		Open Elective 01 (Complsory Subjects :1)	2	2	0	0
39		Open Elective 01 (Complsory Subjects :1)	2	2	0	0
40		PEC 01 (Complsory Subjects :1)	3	3	0	0
		Total	**22**	**18**	**6**	**1**

PEC 01

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	303120331	Oil and Gas Field Development and Planning	3	3	0	0

2	303120333	Sedimentary and Petroleum Geology	3	3	0	0
3	303120335	Petroleum Economics	3	3	0	0
PEC 01-LAB						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303106332	High Voltage Engineering Lab	1	0	2	0
2	303106334	Industrial Electrical Systems Lab	1	0	2	0
Open Elective 01						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303101331	Basic Aircraft Science	2	2	0	0
2	303104311	Disaster Preparedness and Planning	2	2	0	0
3	303105304	Cyber Security	2	2	0	0
4	303105305	Internet of Things	2	2	0	0
5	303107346	Fundamentals of Communication Engineering	2	2	0	0
6	303109346	Renewable Energy Sources	2	2	0	0
Semester 6						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
41	303120351	Surface Production Operations	3	3	0	0
42	303120353	Formation Evaluation	3	3	0	0
43	303120355	Oil and Gas well Testing	3	3	0	0
44	303120356	Oil and Gas well Testing Lab	1	0	2	0
45	303120357	Pumps and Compressor	2	2	0	0
46	303193353	Employability Skills	1	0	0	1
47		Open Elective 02 (Complsory Subjects :1)	2	2	0	0
48		PEC 02 (Complsory Subjects :1)	3	3	0	0
		Total	**18**	**16**	**2**	**1**
PEC 02						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303120381	Energy Technology and Engineering	3	3	0	0
2	303120385	Biomass Conversion and Utilization	3	3	0	0
3	303120387	City Gas Distribution	3	3	0	0

PEC 02-LAB						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303106382	Electrical Machine Design Lab	1	0	2	0
2	303106384	Electro Magnetic Waves Lab	1	0	2	0
PEC 03						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303106385	Power System Protection	3	3	0	0
2	303106387	HVDC Transmission System	3	3	0	0
PEC 03-LAB						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303106386	Power System Protection Lab	1	0	2	0
2	303106388	HVDC Transmission System Lab	1	0	2	0
Open Elective 02						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303100351	Programme Management and Entrepreneurship	2	2	0	0
2	303100352	Life Sciences	2	2	0	0
3	303100353	Fundamentals of Management	2	2	0	0
4	303100354	Constitution of India	2	2	0	0
5	303104411	Innovation & Entrepreneurship	2	2	0	0
6	303105392	Cyber Law and Ethics	2	2	0	0
Open Elective 03						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303106353	Industrial Safety	3	3	0	0
Semester 7						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
49	303120401	Petroleum Engineering Design	3	3	0	0
50	303120402	Summer internship	2	0	4	0
51	303120403	Enhanced Oil Recovery Techniques	3	3	0	0

52	303120404	Project-I	6	0	12	0
53	303120405	Reservoir Modeling and Simulation	2	2	0	0
54	303120406	Reservoir Modeling and Simulation Lab	1	0	2	0
55		PEC 03 (Complsory Subjects :1)	3	3	0	0
		Total	**20**	**11**	**18**	**0**

PEC 04

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	303120481	Hydrocarbon Contracts and Asset Management	3	3	0	0
2	303120483	Petroleum Geo-mechanics & Hydraulic Fracturing	3	3	0	0
3	303120485	Transporation and Marketing of Petroleum and Petroleum Products	3	3	0	0
4	303120481	Hydrocarbon Contracts and Asset Management	3	3	0	0

PEC 04-LAB

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	303106432	Electrical Energy Conservation & Audit Lab	1	0	2	0
2	303106434	Power System Dynamics & Control Lab	1	0	2	0
3	303106436	Line-commutated and Active PWM Rectifiers & Inverters Lab	1	0	2	0
4	303106438	Electrical Drives Lab	1	0	2	0

PEC 05

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	303106439	Power System Analysis	3	3	0	0
2	303106441	Computational Electromagnetics	3	3	0	0

PEC 05-LAB

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	303106440	Power System Analysis Lab	1	0	2	0
2	303106442	Computational Electromagnetics Lab	1	0	2	0

Semester 8

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
56	303120451	Unconventional Energy Resources	3	3	0	0
57	303120453	Health, Safety and Environment in Petroleum Industry	3	3	0	0
58	303120454	Project-II	6	0	12	0
59	303120455	Advanced Production Technologies	3	3	0	0
60		PEC 04 (Complsory Subjects :1)	3	3	0	0
		Total	**18**	**12**	**12**	**0**
PEC 06						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303106481	Wind and Solar Energy Systems	3	3	0	0
2	303106483	Electrical Hybrid Vehicles	3	3	0	0
3	303106485	Advanced Electrical Drives	3	3	0	0
4	303106487	Digital Signal Processing	3	3	0	0
5	303106489	Advance Controller	3	3	0	0
PEC 06-LAB						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect**	**Lab**	**Tut**
1	303106482	Wind and Solar Energy Systems Lab	1	0	2	0
2	303106484	Electrical Hybrid Vehicles Lab	1	0	2	0
3	303106486	Advanced Electrical Drives Lab	1	0	2	0
4	303106488	Digital Signal Processing Lab	1	0	2	0
5	303106490	Advance Controller lab	1	0	2	0
		Total	**167**			

Semester 1

a) **Course Name:** Elements of Civil Engineering
b) **Course Code:** 303104101
c) **Prerequisite:** Knowledge of Physics and Mathematics upto 12th Science
d) **Rationale:** Basic Civil Engineering knowledge is essential for all engineers.
e) **Course Learning Objective:**

CLOBJ 1	Recognize the scope of civil engineering in various fields.
CLOBJ 2	Demonstrate the ability to interpret and create plans and maps.
CLOBJ 3	Explore various methods and instruments used in linear measurements.
CLOBJ 4	Analyze contours and their characteristics in different terrains.
CLOBJ 5	Understand various types of foundations, including spread footings, R.C.C. footings, grillage footing, arch foundation, and pile foundations.
CLOBJ 6	Understand building components, their functions, and nominal dimensions.

f) **Course Learning Outcomes:**

CLO 1	Understanding of application and use of Civil Engineering in practical life.
CLO 2	Exposure to concepts of surveying and mapping.
CLO 3	Design small buildings and drawing plans and elevations.
CLO 4	Understand Global positioning system, remote sensing & GIS.
CLO 5	Understand construction materials
CLO 6	Understand building materials

g) **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	0	2	4	20	20	20	60	30	150

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

h) Course Content:

Sr. No.	Content	Weightage	Teaching hours
1	**INTRODUCTION** Branches of Civil Engineering, Scope of Civil Engineering, Role of Civil Engineer in Society, Impact of infrastructural development on economy of the country	5%	2
2	**SURVEYING** Object and Uses of Surveying, Primary Divisions in Surveying, Fundamental Principles of Surveying, Classification of Surveying, Plans and Maps, Scales, Types of Graphical Scales, Units of Measurements	5%	2
3	**LINEAR MEASUREMENTS** Methods of Linear Measurements, Instruments used in Chaining, Chain Surveying, Ranging, Obstacles in Chaining, Errors in Chaining & Corrections, Tape Corrections, Conventional Symbols	8%	4
4	**ANGULAR MEASUREMENTS** Types of Compass, Method of Using a Compass, Bearing & Its Measurements, Whole Circle Bearing and Reduced Bearing, Computation of Angles, Types of meridians and bearings, Declination and DIP, Compass traversing and correction of bearings for Local Attraction, Chain and Compass Surveying Field Work	15%	7
5	**LEVELING** Aims and applications, Definition of various terms, Instruments for levelling, Methods of levelling, Recording observations in level-book, Computing reduced levels by HI and rise & fall method.	10%	4
6	**MAPPING AND CONTOURING** Mapping, Contours, Characteristics of contours of different terrains and application of contour maps, Methods of Contouring	10%	4
7	**MINOR EQUIPMENTS AND MODERN TOOLS OF SURVEYING** Introduction to Theodolite, Electromagnetic Distance Measuring Instruments, Total Station, Global Positioning System, Remote sensing, Geographical Information System (GIS).	12%	5

8	**SUPER STRUCTURES** Types of Structures Based on the Method of Load Transfer, Building components and their functions and nominal dimensions	5%	2
9	**DAMPNESS AND ITS PREVENTION** Causes of Dampness, Ill effects of Dampness, Requirements of an Ideal Material for Damp Proofing, Materials for Damp Proofing, Methods of Damp Proofing	8%	4
10	**TRADITIONAL BUILDING MATERIALS** Introduction, Types and Properties of Stones, Bricks, Lime, Cement, Timber	7%	3
11	**MORTARS:** Introduction, Properties of Cement Mortar, Lime Mortar, Mud Mortar, Special Mortar, Tests on Mortar.	5%	2
12	**CONCRETE** Introduction, Types and Properties of Plain Concrete, Reinforced Cement Concrete (R.C.C.), Reinforced Brick Concrete (RBC), Prestressed Concrete (PSC), Pre-cast concrete.	5%	3
13	**MISCELLANEOUS BUILDING MATERIALS** Introduction, Types and Properties of Glass, Plastics, Bitumen, Asbestos, Paints, Distempers, Varnishes, Solid and Hollow Concrete Blocks, Roofing and Flooring Tiles	5%	3
	Total weightage and hours	100%	45

i) Text Book and Reference Book:

1. Surveying Vol. I By Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar Jain | Laxmi Publication | 16th Edition
2. Surveying and Leveling By R. Subramanian | Oxford University
3. Elements of Civil Engineering By Dr. R.K. Jain and Dr. P.P. Lodha | McGraw Hill Education India Pvt. Ltd.
4. Building construction By B.C. punmia | Laxmi Publication, New Delhi
5. Building Construction and Construction Material by G.S.Birdie and T.D. Ahuja | Dhanpat Rai Publishing
6. Basics of Civil Engineering (TextBook) by S S Bhavikatti | New Age International Publishers.

j) List of Experiments:

Sr. NO.	Experiment List
1	Introduction to Surveying instruments
2	Chaining and offset taking with thehelp of Chain and Tape
3	Compass Surveying
4	Simple Leveling with the help ofDumpy Level and Staff
5	Differential Leveling with the help ofDumpy level and Staff
6	Study of Theodolite
7	Study of Theodolite
8	Conventional Signs & Symbols insketch Book
9	Plan, Elevation and section of simpleResidential Building
10	Construction Site Visit
11	Different Types of Sketches of Sub structure and super structure in Sketch Book

a. **Course Name:** Basic Electrical Engineering
b. **Course Code:** 303106101
c. **Prerequisite:** Knowledge of Physics and Mathematics up to 12th science level
d. **Rationale:** Basic Electrical Engineering knowledge is fundamental as it provides a strong foundation for various engineering disciplines, promotes problem-solving skills, supports innovation, and opens doors to diverse career opportunities.
e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with electrical current, potential difference, power and energy, sources of electrical energy and elements of electrical circuit.
CLOBJ 2	Solve problems related to Alternating current, alternating voltage, etc, Demonstrate a clear understanding of Pure R, L C circuit and combination of RLC, Series and Parallel combination of R, L and C, etc
CLOBJ 3	Acquire knowledge of the resistor, capacitor, and inductor and their performance characteristics for series and parallel connections.
CLOBJ 4	Understand different single phase and three phase circuits.
CLOBJ 5	Demonstrate a clear understanding of the basic concepts, working principles and applications of transformer, DC machines and AC machines.
CLOBJ 6	Study the use of LT Switch Gear, Fuse, MCB, ELCB etc

f. **Course Learning Outcomes:**

CLO 1	Understand electrical current, potential difference, power and energy, sources of electrical energy and elements of electrical circuit.
CLO 2	Solve basic electrical circuit problems using various laws and theorems
CLO 3	Understand the role of resistor, capacitor and inductor and their performance characteristics for series and parallel connections.
CLO 4	Discuss three phase-balanced circuits.
CLO 5	Understanding the basic concepts and working principles of transformers, DC machines and AC machines.
CLO 6	Acquire knowledge about electrical installations

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	2	4	20	20	20	60	30	150

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

h. Course Content:

Sr. No.	Content	Weightage	Teaching hours
1	**DC Circuits** Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Mesh and Node analysis, Simplifications of networks using series and parallel combinations and star-delta conversions. Superposition, Thevenin and Norton Theorems.	22%	10
2	**AC Circuits** Sinusoidal voltages and currents, their mathematical and graphical representation, Concept of instantaneous, peak (maximum), average and R.M.S. values, frequency, cycle, period, peak factor and form factor, phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasors, examples based on theory. Study of A.C. circuits consisting of pure resistance, pure inductance, pure capacitance and corresponding voltage-current phasor diagrams and waveforms. Development of the concept of reactance, the study of series R-L, R-C, R-L-C circuit and resonance, study of parallel R-L, R-C and R-L-C circuit, concept of impedance, admittance, conductance and susceptance in case of above combinations and relevant voltage-current phasor diagrams, the concept of active, reactive and apparent power and power factor, examples based on theory. Concept of three-phase supply and phase sequence. Voltages, currents and power relations three-phase have balanced star-connected loads and delta-connected loads	33%	15

	along with phasor diagrams, Power and power factor measurement in balanced three-phase circuits (one, two and three wattmeter methods), examples based on theory.		
3	**Transformers** Magnetic effect of an electric current, right-hand thumb rule, Concept of m.m.f., flux, flux density, reluctance, permeability and field strength, their units and relationships, comparison between electrical and magnetic parameters. Fleming's left-hand rule. self and mutual inductance, Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.	20%	9
4	**Electrical Machines** Construction, working and application of DC Motor and Generator. Generation of 3 phase rotating magnetic fields, Construction and working of a three-phase and Single phase induction motor and its types. Construction and working of Synchronous generator.	15%	7
5	**Electrical Installations** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries.	10%	4
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Electrical Engineering Fundamentals, By V. D. Toro, Prentice Hall India, Pub. Year 1989
2. Basic Electrical Engineering, By D. C. Kulshreshtha, McGraw Hill, Pub. Year 2009
3. Fundamentals of Electrical Engineering, By Leonard S. Bobrow, Oxford University Press,Pub. Year 1996
4. Electrical and Electronics Technology, By E. Hughes Pearson, Pub. Year 2010
5. Basic Electrical Engineering, By D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, Pub. Year,2010
6. A textbook of Electrical Technology Volume 1&2, By B. L. Theraja, S. Chand Publication.

j. Experiment List:

Sr. No.	Experiment Name
1	To Study about Various Electrical and Electronics Symbols and demonstrate various measuring instruments used in Basic electrical Engineering laboratory.
2	To Perform and Solve Electrical Networks with Series and Parallel Combinations of Resistors Using Kirchhoff 's Laws.
3	To Obtain Capacitance, Power and Power Factor of the Series RL Circuit With AC Supply Using Phasor Diagram.
4	To Obtain Capacitance, Power and Power Factor of the Series RC Circuit With AC Supply Using Phasor Diagram.
5	To Obtain Capacitance, Power and Power Factor of the Series RLC Circuit With AC Supply Using Phasor Diagram.
6	Verification of superposition theoremwith dc source
7	Verification of Thevenin's theorem with dc source
8	Verification of Norton's theorems in dccircuits
9	Verification of Current and Voltage Relations in Three Phase Balanced Starand Delta Connected Loads.
10	Find out the Efficiency and VoltageRegulation of Single Phase Transformer by Direct Load Test.

a. **Course Name:** Elements of Mechanical Engineering
b. **Course Code:** 303109102
c. **Prerequisite**: Knowledge of Physics and Mathematics up to 12th science level
d. **Rationale**: Elements of Mechanical Engineering Course Provide students with a comprehensive foundation in the fundamental principles and concepts that form the backbone of mechanical engineering for various Engineering disciplines.
e. **Course Learning Objective:**

CLOBJ 1	Identify and basic mechanical components such as gears, bearings, Pumps, Compressor, boiler, I.C Engines.
CLOBJ 2	Understand various laws and behaviour of fluid at different conditions.
CLOBJ 3	Illustrate the operational mechanisms through diagrams, models, or practical demonstrations.
CLOBJ 4	Demonstrate construction and working principles of diverse mechanical devices, such as engines, pumps, and compressors.
CLOBJ 5	Evaluate basic problems related to I.C engine, pumps, compressors and fluids.
CLOBJ 6	Analyse and discuss the interactions and relationships between various mechanical elements within a system

f. **Course Learning Outcomes:**

CLO 1	Identify basic mechanical components and their functions.
CLO 2	Understand basic Properties and behavior of various fluids.
CLO 3	Understand Construction and working of various mechanical devices
CLO 4	Apply fundamental principles to solve basic mechanical engineering problems

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**2**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

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

h. Course Content:

Sr. No.	Content	Weightage	Teaching hours
1	**Basics of Thermodynamics** Prime Movers - Meaning and Classification; Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Internal Energy, Enthalpy, Specific Volume; Thermodynamics – Definition: Change of State, Path, Process, Cycle, Thermodynamic systems, Statement of Zeroth Law, First Law and Second Law of Thermodynamics and its Applications.	10%	5
2	**Properties of Gases** Gas Laws, Boyle's law, Charles law, Combined gas law; Gas Constant, Relation between Cp and Cv Constant Volume Process; Constant Pressure Process; Isothermal Process; Adiabatic Process; Poly-tropic Process. Examples based on above topics.	15%	7
3	**Properties of Steam** Types of Steam and Steam formation; Specific Enthalpy; Specific Volume; Dryness Fraction of Steam; Measurement of Dryness Fraction; Steam Table. Examples based on above topics.	15%	7
4	**Heat Engines** Definition of Heat Engine; Classification of Heat Engine; Carnot Cycle, Rankine Cycle, Otto Cycle and Diesel Cycle. Internal Combustion Engines: Two Stroke Petrol and Diesel Engine; Four Stroke Petrol and Diesel Engine; Measurement of Indicated Power and Brake Power: Numerical on calculation of Mechanical, Thermal and Volumetric Efficiency. Examples based on above topics.	20%	9
5	**Energy Conversion Device Steam Generators:** Definition and Classification; Cochran, Lancashire, Locomotive, Babcock and Wilcox Boiler: Construction and Working; Boiler Mounting and Accessories. Refrigeration and Air Conditioning: Meaning of Refrigeration; Vapor Compression Refrigeration Cycle; Vapor Absorption Refrigeration Cycle; Air conditioning; Window Air Conditioning and Split Air Conditioning.	20%	9

6	**Pumps and Air Compressors Pumps** Definition, Classification and Application of Pumps; Types and Operation of Rotary pump, Reciprocating Pump, Centrifugal Pump. Air Compressors Definition, Classification and Application of Compressors; Types and Operation of Rotary and Reciprocating Air Compressor.	10%	4
7	Motion And Power Transmission Devices Shaft and Axle; Belt Drive; Chain Drive; Friction Drive; Gear Drive; Clutch, Coupling and Brake.	5%	2
8	Conventional And Non-Conventional Energy Sources Introduction and Classification of Energy Sources; Conventional Energy Sources E.g. Solid, Liquid, Gaseous and Nuclear fuels; Calorific Value ofFuels; Non-Conventional Energy Sources E.g. Solar Energy, Wind Energy, Hydro Power, Biomass and Biomass Energy; Comparison of Conventional & Non-Conventional Energy Sources.	5%	2
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. "Elements of Mechanical Engineering", By S.B. Mathur, S. Domkundwar, Dhanpat Rai & Sons Publications.
2. "Thermal Engineering, By R.K Rajput", Laxmi Publications.
3. "Thermal Science and Engineering", By Dr. D. S. Kumar, S. K. Kataria and sons Publishers.
4. "Basic Mechanical Engineering", By T. S. Rajan, Wiley Eastern Ltd
5. "Fundamental of Mechanical Engineering", By G. S. Sawhney, PHI Publication New Delhi.

a) **Course Name:** Mathematics-I
b) **Course Code:** 303191101
c) **Prerequisite:** Knowledge of Mathematics up to 12th science level
d) **Rationale:** To acquire fundamental knowledge and apply in Engineering discipline
e) **Course Learning Objective:**

CLOBJ 1	Understand and apply techniques for evaluating definite and improper integrals.
CLOBJ 2	Solve exact, linear, and Bernoulli's differential equations.
CLOBJ 3	Solve systems of linear equations using Gauss-Jordan and Gauss-Elimination methods.
CLOBJ 4	Determine convergence of sequences and series using various tests.
CLOBJ 5	Understand and apply Dirichlet's conditions for representation by a Fourier series.
CLOBJ 6	Understand functions of several variables, partial derivatives, and their applications.

f. Course Learning Outcomes:

CLO 1	Apply differential and integral calculus to improper integrals and to determine applications of definite integral. Apart from some other applications they will have a basic understanding of indeterminate forms, Beta and Gamma functions.
CLO 2	Apply effective mathematical tools for the solutions of first order ordinary differential equations.
CLO 3	Apply the various tests of convergence to sequence, series and the tool of power series and Fourier series for learning advanced engineering mathematics.
CLO 4	Compute maximum or minimum rate of change and optimum value of functions of several variables.
CLO 5	Perform matrix computation in a comprehensive manner.
CLO 6	Apply differential and integral calculus to improper integrals and to determine applications of definite integral. Apart from some other applications they will have a basic understanding of indeterminate forms, Beta and Gamma functions.

g. Teaching & Examination Scheme:

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

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

h. Course Content:

Sr. No.	Content	Weightage	Teaching hours
1	UNIT 1: Improper Integral & Application of Definite Integral: Evaluation of definite and improper integrals, Beta and Gamma functions and their properties Area bounded by curves in Cartesian and Polar form, Area of a region bounded by function, Area of a region bounded by curves in Parametric form, Volume by slicing, Volume of solid by revolution.	8%	5
2	UNIT 2: First order Ordinary Differential equation: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, Applications	15%	9
3	UNIT 3: Matrices: Matrices & Determinants with Properties, Linear Independence, Rank of Matrix, System of Linear Equations, Consistency of System, Solution of system of Linear Equations by Gauss Jordan and Gauss-Elimination Method, Eigen values, Eigenvectors, Symmetric, Skew-symmetric, and orthogonal Matrices, Eigen bases, Diagonalization, Cayley Hamilton Theorem and its Applications, Diagonalization, Orthogonal Transformation, Quadratic form.	25%	15
4	UNIT 4: Sequences and Series: Basic of Sequences, Bounded and Monotonic Sequences, Series, Convergence of sequence and series, Geometric series, P- series, Cauchy's Integral Test, Comparison Test, Alternating Series, Absolute and	17%	10

	Conditional convergence, Ratio test, Cauchy's Root Test, Power series, Taylor's and Maclaurin's series.		
5	**UNIT 5** Fourier Series: Fourier Series of 2 periodic functions, Dirichlet's conditions for representation by a Fourier series, Fourier Series of a function of period 2, Fourier Series of even and odd functions, Half range series.	10%	6
6	**UNIT 6** Multivariable Calculus (Differentiation): Functions of Several Variables, Limit, Continuity, Partial Derivatives, Homogeneous function, Euler's Theorem for homogeneous function, Modified Euler's Theorem, Chain Rule, Implicit function, Jacobian, Tangent plane and Normal line, Maximum and Minimum Values, Lagrange 's Multiplier, Taylor's and Maclaurin's Series for functions of two variables.	25%	15
	Total weightage and hours	100%	60

i. Text Book and Reference Book:

1. Calculus and Analytic Geometry (Text Book) by G.B. Thomas and R.L. Finney | Addison Wesley
2. Calculus with early transcendental functions by James Stewart | Cengage Learning
3. Higher Engineering Mathematics by B. S. Grewal | Khanna Publications
4. Elementary Linear Algebra (Text Book) by Howard Anton, Chris Rorres | Willy India Edition | 9th Edition
5. Advanced Engineering Mathematics (Text Book) By Erwin Kreyszig | Willey India Education
6. A text book of Engineering Mathematics by N.P. Bali and Manish Goyal | Laxmi Publications

- **course name:** Engineering Physics-I
- **Course Code:** 303192101
- **Prerequisite:** Knowledge of Physics and some basic concepts in Mathematics like differentiation, integration, limit, differential equation, vector calculus up to 12^{th} science level.
- **Rationale:** Knowledge of physics is essential for all Engineering branch because physics is the foundation subject of all the branches of engineering and it develops scientific temperament and analytical capability of engineering students.

  Comprehension of basic physics concepts enables the students to solve engineeringproblem logically and develop scientific approach.
- **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding of signals, including continuous-time and discrete-time signals, analog and digital signals, and their characteristics such as amplitude, frequency, and phase.
CLOBJ 2	Analyze signals in the time domain by performing operations such as addition, multiplication, differentiation, and integration. Understand the concept of linearity and time-invariance in systems.
CLOBJ 3	Apply Fourier analysis to decompose signals into their frequency components. Perform frequency domain operations like convolution and filtering.
CLOBJ 4	Learn to transform signals from the time domain to the complex frequency domain using Laplace and Z-transforms. Analyze the stability and system behaviour in the transformed domains.
CLOBJ 5	Understand the characteristics of linear, time-invariant (LTI) systems. Compute and interpret the impulse response of systems.
CLOBJ 6	Grasp the fundamentals of sampling and the Nyquist theorem.

- **Course Learning Outcomes:**

CLO 1	Understand the concepts of forces in nature and apply the Newton's laws to describe the motion for a given system
CLO 2	Distinguish between single body system and many particle systems and analyze a two-body mechanical system into a single particle system
CLO 3	Understand the key components of a classical problem (like motion under central force field) and reminisce them to solve the physical problems.

CLO 4	Apply the Euler's equations of motion to solve the problems include rotation of rigid bodies
CLO 5	Distinguish diverse types of equilibrium. Using concept of small oscillations to solve coupled oscillator problems and identify the normal modes.

- **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	0	2	4	20	20	20	60	30	150

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

- **Course Content:**

Sr. No.	**Content**	**Weightage**	**Teaching hours**
1	**UNIT- I Properties of Material** Mechanical Properties: Elastic properties, Model of elastic behavior, tensile stress strain curve, shear strength of perfect and real crystals. Thermal Properties: Thermo-electric effects, Wiedemann-Franz law, Phonons, Modes of heat transfer, Specific heat of solids, Einstein and Debye Model, Qualitative idea about Maxwell-Boltazmann, Bose Einstein, Fermi-Dirac statistics	20%	09
2	**UNIT- II Motion in a Plane** Transformation of coordinates, Newton's laws and its completeness in describing particle motion, Problems including constraints and friction, Motion of a rigid body in the plane; Rotation in the plane; Angular momentum about a point of a rigid body in planar motion.	20%	09

3	**UNIT-III Classical Mechanics** Degrees of freedom, Constraints and constraint forces, Lagrange's equations of motion, Conservation law, Euler's laws of motion, Non inertial frames of reference; Centripetal and Coriolis accelerations; Fluid Mechanics: - Flow of fluids, Viscosity, Continuity equation, Euler and Bernoulli's equations	20%	09
4	**UNIT–IV Waves & Vibration** Transverse wave on a string, Wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, Standing waves and their Eigen frequencies, longitudinal waves and the wave equation, Acoustics waves and speed of sound, Phase velocity and group velocity.	20%	09
5	**UNIT–V Lasers** Einstein's theory of matter-radiation interaction, Absorption, Spontaneous and Stimulated Emission of Radiation, Characteristics of Laser, Components of Laser, Types of Laser: Nd:YAG Laser, CO2 Laser, Semiconductor Diode Laser, Applications of Lasers.	20%	09
	Total weightage and hours	100%	45

- **Text Book and Reference Book:**
  - "Engineering Mechanics (TextBook)By MK Harbola
  - Engineering Mechanics - Dynamics (TextBook)By JL Meriam
  - "Mechanical Vibrations (TextBook)By JP Den Hartog University Physics (TextBook)By Sears And Zemansky |

a) **Course Name:** Communication Skills
b) **Course Code:** 303193103
c) **Prerequisite:** Knowledge of English Language studied till 12th standard.
d) **Rationale:** Basic Communication Skills are essential for all Engineers.
Course Learning Objective:

CLOBJ 1	To instill an understanding of the significance of invention and innovation.
CLOBJ 2	Develop phonetic skills and familiarity with the International Phonetic Alphabet (IPA).
CLOBJ 3	Enhance vocabulary acquisition and word formation skills.
CLOBJ 4	Foster critical thinking and persuasive communication skills through role-playing scenarios.
CLOBJ 5	Develop logical thinking and creativity by connecting and describing sets of pictures.
CLOBJ 6	Enhance grammatical and writing skills by identifying and correcting common errors.

e) **Course Learning Outcomes:**

CLO 1	Understanding the importance of creative and critical thinking.
CLO 2	Expand vocabulary with proper pronunciation.
CLO 3	Comprehend the basics of English grammar.
CLO 4	Read & write effectively for a variety of contexts.
CLO 5	Develop confidence in speaking skills.
CLO 6	Understanding the importance of creative and critical thinking.

f) **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	2	0	2	-	100	-	-	-	100

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

g) Course Content:

Sr. No.	Content	Weightage	Teaching hours
1	**Crazy Scientist** The students will be taught the importance of invention and innovation using some examples that changed the world the way it worked.	5%	2
2	**Phonetics:** IPA Introduction (listening tracks) Phonic Sounds Pronunciation Practice including transcription	10%	4
3	**Vocabulary Building & Word Formation Process** Compounding, clipping, blending, derivation, creative respelling, coining and borrowing Prefixes & suffixes, synonyms & antonyms, standard abbreviations (related activities will be provided)	10%	2
4	**Speaking Activity**: Role play on Critical Thinking (Life boat) This activity topic gears towards making students do role play based on various scenarios. It involves giving them a scenario and asking them to further develop the idea in a very interesting manner, then going on to enact it. It aims to improve students' convincing skills.	10%	4
5	**Picture Description & Picture Connector:** Enable students to use vocabulary and useful expression to describe the picture. In this class the students will be trained to form logical connections between a set of pictures which will be shared with them. This geared towards building creativity and presentation skills.	15%	4
6	**Mine Activity:** Usage of Preposition Students will learn to use proper propositions by active participation in the activity.	8%	2

7	**Worksheets** on Identifying Common Errors in Writing Sentence structure Punctuations Subject-Verb Agreement Noun-Pronoun Agreement	12%	2
8	**Reading Skills**: The art of effective reading and its various strategies to be taught to the learners and practice exercises be given on reading comprehension.	10%	2
9	**Speech and spoken Exchanges; Extempore** Students will learn the correct usage of spoken language as different from the written form. It will help the students in extempore speech. This will be done by making the students give variety of impromptu speeches in front of the class: 1 minute talk on simple topics. To change the average speakers in the class to some of thebest Orator.	10%	4
10	**Book Review** The learners will identify the central idea of the book, author's style and approach towards the book. functions and nominal dimensions	10%	4
	Total weightage and hours	100%	30

h) Text Book and Reference Book:

1. Understanding and Using English Grammar by Betty Azar & Stacy Hagen | Pearson Education
2. Business Correspondence and Report Writing by SHARMA, R. AND MOHAN, K.
3. Communication Skills by Kumar S and Lata P | New Delhi Oxford University Press
4. Technical Communication: Principles And Practice by Sangeetha Sharma, Meenakshi Raman | Oxford University Press
5. Practical English Usage by MICHAEL SWAN
6. A Remedial English Grammar for Foreign Student by F.T. WOOD
7. Oxford Practice Grammar, by John Eastwood | Oxford University Press

Semester 2

a. **Course Name:** Workshop
b. **Course Code:** 303100101
c. **Prerequisite:** Zeal to learn the subject
d. **Rationale:** The workshop practice is the backbone of the real industrial trades which helps to develop and enhance relevant technical hands-on experience of using various tools and instruments related to various trades. The use of workshop practices in day to day industrial as well domestic life helps to solve the problems. Further, it also deals with basic introduction of system components of electrical and electronic systems, and provides hands on practice in assembling, interconnecting, testing, and repairing such system by making use of various tools used in electricaland electronic workshop. Electronic systems are built on printed circuit board (PCB) and breadboard. One need to use source instruments (power sources and signal sources), and appropriate measuring instruments to study behaviour of a system.
e. **Course Learning Objective:**

CLOBJ 1	Provide an overview of the principles, scope, and importance of mechanical engineering, including its various sub-disciplines and applications.
CLOBJ 2	Emphasize and enforce safety protocols, practices, and procedures to ensure a safe working environment within a mechanical workshop.
CLOBJ 3	Measurement Techniques and Instruments: Familiarize students with various measurement techniques and instruments used in mechanical engineering, emphasizing precision and accuracy in measurements.
CLOBJ 4	Introduce students to basic manufacturing processes such as machining, casting, forming, and welding, providing insights into how different materials are shaped and manipulated.
CLOBJ 5	Hands-on Experience with Tools and Equipment: Familiarize students with basic tools, machines, and equipment commonly used in mechanical engineering through hands-on activities and demonstrations in a workshop setting.

f. **Course Learning Outcomes:**

CLO 1	Comprehend the safety measures required to be taken while workingin workshop.
CLO 2	Select the appropriate tools required for specific operation.
CLO 3	Understand the different manufacturing technique for production out of the given raw material.
CLO 4	Understand applications of machine tools, hand tools and power tools.
CLO 5	Understand the importance of the safety measures to be taken while working in the laboratory and safety standards
CLO 6	Understand working principle of various electrical & electronics measurement equipment. Also, the safety measures to be takenwhile working in the laboratory and safety standards.

g. Teaching & Examination Scheme:

Evaluation Scheme									
Teaching Scheme				**Internal Evaluation**			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	0	4	2	0	0	40	0	60	100

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

h. Text Book and Reference Book:

1. Electronic Principles by Albert Paul Malvino | TMH
2. Electronic Devices by Thomas L. Floyd | Pearson, Prentice Hall "Linear Systems and Signals" by B.P. Lathi.
3. Electronic Devices and Circuits by David A. Bell | Oxford Publication
4. Electronic Devices and Circuits by Jacob Millman and Halkias | Tata McGraw Hill Publication New Delhi.
5. Shop Theory by Anderson James & Earl E. Tatro | Macmillan/McGraw-Hill School.
6. Workshop Technology by Bava H. S. | Tata McGraw Hill Publishing Co. Ltd.
7. Elements of Workshop Technology Vol. I By Hajra Chaudhary S.K. | Asia Publishing House.
8. Workshop Technology by Chapman, W.A.J. ELBS Low Price Text | Edward Donald Pub. Ltd.
9. Basic Machine Shop Practice Vol. I & II By Tejwani, V.K. | Tata McGraw Hill Pub. Co.
10. Workshop Technology Vol. I & II By Arora, B.D. | Satya Prakashan, New Delhi" Signals and Systems" by Simon Haykin and Barry Van Veen.

i. Experiment List:

Exp. No.	Name of the Experiment
1	Study of Digital Multi meter and Measurement of voltage, current, frequency, phase difference, power, power factor for single phase supply using Digital Millimeter.
2	To study about safety, Electric shock, First aid for electric shock and otherHazards of electrical Laboratories and Safety rules.

3	Identification and symbolic representation of basic passive components
4	Understanding of working andspecifications of CRO and Function Generator
5	Identification, symbolic representation and testing of various electronics components (including SMD).
6	To understand working and specifications of DC regulated Power supply.
7	Understanding soldering techniques and practicing propersoldering and de-soldering.
8	Overview of PCB layout designingand fabrication.
9	Study of different types of cables,wires, probes, connectors
10	To understand series & parallel type of connections and to performBulb wiring, Fan wiring, Tube-light wiring
11	To perform staircase wiring, double stair case wiring, and Go-down wiring.
12	Demonstration of Fuse, MCB along itsoperation and study of ELCB.
13	Prepare installation diagram for a newly builtroom, Simple room wiringwith one fan, one tube-light and one bulb with switch board
14	Introduction to Workshop Layoutand Its importance
15	Introduction to Industrial Safety
16	Introduction to Measuring Instruments
17	Fitting and Drilling Practice
18	Carpentry Practice
19	Sheet Metal Practice
20	Smithy Practice
21	Metal Joining Processes: Weldingand Soldering Practice
22	Plumbing Practice
23	Metal Cutting on Lathe machine.

a. **Course Name:** Environmental Science
b. **Course Code:** 303104105
c. **Prerequisite:** Knowledge of Physics, Chemistry and Mathematics up to 12th science level and Biology up to 10th science level
d. **Rationale:** The Basic knowledge of the environment is essential for all human beings for a good life and sustainable existence
e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding of signals, including continuous-time and discrete-time signals, analog and digital signals, and their characteristics such as amplitude, frequency, and phase.
CLOBJ 2	Analyze signals in the time domain by performing operations such as addition, multiplication, differentiation, and integration. Understand the concept of linearity and time-invariance in systems.
CLOBJ 3	Apply Fourier analysis to decompose signals into their frequency components. Perform frequency domain operations like convolution and filtering.
CLOBJ 4	Learn to transform signals from the time domain to the complex frequency domain using Laplace and Z-transforms. Analyze the stability and system behaviour in the transformed domains.
CLOBJ 5	Understand the characteristics of linear, time-invariant (LTI) systems. Compute and interpret the impulse response of systems.
CLOBJ 6	Grasp the fundamentals of sampling and the Nyquist theorem.

f. **Course Learning Outcomes:**

CLO 1	Understand the interrelation and inter dependency of organisms and their interactions with the environment.
CLO 2	Identify eco-friendly measures in engineering projects.
CLO 3	Understand preventive steps for environmental protection.
CLO 4	Act as a responsible individual who is aware of efficient usage of resources and securing sustainable development

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
1	0	0	0	-	50	-	-	-	50

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

h. Course Content:

Sr. No.	Content	Weightage	Teaching hours
1	**ENVIRONMENTAL HEALTH, ECOLOGY AND QUALITY OF LIFE:** Environmental education: Objective and scope, Impact of technology on the environment, Environmental disasters: Case studies, Global environmental awareness to mitigate stress on the environment, Structure and function of an ecosystem, Ecological pyramids, Pyramid of number, Pyramid of energy and pyramid of biomass.	25%	03
2	**POLLUTION PREVENTION** Air & Noise pollution - Sources & their Effects, Case studies of Major Catastrophes, Structure and composition of the atmosphere, Water, Soil, Marine, Thermal & Marine Pollution: The story of fluoride contamination, Eutrophication of lakes, control measures, Measuring water quality: Water quality index, Waste water treatment (general) primary, secondary and tertiary stages, Municipal Solid waste management: Sources and effects of municipal waste, Biomedical waste, Hazardous waste	20%	04

3	**POPULATION GROWTH, GLOBAL ENVIRONMENTAL CHALLENGES & LATEST DEVELOPMENTS** Population Explosion - Causes, Effects and Control, an International initiative in population-related issues, Urbanization, Growth of the world's large cities, Water resources: Sources of water, Stress on water resources, Climate Change, Global Warming and Green House Effect, Acid Rain, Depletion of Ozone layer, Variation in concentrations of GHG gases in ambient air during last millennium, Role of Environmental Information System (ENVIS) in India and similar programs run by EPA(USA), Role of soft tools like Quantum GIS, Autodesk Building Information Modeling (BIM) and City Finance Approach to Climate-Stabilizin Targets (C- FACT), Life Cycle Assessment, Bioinformatics and Optimization tools for sustainable development.	25%	03
4	**SMART CITIES:** The Introduction to smart cities - about smart cities, what is a smart city, world urbanization, case studies of Songdo, Rio De Janeiro, what makes cities smart. City as a system of systems – Introduction, systems thinking, Milton Keynes Future Challenges, Rich picture as city challenges, Wicked problems, Development of smart city approach – core elements, open data, sustainability, privacy and ethics, development processes. Smart Citizens – their role, engaging citizens, IES Cities, Energy systems, Approaches for Citizen Engagement, cocreating smart cities, cities unlocked, living labs, city problems, crowdsourcing ideas, redesigning cities for citizens, all age-friendly cities, mobility on demand, motion maps. Infrastructure, Technology and Data – urban infrastructure and its technology, future of lighting, IoT, connected objects, sensing the city, NOx eating paints and air quality sensors, safest, smart citizen kit, sensing your city, Sensored City, Cyber security for data power, open, shared and closed data, satellite data, open data revolution, Smart City Project Data Innovation – smart innovations, smart city ecosystem, data- driven innovations for smart cities Standards and Capacity Building – the role of Standard, BSI smart city Standards, HyperCat, ITU Smart Sustainable cities, Smart City Readiness Lessons Learnt from Amsterdam Smart Measurements - metrics and indicators, city indicators, WCCD data portal, value proposition, integrated reporting, smart city learning and education, urban data school.	30%	5
	Total weightage and hours	100%	15

i. Text Book and Reference Book:

1. "Textbook of Environmental Studies For Undergraduate Courses (TextBook)By Dr Erach Bharucha | Orient BlackSwan | Second Edition, Pub. Year 2013.
2. "Basics of Environmental Studies by U K Khare | Tata McGraw Hill.
3. "Environmental Studies by Anindita Basak | Drling Kindersley(India)Pvt. Ltd Pearson
4. " Environmental Sciences by Daniel B Botkin & Edward A Keller | John Wiley & Sons
5. “Air Pollution By M N Rao , H .V N Rao | McGraw Hill Publishing CompanyLimited, New Delhi

a. **Course Name:** Programming for Problem Solving
b. **Course Code:** 303105102
c. **Prerequisite:** Requires Basic Knowledge of Computer
d. Rationale: This course is design to provide basic ideas of computer programming. This course also makes help to understand programming language. It will help to develop their logical abilities.
e. **Course Learning Objective:**

CLOBJ 1	Recognize and recall fundamental principles and organizations of computers, demonstrating a foundational understanding of computer architecture and design.
CLOBJ 2	Comprehend the concepts of computer programming languages, illustrating a grasp of syntax, semantics, and the essential components of programming languages.
CLOBJ 3	Develop algorithms for solving basic engineering problems, demonstrating the ability to apply theoretical knowledge to practical problem-solving scenarios.
CLOBJ 4	Demonstrate proficiency in the practical application of C programming by writing, compiling, and debugging programs, showcasing the ability to implement and troubleshoot code effectively.
CLOBJ 5	Evaluate and analyse complex computational programs written in C, demonstrating the capacity to assess and understand intricate solutions to computational challenges.
CLOBJ 6	Develop simple projects using the C programming language, showcasing creativity and application of learned principles to produce functional and practical software solutions.

f. **Course Learning Outcomes:**

CLO 1	Recognize the computer's basic principles and organizations.
CLO 2	Understand Concepts of Computer Programming Language.
CLO 3	Develop the algorithm for solving basic Engineering Problems.
CLO 4	Write, Compile and debug program with C Programming.
CLO 5	Analyse the Solved, Complex Computational Program written in C.
CLO 6	Develop simple projects using C Language.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	0	2	4	20	20	20	60	30	150

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

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
1	**Number System:** Introduction and type of Number system, Conversion between number system, Arithmetic operations on number system, Signed and unsigned number system Software, Computer Languages and Computer Program	2%	1
2	**Introduction to 'C' Programming:** Features of C language, structure of C Program, Flow Charts and Algorithms Types of errors, debugging, tracing/stepwise execution of program, watching variables values in memory.	3%	1
3	**Constants, Variables and data Types:** Character Set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of Variables, assigning values to variables, typedef, and defining symbolic constants.	5%	2
4	**Operators and Expression:** Introduction to Operators and its types, Evaluation of expressions, Precedence of arithmetic operators, Type conversions in expressions, Operator precedence and associatively.	10%	5
5	**Management Input and Output Operators:** Introduction, reading a character, writing a character, formatted input, formatted output.	5%	2
6	**Control structure in C:** Decision Making & branching: Decision making with If &I .. Else statements, If.. Else statements (Nested …. Ladder), The Switch & goto statements, The turnery (?:) Operator Looping: The while statement, The break statement & The Do.. While loop, The FOR loop, Jump within loops – Programs	15%	7
7	**Array:** Introduction, One-dimensional arrays,Two-dimensional arrays, arrays, Concept of Multidimensional arrays.	10%	4
8	**String:** string, string storage, Built-in-string functions	10%	4
9	**User-Defined Functions:** Concepts of user defined functions, prototypes, definition of function, parameters, parameter passing, calling a function, recursive function, Macros, Pre-processing.	10%	5
10	**Structure and Unions:** Introduction, Structure definition, declaring and initializing Structure variables, Accessing Structure members, Copying & Comparison of structures, Arrays of structures, Arrays within structures, Structures within Structures, Structures and functions, Unions	10%	5
11	**Pointers:** Basics of pointers, pointer to pointer, pointer and array, Pointer to array, array of pointers, functions returning a	10%	5

	pointer		
12	**Dynamic memory allocation:** Introduction to Dynamic memory allocation, malloc (), calloc (), free (), realloc ()	5%	2
13	**File Management in C:** Introduction to file management and its functions	5%	2
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. "Programming in ANSI C", (Textbook), By E. Balaguruswamy, Tata McGraw-Hill
2. "C Programming: Test Your Skills", By Ashok Kamthane
3. "Computer Fundamentals", By P.K. Sinha and Priti Sinha, BPB Publications, 4th Edition

a. Course Name: Engineering Graphics
b. Course Code: 303109101
c. Prerequisite: Zeal to learn the subject.
d. Rationale: Engineering Graphics is the language of communication for Engineers. Engineering Graphics course provides tools and techniques of communication for various fields of Engineering.

e. Course Learning Objective:

CLOBJ 1	Proficiency in using drawing instruments and accessories for accurate representation.
CLOBJ 2	Knowledge of drawing standards, specifically BIS-SP-46, ensuring drawings comply with established norms.
CLOBJ 3	Skill in constructing various engineering curves such as conics, spirals, involutes, and cycloids with tangents and normal.
CLOBJ 4	Understanding the types of projections, including oblique, perspective, orthographic, and isometric projections.
CLOBJ 5	Competence in projecting various planes and solids with different shapes and orientations.
CLOBJ 6	Proficiency in creating orthographic projections from pictorial views using both first angle and third angle projection methods.

f. Course Learning Outcomes:

CLO 1	Demonstrate the use of Drawing Instruments.
CLO 2	Identify the Drawing Symbols, Conventions used in Engineering Drawing.
CLO 3	Interpret Engineering Drawings.
CLO 4	Construct the Different types of Engineering Curves.
CLO 5	Apply Descriptive Geometry Principles to Solve Engineering Problems Involving Points, Lines, Planes and Solids.
CLO 6	Recognize the need of Advanced Computer Aided Tools and Software.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
2	0	4	4	20	20	20	60	30	150

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

h. Course Content:

Sr. No.	Content	Weightage	Teaching hours
1	**INTRODUCTION TO ENGINEERING GRAPHICS** Scope of Engineering Drawing in all Branches of Engineering, Uses of Drawing Instruments and Accessories, Introduction to Drawing Standards BIS-SP- 46, Representative Fraction, Engineering Scales, Dimensioning Terms and Notations, Types of Lines used in Engg. Practice recommended by BIS.	5%	02
2	**ENGINEERING CURVES** Classification of Engineering Curves, Application of Engineering Curves, Constructions of Engineering Curves - Conics, Spirals, Involutes and Cycloids with Tangents and Normal.	10%	03
3	**PRINCIPLES OF PROJECTIONS** Types of Projections - Oblique, Perspective, Orthographic and Isometric Projections; Introduction to Principal Planes of Projections, Projections of Points located in all four Quadrants; Projections of lines inclined to one of the Reference Plane and inclined to two Reference Planes.	10%	03
4	**PROJECTIONS OF PLANES** Projections of various planes 'Polygonal, Circular and Elliptical shape inclined to one of the Reference Plane and inclined to two Reference Planes; Concept of Auxiliary Plane of Projections.	10%	03

5	**PROJECTIONS OF SOLIDS AND SECTIONS OF SOLIDS** Classifications of basic Solids, Projections of Solids - Right Regular Prism, Pyramid, Cone, Cylinder, Tetrahedron and Cube inclined to one of the Reference Plane and inclined to two Reference Planes; Frustum of Prism, Pyramid and Cone inclined to one of the Reference Plane; Types of Cutting Planes - Auxiliary Inclined Plane, Auxiliary Vertical Plane, Horizontal Cutting Plane, Profile Cutting Plane; Sections of Solids resting on H.P/V.P and Inclined to only one of the Reference Planes; Sectional Views, True Shape of the Sections.	20%	06
6	**DEVELOPMENT OF SURFACES** Methods of Development of Lateral Surfaces of Right Regular Solids, Parallel Line Development and Radial Line Development, Applications of Development of Surfaces.	10%	03
7	**ORTHOGRAPHIC PROJECTIONS** Projections on Principal Planes from Front, Top and Sides of the Pictorial view of an Object, First Angle Projection and Third Angle Projection method; Full Sectional Orthographic Views 'Side and Front, Offset Cutting views.	15%	04
8	**ISOMETRIC VIEW/DRAWING AND ISOMETRIC PROJECTIONS** Conversion of Orthographic Views into Isometric Projection, View or Drawing; Isometric Scale.	15%	04
9	**OVERVIEW OF COMPUTER AIDEDDRAFTING TOOLS** Basic User Interface of Drafting Software, Demonstration of basic modelling commands, Preparation of Orthographic Projections and Isometric Views of 3D Solids using Drafting Software.	5%	02
	Total weightage and hours	100%	30

i. Text Book and Reference Book:

1. "Engineering Graphics" by N.D. Bhatt:
2. "Engineering Drawing" by K.R. Gopalakrishna:
3. "Engineering Drawing and Design" by David A. Madsen, David P. Madsen, and Emeritus:
4. "Fundamentals of Engineering Drawing" by Warren J. Luzadder and Jon M. Duff:
5. "Technical Drawing" by Frederick E. Giesecke, Alva Mitchell, Henry C. Spencer, Ivan L. Hill, and John T. Dygdon

j. Experiment List:

Sr. NO.	Experiment List
1	Introduction to Engineering Graphics: Types of lines, Letterings, Drawing Symbols, Numberings, Dimensioning Terms and Notations, Title Block, Geometric Constructions etc.
2	Exercise on Engineering Curves.
3	Exercise Sheet on Projections of Pointsand Lines.
4	Exercise on Projections of Planes.
5	Exercise on Projections of Solids andSections of Solids.
6	Exercise on Development of Surfaces.
7	Exercise on Orthographic Projections.
8	Exercise on Isometric Projection/View or Drawing.
9	Prepare 2D Drawings using AutoCAD.
10	Prepare 3D Drawings using AutoCAD.

a. **Course Name:** Chemistry
b. **Course code:** 303120101
c. **Prerequisite:** Knowledge of fundamental concepts of chemistry and some basic concepts related to practical up to 12th science level
d. **Rationale:** Chemistry is a fundamental branch of science that studies the properties, composition, structure, and changes of matter. The rationale for studying chemistry is multifaceted and encompasses various aspects that contribute to our understanding of the natural world and have practical applications.

e. **Course Learning Objective:**

CLOBJ1	Knowledge of chemistry is essential for all Engineering branch because chemistry finds application in all the branches of engineering and it develops scientific temperament and analytical capability of engineering students.
CLOBJ2	Comprehension of basic chemistry, physics & mathematics concepts enable the students to solve engineering problem logically and develop scientific approach
CLOBJ3	Students will gain the knowledge about the latest applications of technology.
CLOBJ4	Students will be able to apply chemical concepts to solve qualitative and quantitative problems

f. Course Learning Outcomes:

CLO 1	Students will gain the knowledge about different fields of chemistry
CLO 2	Students will able to use basic concepts of chemistry in industry
CLO 3	Students will gain the knowledge about the latest applications of technology.
CLO 4	Students will be able to apply chemical concepts to solve qualitative and quantitative problems

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	0	2	4	20	20	20	60	30	150

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

h. Course Content:

Sr. No.	Content	Weightage	Teaching hours
1	**Introduction to quantum theory for chemical systems:** Schrodinger equation, Applications to Hydrogen atom, Atomic orbitals, many electron atoms	16%	7
2	**Chemical bonding in molecules** MO theory, Structure, bonding and energy levels of bonding and shapes of many atom molecules, Coordination Chemistry, Electronic spectra and magnetic properties of complexes with relevance to bio-inorganic chemistry, organometallic chemistry	20%	10
3	**Introduction to Stereochemistry** Stereo descriptors 'R, S, E, Z. Enantiomers and Diastereomers. Racemates and their resolution. Conformations of cyclic and acyclic systems	16%	7
4	**Reactivity of organic molecules** factors influencing acidity, basicity, and nucleophilicity of molecules, kinetic vs. thermodynamic control of reactions	16%	7
5	**Strategies for synthesis of organic compounds:** Reactive intermediates substitution, elimination, rearrangement, kinetic and thermodynamic aspects, role of Solvents	16%	7
6	**Electrochemistry** Laws of electrolysis and their applications. Difference between galvanic and electrolytic cells, E.M.F. galvanic cells, free energy changes in cells, reversible electrode potentials, single electrode potential and its determination. Nernst equation and its derivation, reference (hydrogen and calomel) electrode. EMF series and its applications. Primary and secondary cells, electrochemical cell.	16%	7
	Total weightage and hours	100%	45

Text Book and Reference Book:

1. Organic Chemistry Bahl and Bahl; S Chand & Co. Ltd, New Delhi
2. Essential of Physical Chemistry Bahl and Tuli; S Chand & Co. Ltd. New Delhi
3. ENGINEERING CHEMISTRY B. SIVSANKAR; TATA MACGRAWHILL
4. ENGINEERING CHEMISTRY MARRY JANE & SHULT; CENCAGE LEARNING
5. ENGINEERING CHEMISTRY JAIN & JAIN; DHANPAT RAI
6. ENGINEERING CHEMISTRY,O.P AGRAWAL; KHANNA

i. Experiment List:

Sr. NO.	Experiment List
1	Find the concentration in terms of normality and gram/liter of oxalic acid and sulphuric acid from their mixture.
2	To determine the amount of calcium and magnesium inthe given solution using 0.01M EDTA solution, by complexometric titration
3	You are given 0.08 N KMnO4 solution. Determine the normality and gram/liter of ferrous sulphate (FeSO47H2O) and hence that of potassium dichromate (K2Cr2O7) using external indicator potassium ferricyanide.
4	To determine the amount of Cu+2 and CuSO4 5H2Ousing given sodium thiosulphate solution, lodometrically.
5	To estimate the amount of ester present in the givensolution.
6	Estimation of Acetamide by hydrolysis method.
7	To determine the strength of the strong acid bytitration with strong base Conductometric ally
8	To determine the strength of the mixture of acids bytitration with strong base Conductometric ally.
9	To determine the strength of the strong acid bytitration with strong base Potentiometrically

a. **course name:** Mathematics -II
b. **Course Code: 303191151**
c. **Prerequisite:** Knowledge of derivative and Integration
d. **Rationale: To acquire fundamental knowledge and apply in Engineering discipline**
e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding of signals, including continuous-time and discrete-time signals, analog and digital signals, and their characteristics such as amplitude, frequency, and phase.
CLOBJ 2	Analyze signals in the time domain by performing operations such as addition, multiplication, differentiation, and integration. Understand the concept of linearity and time-invariance in systems.
CLOBJ 3	Apply Fourier analysis to decompose signals into their frequency components. Perform frequency domain operations like convolution and filtering.
CLOBJ 4	Learn to transform signals from the time domain to the complex frequency domain using Laplace and Z-transforms. Analyze the stability and system behaviour in the transformed domains.
CLOBJ 5	Understand the characteristics of linear, time-invariant (LTI) systems. Compute and interpret the impulse response of systems.
CLOBJ 6	Grasp the fundamentals of sampling and the Nyquist theorem.

f. **Course Learning Outcomes:**

CLO 1	Apply mathematical tools needed in evaluating vector calculus and their usage like Work, Circulation and Flux.
CLO 2	Apply Laplace transform as tools to solve differential equations and Fourier integral representation.
CLO 3	Apply effective mathematical methods for the solutions of higher order ordinary differential equations.
CLO 4	Use series solution methods and special functions like Bessels' functions
CLO 5	Compute the areas and volumes using multiple integral techniques.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
4	0	0	4	20	20	00	60	00	100

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

h. Course Content:

Sr. No.	Content	Weightage	Teaching hours
1	**Higher order ordinary differential equations:** Ordinary differential equations of higher orders, Homogeneous Linear ODEs of Higher Order, Homogeneous Linear ODEs with Constant Coefficients, Euler–Cauchy Equations, Non homogeneous ODEs, Method of Undetermined Coefficients, Solution by Variation of Parameters, Applications.	17%	10
2	**Power Series:** Power series solutions at ordinary point and regular singular point; Legendre polynomials, Bessel functions of the first kind and their properties.	15%	09
3	**Laplace Transform:** Laplace Transform and inverse Laplace transform, Linearity, First Shifting Theorem (sShifting), Transforms of Derivatives and Integrals, ODEs, Unit Step Function (Heaviside Function), Second Shifting Theorem (t-Shifting), Laplace transform of periodic functions, Short Impulses, Dirac's Delta Function, Convolution, Integral Equations, Differentiation and Integration of Transforms, Solution of ordinary differential equation by Laplace transform	25%	15
4	**Fourier Integral:** Fourier Integral, Fourier Cosine Integral and Fourier Sine Integral.	08%	05

5	**Vector Calculus:** Gradient of scalar field, Directional Derivative, Divergence and curl of Vector field, Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	18%	11
6	**Multivariable Calculus (Integration):** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Triple integrals (Cartesian)	17%	10
	Total weightage and hours	100%	60

h. Text Book and Reference Book:

1. "Advanced Engineering Mathematics (TextBook) By Erwin Kreyszig | Willey India Education
2. Calculus with early transcendental functions By James Stewart | Cengage Learning
3. "Higher Engineering Mathematics By B. S. Grewal | Khanna Publications
4. Calculus and Analytic Geometry (TextBook) By G.B. Thomas and R.L. Finney | Addison Wesley

a. Advanced Communication & Technical Writing
b. **Course Code:** 303193152
c. **Prerequisite:** Knowledge of English language studied till 12th standard.
d. **Rationale:** Communication confidence laced with knowledge of English grammar is essential for all engineers**.**

e. **Course Learning Objective:**

CLOBJ 1	Students will be able to demonstrate the ability to adapt writing style to different audiences and purposes.
CLOBJ 2	Students will create comprehensive technical documents such as reports, essay, review and project proposals.
CLOBJ 3	Students will develop and deliver professional presentations, incorporating effective visual aids, engaging content and confident delivery.
CLOBJ 4	Student will explore and apply technical communication through various mediums (video, web content, multimedia)
CLOBJ 5	Students will be able to incorporate advanced document design principles for clarity and readability.
CLOBJ 6	Students will be able to deliver different types of speeches.

f. **Course Learning Outcomes:**

CLO 1	Develop four basic communication skills.
CLO 2	Construct grammatically correct sentences.
CLO 3	Develop and deliver professional presentation skills.
CLO 4	Develop the skills of critical thinking.
CLO 5	Compare different types of written communication.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	2	0	2	-	100	-	-	-	100

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

h. Course Content:

Sr.	Content	Weightage	Teaching hours
1	**Developing Effective Listening Skills**: To help students understand the meaning and importance of good listening skills, learning the traits of being a good listener through activity and listening audio tracks.	10%	2
2	**Error analysis**: To provide insights into the complicated processes of language development as well as a systematic way for identifying, describing and explaining errors. (Tenses, Voices, Reported speech)	10%	4
3	**Delivering different types of speeches:**: Students will understand and use the different patterns for structuring speeches • Welcome / Introductory speech • Vote of Thanks speeches • Farwell speeches	10%	2
4	**Professional Presentations**: Students will learn • Combating stage fright • Preparing power point presentation • Delivering PPT	10%	5
5	**Essay writing**: Students will overcome the common pitfalls in the task of essay writing by understanding • Basics of Paragraph development and paragraph jumble • Types of essays • Characteristic features of essays • Guiding Principles	10%	4
6	**Reading Comprehension**: • Employing Different Reading Skills • Activity • Practice	10%	2
7	**Project Proposal**: • To equip students with the various elements required to prepare a winning proposal.	5%	2
8	**Misplaced Modifiers**: Students will understand how to place the improperly separated word, phrase or clause from the word it describes.	5%	1
9	**Movie Review**: • A movie show followed by writing a review. • To provide an exposure to students how to express their opinions about some film or documentary with unbiased and objective approach.	10%	2

10	**Narrative Writing**: • Narrative writing helps them explore different characters and settings. • To help students clarify their thinking, and teach them to express that in writing in an organized way.	5%	2
11	**Writing Reports**: • Process of writing • Order of writing • Final draft & checklist for reports • Sample reports: 1. Memorandum **2.** Letter report	10%	2
12	**Critical Thinking**: • Need, relevance and Significance of Critical Thinking • Logic in problem solving and decision making(activities) • Moral Reasoning (Case Studies)	5%	2
	Total weightage and hours	100%	30

i. Reference Books:

1. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.

2. Communication Skills Kumar S and Lata P; New Delhi Oxford University Press

3. Practical English Usage MICHAEL SWAN

4. A Remedial English Grammar for Foreign Student F.T. WOOD

5. On Writing Well William Zinsser; Harper Paperbacks,2006; 30th anniversary edition

6. Oxford Practice Grammar, John Eastwood; Oxford University Press

7. Technical Communication : Principles And Practice Sangeetha Sharma, Meenakshi Raman; Oxford University Press

Semester 3

(1)

a. **Course Name:** Introduction of Petroleum Geology
b. **Course Code:** 303120201
c. **Prerequisite:** Basics knowledge of Physics and rock structures. Understanding of Doppler effects and other acoustic laws are required.
d. **Rationale:** The course will introduce students to learn on various segments of earth structure and understand about the formation of different rocks. Rocks classification based on texture, packing and formation era.
e. **Course Learning Objective:**

CLOBJ 1	The needed confidence and experience to train other professionals on various aspects related to petroleum geology and geoscience
CLOBJ 2	The knowledge of all geology- and geoscience-related risks that pose a big threat or hindrance to the petroleum exploration and accumulation process and the ability to overcome these without much impact on the organization
CLOBJ 3	The experience and confidence to work with advanced technology to enhance the quality and speed of various processes undertaken during the exploration and extraction of petroleum
CLOBJ 4	The potential and ability to contribute to organizational growth by upgrading systems and processes to match existing competition and meet the challenging demands of the market
CLOBJ 5	The knowledge of optimizing exploration and extraction processes to identify the best sources and make the best use of resources from these areas, thereby reducing redundant costs for subsequent exploration activities
CLOBJ 6	The understanding and experience to ensure that all activities carried out are within the geological limits and guidelines expected of the organization

f. **Course Learning Outcomes:**

CLO 1	Evaluate on the composition of solid-earth and how their make-up changes underwent over time
CLO 2	Describe about the dynamics of the earth, investigation of how minerals can be discovered and utilized ie. Its resources and economics
CLO 3	Contrast the different types of deformation based on the composition of the rock as well as external stress factors
CLO 4	Create and develop the idea behind petroleum generation and accumulation

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr.	Topic	Weightage	Teaching hours
1	**The Earth:** Introduction to origin, age, internal structure and constitution of earth; introduction to earth's lithosphere, atmosphere, hydrosphere, and biosphere; plate tectonic theory, tectonic elements of continents and oceans; continental drift; concept of isostasy.	22%	10
2	**Crystallography, Mineralogy and Petrology:** **Crystallography –** unit cell, crystal systems, crystal faces, and crystal symmetry; concept of stereographic projection. Mineralogy – classification of minerals, physical and optical properties of rock forming minerals; classification and structure of silicates; brief descriptions of common silicates viz., olivine, pyroxene, amphibole, mica, feldspar and quartz; Concepts of solid solution and binary eutectic; Bowen's reaction series. Petrology introduction; classification of rock types; formation, classification, texture and structure of igneous, metamorphic,and sedimentary rocks. Description of common Igneous Rocks viz., Rhyolite, Granite, Pegmatite, Basalt, Dolerite, and Gabbro; Sedimentary Rocks viz. Conglomerate, Breccia, Sandstone, Shale, and Limestone e; Metamorphic Rocks viz., Slate, Schist, Gneiss, Quartzite, and Marble. Rock cycle; introduction to weathering of rocks with an emphasis on chemical weathering	34%	15
3	**Structural Geology:** Domain of Structural Geology; concepts of strike and dip; parameters controlling deformation of rocks; deformation in rocks – descriptions of folds, joints, faults and their classifications; unconformity; geologicalmaps and sections; map symbols.	22%	10

4	**Source Migration and Trap:** Source, Source characterization, Source quantification, Oil and gas Window, Migration, Primary and Secondary migration, Mechanism of Migration, Migration quantification, Migration pathways, Traps, Classification of traps, Traps classification based on GWC and OWC, Trapping Mechanism, Seal, Seal integrity study, Seal style.	22%	10
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. AAPG Treatise on Petroleum Geology, 1999
2. AAPG, Development Geology Reference Manual, 1992
3. Sedimentary Rocks F. J. Pettijohn,
4. Geology of Carbonate reservoir, Ahr, W. M. (2008); John Willey and Sons
5. Geology of Petroleum, Leverson; CBS Publishers & Distributors
6. Evaporites: Sediment, resources and Hydrocarbon, Warren, J.; Springer Publication

(2)

a. **Course Name:** Drilling Engineering-I Lab
b. **Course Code:** 303120202
c. **Prerequisite:** Basics of Physics and Maths for understanding the problems in Drilling Rig design.
d. **Rationale:** This course will introduce students to learn about the methodology of making a conduit into the earth surface creating a overbalance. The various steps are included throughsubject by which students can efficiently plan for a completion of a well.
e. **Course Learning Objective:**

CLOBJ 1	To show the effects of varying amounts of mixing water on the physical properties of Portland cement. These properties are Free Water Separation, Normal and Minimum Water Content and Thickening Time.
CLOBJ 2	Understand the importance of drilling fluids and calculate how much additives required to increase/decrease mud weight, tank volumes, prepare new mud etc.
CLOBJ 3	Design drilling string using buoyancy and pressure area methods
CLOBJ 4	Choose different bit for different formations, cost/ft analysis, WOB and RPM calculations and effect of parameters on ROP
CLOBJ 5	Apply different hydraulic models for drilling fluid calculations and utilize the basic drilling operations, drilling machinery and drilling fluids.

f. **Course Learning Outcomes:**

CLO 1	Summarize the parameters for designing a drilling mud system
CLO 2	Observe the various properties in designing a water-based mud
CLO 3	Calculation of different petrological properties
CLO 4	Designing the mud to overcome the various hole problems.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	0	2	1	-	-	20	-	30	50

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

h. Text Book and Reference Book:

1. Petroleum Engineering: Drilling and Well Completion,Carl Gatlin (1960); Prentice Hall; 1st Ed
2. Applied Drilling Engineering, Society of Petroleum Engineers. Bourgoyne , Adam T. Jr., Martin E. Chenevert, Keith K. Millheim and F.S. Young Jr., Richardson, T
3. Oil Well Drilling Engineering Principles and Practices, Rabia (1986); Kluwer Law Internationa.

i. Experiment List:

Exp.No.	Name of the Experiment
1	To prepare the Drilling fluid and calibrate theequipment used in the drilling fluid laboratory
2	To determine the Mud Weight using mud balance.
3	To determine the Marsh Funnel Viscosity of mudusing marsh funnel.
4	To perform the Mud Rheology Test using rotational viscometer.
5	To determine the Filtration, Wall Buildingcharacteristics of mud using LPLT API filter-press.
6	To determine the Mud Resistivity using theconductivity meter
7	To determine the Solid and Liquid Content in mud using the Baroid Sand Content Set.
8	To determine the Cation Exchange Capacity of the drilling fluid using the Methylene Blue Dye Test (MBT)
9	To estimate the Mud Weight Control usingBentonite and Barite
10	To perform the Drilling Fluid Contamination test using Rotational Viscometer.

(3)

a. Course Name: Drilling Engineering-I
b. Course Code: 30312023
c. Prerequisite: Basics of Physics and Maths for understanding the problems in Drilling Rig design
d. Rationale: This course will introduce students to learn about the methodology of making a conduit intothe earth surface creating a overbalance. The various steps are included through subject by which students can efficiently plan for a completion of a well.

e. Course Learning Objective:

CLOBJ 1	Design and evaluate drilling fluid program and cementing operations under specific well conditions
CLOBJ 2	Prepare and test drilling fluids and cementing slurry according to API standards
CLOBJ 3	Optimize drilling fluid hydraulics for high rate of penetration and cuttings transportation efficiency
CLOBJ 4	Effectively describe petroleum well drilling including key features of various components, and use these descriptions in appropriate for design, design analysis and evaluations;
CLOBJ 5	Develop awareness of the multiple aspects of drilling operations and the challenge of analysing and synthesizing the numerous technical issues encountered during drilling.
CLOBJ 6	Apply theoretical and practice skills in data analysis used for real petroleum engineering problems through case studies.

f. Course Learning Outcomes:

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

g. Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
3	1	0	4	60	-	20	20	-	100

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

h. Course Content:

Sr.	Topic	Weightage	Teaching hours
1	**Basic Drilling Practices**: Well Planning, Drilling Rig: Components, Selection and Operating systems - Hoisting, Circulation and Rotary systems, Power transmission, Rig control system. Wire lines and service life evaluation, Drilling Fluids – Basics, Functions, Classification, Properties and Nature. Drilling fluids equipment related to pressure and separation. Formulations of drilling fluid, Mud systems like Pneumatic, Synthetic oil based, Inhibitive and Non-inhibitive Rheology models of drilling fluids Mud Hydraulics and Mud weight and Pressure loss calculations in round trip circulation cycle, Pore Pressure prediction, Fracture pressure	33%	15
2	**Drill string, Casing and Bit Design:** Drill String - Components, functions and design, Casing Practices – Configuration, operation, properties, types and design, casing setting depth and hole sizes, liner design, casing handling practices Drill Bits–Types, Performance and Criteria for design.	23%	10
3	**Cementation Techniques:** Cementing, Cements & cement slurry: Objectives of cementing, oil wellcements, Classification of cement, Slurry design, Slurry additives, Factors influencing cement slurry design, Cementing equipment. Cementing Methods -Primary cementing, Stage cementing, Liner cementing, Plugging, Squeeze Cementing techniques in practice. Cementing calculations.	28%	13
4	**Drilling Problems and Remedies:** Pipe sticking and failure, Lost circulation, Hole Deviation, Sloughing shale, Formation damage, Bore hole instability. Drill string fatigue failure. Bit failure, wire line failure etc. Fishing and coring operations. Well kick and Blow outs: Problem, symptoms and controlling measures, Hole Cleaning.	16%	07
	Total weightage and hours	100%	45

h. Text Book and Reference Book:

a. Petroleum Engineering: Drilling and Well Completion, Carl Gatlin (1960); Prentice Hall; 1st Ed
b. Applied Drilling Engineering, Society of Petroleum Engineers. Bourgoyne , Adam T. Jr., Martin E. Chenevert, Keith K. Millheim and F.S. Young Jr., Richardson, T
c. Oil Well Drilling Engineering Principles and Practices, Rabia (1986); Kluwer LawInternational.

(4)

a. Course Name: Fluid Flow Operations Lab

b. Course Code: 303120204

c. Prerequisite: Knowledge of Physics and Engineering Mathematics.

d. Rationale: Various types of fluids are involved in chemical plants. Thorough knowledge of the flow behaviour of such fluids is essential to design and to operate such plants. This subject provides the basic understanding of the flow behaviour of fluids.

e. Course Learning Objective:

CLOBJ 1	Compare the results of analytical models introduced in lecture to the actual behaviour of real fluid flows.
CLOBJ 2	Discuss and practice standard measurement techniques of fluid mechanics and their applications.
CLOBJ 3	Identify, name, and characterize flow patterns and regimes.
CLOBJ 4	Understand basic units of measurement, convert units, and appreciate their magnitudes.
CLOBJ 5	Utilize basic measurement techniques of fluid mechanics and discuss the differences among measurement techniques.

f. Course Learning Outcomes:

CLO 1	Perform the various energy equations for fluid flow.
CLO 2	Interpreting the parameters related to optimum fluid loss
CLO 3	Illustrate the basic laws in modifying the basic equation of fluid mechanics.
CLO 4	Evaluate the various parameters in comparison to real field

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**0**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

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

h. Text Book and Reference Book:

1. Unit Operations of Chemical Engineering McCabe W L, Smith J C, Harriott P; McGraw Hill, Chemical Engineering, Vol-I Coulson &Richardson's; Butterworth– Heinemann Publication
2. Fluid Dynamics and Heat Transfer, James G. Knudson and Donald L.Katz;; McGraw Hill Publication
3. Introduction to Fluid Mechanics, R. W. Fox, P. J. Pritchard and A. T. McDonald; 7th Edition, Wiley-India 2010.
4. Fluid Mechanics for Chemical Engineers James O.; Wilkes Prentice Hall Publication

i. Experiment List:

Exp.No.	Name of the Experiment
1	To understand the concept of fluid flow and fluid
2	To determine coefficient of discharge for V-Notch
3	To determine the Reynolds Number at differentflow conditions
4	To determine the discharge coefficient of venturimeter
5	To determine the discharge coefficient of orificemeter
6	To verify Bernoulli theorem experimentally
7	To determine loss coefficients for different pipefittings.
8	To calibrate the rotameter
9	To Study different types of Pressure measurementdevices
10	To study the characteristics of a Centrifugal pump

(5)

a. Course Name: Fluid Flow Operations

b. Course Code: 303120205

c. Prerequisite: Knowledge of Physics and Engineering Mathematics.

d. Rationale: Various types of fluids are involved in chemical plants. Thorough knowledge of the flow behavior of such fluids is essential to design and to operate such plants. This subject provides the basic understanding of the flow behavior of fluids.

e. Course Learning Objective:

CLOBJ 1	Train undergraduate students about the basic concepts of Fluid Mechanics and fluid measurement techniques (concepts of fluid statics, fluid kinematics and fluid dynamics).
CLOBJ 2	Prepare students for the versatility of "Fluid Mechanics system(s)" applications in safe, economical and sustainable design as well as construction of better infrastructure to meet societal needs related to irrigation and domestic water management (for sustainable growth) of the society and in particular to the country
CLOBJ 3	Extend the students ability to apply the design and analysis principles (used for cost effective and hydraulically efficient designing) to handle different types of hydraulic forces.
CLOBJ 4	Train students to think critically, behave ethically, and consider the technical and social consequences of their work, especially as it affects the health, safety and living environment of human community
CLOBJ 5	Understanding the complex fluid engineering problems related to particularly open channel flow (Irrigation Engineering) and pipe flow (Environmental Engineering)
CLOBJ 6	Evaluate the structural safety for different parts of hydraulic structures, irrigation structures, and environmental projects/systems.

f. Course Learning Outcomes:

CLO 1	Analyze hydrocarbon system by using various PVT properties.
CLO 2	Classify different types of fluid flow phenomena and derive the necessary non-dimensional parameters
CLO 3	Apply fluid mechanics on real life problems by simplifying the governing equations for peculiar flow and solving them
CLO 4	Justify the mathematical fundamentals of differential modelling of fluid flow for the conservation of mass, momentum and energy

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr.	Topic	Weightage	Teaching hours
1	**Introduction**: Introduction to basic concepts of fluid, Properties of fluids, Dimensional, Analysis, Dimensional homogeneity	9%	4
2	**Fluid Statics and its Applications**: Pressure concept, Hydrostatic equilibrium in Gravitational & Centrifugal fields, Manometers, Continuous gravity decanter, Centrifugal decanter	4%	2
3	**Fluid Flow Phenomena:** Types of flow, Potential flow, One dimensional flow, Laminar flow, Reynolds number, Newtonian and non-Newtonian fluids, Velocity gradient and Rate of shear, Viscosity of gases and liquids, turbulent flow, Nature of turbulence, Eddy viscosity, Eddy diffusivity of momentum, Flow in boundary layers, Laminar and turbulent flow in boundary layers, Boundary layer formation in straight tube and flat plates, Boundary layer thickness, Boundary layer separation and wakeformation	11%	5
4	**Basic Equations of Fluid Flow:** Stream line and stream tubes, Average velocity, Mass velocity, Momentum balance, Bernoulli's equation without friction, Correction of Bernoulli's equation for fluid friction, Pump work in Bernoulli's equation	11%	5
5	**Flow of Incompressible Fluids in Conduits:** Flow of incompressible fluids in pipes, Friction factor, Laminar flow of Newtonian and non-Newtonian fluids, Hagen- Poiseuille equation, Turbulent flow in pipes and closed channels, Effect of roughness, Friction factor chart, Drag reduction in turbulent flow, Equivalent diameter, Friction factor in flow through channels of non-circular cross section, Friction from changes in velocity or direction, Effect	16%	7

	of fittings and valves, Practical use of velocity heads in design, Minimization expansion and contraction losses.		
6	**Flow Past Immersed Bodies:** Introduction to Drag, drag coefficient, form drag, and streamlining, friction in fluids through bed of solids, fluidization, condition of fluidization, types of fluidizations, application of fluidization, continuous fluidization, slurry and pneumatic transport.	11%	5
7	**Fluid Flow Measurement:** Fluid flow measurement, Venturimeter, Orifice meter, Rotameter, Pilot tubes, Target meter, Magnetic meters.	9%	4
8	**Applications of Fluid Mechanics:** Pipe and tubes, joints and fittings, pipe sizes, prevention of leakage around moving parts, stuffing boxes, mechanical seals, valves, pumps, characteristics of centrifugal pumps, NPSH, cavitation's, positive displacement pumps, priming of pumps fans, blowers and compressors, vacuum pumps, ejectors, Introduction to computational fluid dynamics (CFD).	20%	9
9	**Flow of Compressible Fluids:** Continuity equation, total energy balance equation, velocity of sound, process of compressible flow for isentropic expansion.	9%	4
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Unit Operations of Chemical Engineering McCabe W L, Smith J C, Harriott P; McGraw Hill,
2. Chemical Engineering, Vol-I Coulson &Richardson's; Butterworth– Heinemann Publication
3. Fluid Dynamics and Heat Transfer, James G. Knudson and Donald L.Katz;; McGraw Hill Publication
4. Introduction to Fluid Mechanics, R. W. Fox, P. J. Pritchard and A. T. McDonald; 7th Edition, Wiley-India 2010.
5. Fluid Mechanics for Chemical Engineers James O.; Wilkes Prentice Hall Publication.

(6)

a. Course Name: Petroleum Exploration

b. Course Code: 303120207

c. Prerequisite: Basics of Physics and Geology.

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

e. Course Learning Objective:

CLOBJ 1	This course is offered to build foundations of the geological and geophysical methods used in hydrocarbon exploration and prospecting and rocks, sedimentary processes, structural geology and petroleum geology.
CLOBJ 2	In this course, the students will learn about the geophysical techniques and data interpretation involved in finding oil and gas, how to select an exploration area and generate prospects for drilling.
CLOBJ 3	Various geophysical methods (with emphasis on the seismic methods) will be covered in this course and the students will learn how to integrate geological and geophysical information for oil and gas exploration.
CLOBJ 4	There will be several class projects in this course. Groups of students will be working in different teams for various sedimentary basins.
CLOBJ 5	Know the process of imaging subsurface with reflection and refraction seismic.
CLOBJ 6	Understanding of various geophysical data and its role in petroleum exploration.

f. Course Learning Outcomes:

CLO 1	Label the fundamentals regarding exploration in various prolific areas of the earth.
CLO 2	Paraphrase the various geophysical and geochemical methods involved in oil and gas exploration.
CLO 3	Categorize the various attributes related to seismology in earth variations.
CLO 4	Develop the idea behind geophysical methods like gravity and Magnetic.
CLO 5	Apply Descriptive Geometry Principles to Solve Engineering Problems Involving Points, Lines, Plane sand Solids.
CLO 6	Recognize the need of Advanced Computer Aided Tools and Software

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr.	Topic	Weightage	Teaching hours
1	**Fundamentals of Petroleum Exploration**: Ingredients of Petroleum Exploration, Concept of source, reservoir, migration, trap and seal, Concept of Play, Lead, Prospect and DrillableProspect, Types of Petroleum Traps- Structural, Stratigraphic and Combinational traps, Primary and Secondary Migration, E&P Life Cycle,Concept of Reserve, Lease and Reservoir, Techniques of Petroleum Exploration, Geochemical, Gravity, Magnetic, Electrical and seismic method of hydrocarbon exploration.	27%	12
2	**Geochemical Analysis**: Geochemical seep, Classification of seep by Link, Weathering of seeps, a geochemical program for petroleum exploration, Surface Reconnaissance, hydrocarbon Mud Logging, Rock Pyrolysis, Understanding S1, S2, S3, S1/S1+S2, Production Index, Hydrogen Index and Oxygen Index, Processing and interpretation of Geochemical data.	17%	08

3	**Fundamentals of Seismic processing, Interpretation and Attribute**: Body waves and surface waves, Rayleigh, Love, P and S wave, Seismic acquisition principle, Seismic refraction and reflection surveys,Land and marine sources, Geophone, Hydrophone and Vibroseis survey, Seismic Fold, Signal and Noise, Seismic Processing, CDP/CMP and NMO, DMO, Seismic migration, Base map, Strike Line and Dip Line, 2D and 3D seismic, inline and cross line, 3D fold, time slice and its importance. Horizon and Fault mapping, Seismic impedance and reflection coefficient, convolution and autocorrelation, Synthetic generation, Time and depth map, VSP survey, Attributes: Amplitude, Frequency and Sweetness, AVO analysis, Classification of sands, Rock solid attributes.	33%	15
4	**G and M Methods:** Gravity and magnetic prospecting, Instruments of G & M survey, Gravity and magnetic data correction, Interpretation of G&M anomaly, Correlation of Gravity anomaly with seismic anomaly. SP, Telluric and Magnetotelluric data interpretation, Electrical properties of hydrocarbon, Electrical conductivities, Resistivities of various lithology's, Dielectric constants, land airborne EM, Basic well logs, GR and SP logs, Shallow, Medium and Deep Resistivity logs, Porosity logs- Sonic, Neutron and Density logs, Importance of log interpretation, qualitative and quantitative Interpretation	23%	10
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

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

(7)

a. Course Name: Professional Communication Skills

b. Course Code: 303193203

c. Prerequisite: Knowledge of English language in practical life.

d. Rationale: Knowledge and application of English, Aptitude and Management Skills are crucial for better employability as well as professionalism.

e. Course Learning Objective:

CLOBJ 1	Students will be able to demonstrate the ability to communicate clearly and persuasively in oral presentations.
CLOBJ 2	Students will practice active listening techniques to enhance understanding in professional interactions.
CLOBJ 3	Students will write professional emails, memos, and reports with clarity and conciseness.
CLOBJ 4	Students will understand and practice time management strategies effectively.
CLOBJ 5	Students will be able to demonstrate skills in resolving conflicts and negotiating effectively.
CLOBJ 6	Students will use digital communication tools and platforms effectively.

f. Course Learning Outcomes:

CLO 1	To develop advanced communication skills
CLO 2	To become more proficient in formal writing
CLO 3	To apply interpersonal communication skills to be more productive at the workplace
CLO 4	To identity, set and achieve the goals with the help of time management
CLO 5	To use with range of vocabulary to communicate effectively

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	2	0	2	-	100	-	-	-	100

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

h. Course Content:

Sr.	Content	Weightage	Teaching hours
1	**Technical Writing: Email etiquette & Email writing Letter Writing (Types of Letters & Layout)**: • Trains students on detailed email and letter writing etiquette. • Students will be able to write formal letters following certain stipulated formats. • They will learn different types of letters for different official purposes.	10%	4
2	**Interpersonal Communication at Workplace: Dynamics of communication**: • To develop the confidence to handle a wide range of demanding situation more effectively at the workplace • To enable the students to analyse their own interpersonal communication style.	10%	2
3	**Debate: The three minute debate planner**: • To enable the students to generate effective critical thinking into primary issues in the given topic. • Students will be able to resolve controversies and recognize strengths and weaknesses of arguments.	10%	4
4	**Goal setting & Tracking**: • To enable the students to define strategies or implementation steps to attain the identified goals and make progress every day.	10%	2
5	**Time Management & Task Planning (Case –study)**: • To enable the students to identify their own time wasters and adopt strategies to reduce them. • To enable students to clarify and priorities their objective and goals by creating more planning time	5%	2
6	**Reading Comprehension: Intermediate level**: • To enable the students develop the knowledge, skills, and strategies they must possess to become proficient and independent readers	10%	2
7	**Listening Skills: Small everyday conversation and Comprehension** • Provides practice on understanding accents and day to day conversations • Listening to English conversations in different context.	10%	2
8	**Information design and writing for print and online media: Blog Writing**: • To enable students to design information that is targeted to specific audiences in specific situation to meet defined objectives. • To create blogs and share their own knowledge and experience to the world.	5%	2
9	**Advanced Vocabulary Building:**: • The students will expand their vocabulary so as to enhance their proficiency in reading and listening to academic texts, writing, and speaking. • The students will attain vocabulary to comprehend academic and social reading and listening texts. • The students will develop adequate speaking	10%	4

	skills to communicate effectively.		
10	**Picture Perception**: • To prepare the students for a test for basic intelligence and IQ, generally done on the first day of SSB (Sashastra Seema Bal is one of India's Central Armed Police Forces)	5%	2
11	**Appreciation, Apology and Acknowledgement letters**: • To enable the students to maintain productive business relationship through different types of letters. • To enable the students to express their feelings without speaking out loud.	10%	2
12	**The Art of Negotiation**: • To enable the students to reach an agreement for mutual benefits through negotiation. • To enable the students to learn a process by which compromise or agreement is reached while avoiding argument and dispute.	5%	2
	Total weightage and hours	100%	30

i. Reference Books:

1. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.
2. Communication Skills
   Kumar S And Lata P; New Delhi Oxford University Press
3. Practical English Usage MICHAEL SWAN
4. A Remedial English Grammar for Foreign Student
   F.T. WOOD
5. On Writing Well
   William Zinsser; Harper Paperbacks,2006; 30th anniversary edition
6. Oxford Practice Grammar,
   John Eastwood; Oxford University Press
7. Quantitative Aptitude for Competitive Examinations Dr. R.S. Aggarwal

(8)

a. Course Name: Thermodynamics

b. Course Code: 30312009

c. Prerequisite: Physics and mathematics of basic science, Element of Mechanical Engineering.

d. Rationale: The application of the science of thermodynamics is found in many branches of engineering including chemical engineering. This subject provides the basic principles and the applications of thermodynamic in the fields of chemical engineering.

e. Course Learning Objective:

CLOBJ 1	Students must have understanding of thermodynamic fundamentals before studying their application in applied thermodynamics.
CLOBJ 2	Understanding of thermodynamic properties and processes will assist students in other related coursework.
CLOBJ 3	Explain fundamental thermodynamic properties and derive and discuss the first and second laws of thermodynamics
CLOBJ 4	Apply the first law of thermodynamics for a control volume, including with turbines, compressors, nozzles, diffusers, heat exchangers, and throttling devices
CLOBJ 5	Explain the second law of thermodynamics, including why it is necessary, how it is defined (Kelvin-Planck and Clausius), the nature of irreversibility, and the Carnot cycle
CLOBJ 6	Explain the concept of entropy, including the Clausius Inequality, using thermodynamic tables, setting up entropy balances, and calculating isentropic efficiency of pumps, compressors, turbines, and heat exchangers.

f. Course Learning Outcomes:

CLO 1	Understanding the important field and the laws related to thermodynamics
CLO 2	Illustrating the various applications of thermodynamics to a wide range of fields of study
CLO 3	Comparing a flexible approach that can be used at various levels
CLO 4	Analyse Hydrocarbon system by using various PVT approach.

g. Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr.	Topic	Weightage	Teaching hours
1	**BASIC CONCEPTS**: The terminologies of thermodynamics, the variables and quantities of thermodynamics, categorization of systems and processes. Energy classifications, point and path properties, energy in transition, heat and work, reversible and irreversible processes, phase rule.	15%	7
2	**FIRST LAW OF THERMODYNAMICS**: The first law and internal energy, statements of first law for the non -flow and flow systems, enthalpy and heat capacity limitations of the first law.	15%	7
3	**SECOND LAW OF THERMODYNAMICS**: Statements of the second law of thermodynamics, available and unavailable energies, The entropy function, applications of the secondlaw.	15%	7
4	**HYDROCARBON RESERVOIR FLUIDS AND THEIR PHASEBEHAVIOR:** Hydrocarbon (Petroleum) Reservoir Fluid composition and their physical Properties; Thermodynamic behavior of naturally occurring hydrocarbon (Oil, gas, condensate) System	28%	12
5	**PVT ANALYSIS OF HYDROCARBON FLUIDS:** Collection of reservoir fluid samples for PVT study, PVT analysis: Constant composition expansion, flash liberation, differential liberation, separator test for PVT data of hydrocarbon fluids. Evaluation and correlation of physical and chemical properties of reservoir fluids including laboratory and empirical methods.	27%	12
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

a. A text book of Chemical Engineering Thermodynamics K. V. Narayanan; Prentice-Hall of India Pvt. Ltd.
b. Introduction to Chemical Engineering Thermodynamics– Smith, J.M., Van Ness, H.C., & Abbot M. C,; McGraw Hill VII Edition 2004.
c. Petroleum Reservoir Rock and Fluid Properties –Abhijit Y. Dandekar- Taylor and Francis-2006.

(9)

a. Course Name: Complex Variables and PDE
b. Course Code: 303191201
c. Prerequisite: Knowledge of Mathematics up to 12th science level
d. Rationale: The Mathematics I, Mathematics-II syllabus integrates fundamental calculus concepts, advanced mathematical techniques, and vector calculus, preparing students for engineering challenges with optimized problem-solving skills.
e. Course Learning Objective:

CLOBJ 1	Understand complex numbers in polar form, powers, and roots. Apply complex variable differentiation principles, including Cauchy-Riemann equations.
CLOBJ 2	Master contour integrals and apply the Cauchy-Goursat theorem. Utilize Cauchy Integral formula, Liouville's theorem, and Maximum-Modulus theorem.
CLOBJ 3	Express functions through power series, including Taylor and Maclaurin Series. Analyze zeros, singularities, and residues using the Cauchy Residue theorem.
CLOBJ 4	Solve first-order linear and nonlinear PDEs using Charpit's Method.
CLOBJ 5	Solve linear partial differential equations using complementary function and particular integral method.
CLOBJ 6	Apply separation of variables to solve problems, classify second-order linear equations, and model solutions for Heat, Wave, and Laplace equations.

f. Course Learning Outcomes:

CLO 1	Demonstrate proficient problem-solving skills, translating real-world problems into mathematical formulations and applying appropriate techniques for solutions.
CLO 2	Develop integrated analytical and critical thinking skills by engaging with a wide range of mathematical structures, proofs, and problem-solving techniques presented throughout the entire syllabus.
CLO 3	Understand and interpret mathematical solutions within the context of specific problems, recognizing the practical applications of discrete mathematics in diverse fields covered in all units.
CLO 4	Communicate mathematical concepts and solutions clearly and effectively, both in written and verbal forms, adapting communication styles to the diverse topics covered in each unit.
CLO 5	Present mathematical arguments and solutions in a unified, logical, and organized manner, emphasizing clarity, coherence, and precision across all units.
CLO 6	Lay a solid foundation for more advanced courses in mathematics and related disciplines.

g. Teaching & Examination Scheme:

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

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

h. Course Content:

Sr.	Topics	Weightage	Teaching hours
1	UNIT 1 **Complex Numbers:** Polar Form of Complex Numbers, Powers and Roots Complex Variable – Differentiation: Differentiation, Cauchy-Riemannequations, analyticfunctions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties;Conformal mappings,Mobius transformations and their properties.	28%	16
2	UNIT 2 **Complex Variable - Integration:** Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula(without proof), Liouville's theorem andMaximum-Modulus theorem (without proof)	10%	6
3	UNIT 3 **Functions Given by Power Series**: Taylor and Maclaurin Series, Laurent's series; Zeros of analytic functions, singularities,Residues, Cauchy Residue theorem (withoutproof), Residue Integration Method	10%	6
4	UNIT 4 **Algebraic Structures and Morphism:** Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form	18%	11
5	**UNIT 5 First Order Partial Differential Equations:** First order partial differential equations, solutions of first order linearand nonlinear PDEs,Charpit's Method	8%	5

6	**Unit 6: Second and Higher Order Partial Differential Equations:** Solution to homogeneous and nonhomogeneous linear partial differential equations second and higher order by complementary function and particular integral method. Separation of variables method to simple problems in Cartesian coordinates, second-order linear equations and their classification, Initial and boundary conditions, Modeling and solution ofthe Heat Wave and Laplace equations.	26%	16
	Total weightage and hours	100%	60

i. Text Book and Reference Book:

1. J. W. Brown and R. V. Churchill, Complex Variables and Applications, McGraw Hill.
2. E. Kreyszig, Advanced Engineering Mathematics, , Willey India Edition.
3. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and BoundaryValue Problem, 4th Ed., Prentice Hall, 1998.
4. D. G. Zill, P. D. Shanahan, A First Course in Complex Analysis with Applications, Jones and BartlettPublishers.
5. P. O'Neill, Advanced Engineering Mathematics, 7th Edition, Cengage Sneddon, Elements of PartialDifferential Equations, McGraw Hill.

Semester 4

(1)

a. Course Name: Heat and Mass Transfer

b. Course Code: 303120251

c. Prerequisite: Basic knowledge of Physics and Chemical engineering in various modes of heat transfer and various basic science equations in mass and momentum change.

d. Rationale: This subject is dealt with different modes of heat transfer and the conservation of mass and the mass varies with different system. This subject also dealt with some basic equations which is necessary in industry for taking out various filtration process taking into consideration the temperature index.

e. Course Learning Objective:

CLOBJ 1	Account for the consequence of heat transfer in thermal analyses of engineering systems.
CLOBJ 2	Analyse problems involving steady state heat conduction in simple geometries.
CLOBJ 3	Develop solutions for transient heat conduction in simple geometries and obtain numerical solutions for conduction and radiation heat transfer problems.
CLOBJ 4	Understand the fundamentals of convective heat transfer process and evaluate heat transfer coefficients for natural convection.
CLOBJ 5	Analyse heat exchanger performance by using the method of log mean temperature difference.
CLOBJ 6	Analyse heat exchanger performance by using the method of heat exchanger effectiveness. Calculate radiation heat transfer between black body surfaces and radiation heat exchange between gray body surfaces

f. Course Learning Outcomes:

CLO 1	Learn the various modes of heat transfer operation required for PVT analysis.
CLO 2	Understand the concepts and design of heat exchanger used in surface production.
CLO 3	Solve the molar co-efficient using basic equations like Fick's law and diffusion constant.
CLO 4	Analysis the implementations of vapor-liquid equilibrium related to petroleum fluids.

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Heat Transfer** Conduction: Steady-state and transient flow through various geometries, Convection: LMTD and NTU, overall heat transfer coefficient. Application of dimensional analysis to convection. Heat transfer rate and Heat transfer coefficient calculations. Double pipe parallel and counter-flow heat exchangers, natural and forced convection through tubes and outside tubes, Shell and tube heat exchanger, and finned tube heat exchanger. Boiling of liquids and condensation of vapors	27%	12
2.	**Radiation** Radiation from black and real surfaces, radiation transfer between black and grey surfaces, view factor, radiation shield, and multi-sided enclosures., Thermal insulation, Economic and critical thickness of lagging.	24%	11
3.	**Mass Transfer** Diffusion in gases: Fick's law, determination and estimation of diffusion coefficient; diffusion through stagnant gas and equimolecular counter-diffusion. Diffusion in liquids: Mass transfer across phase boundaries, two-film theory and mass transfer coefficient.	27%	12
4.	Gas Absorption, adsorption, Extraction and Distillation (flash and differential): Basic principles, laws, and calculations. Equilibrium, co-current and counter-current operations. Ideal stage concept and calculation of number of ideal stages. Efficiency. Packed bed and tray columns.	22%	10
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

a. Coulson and Richardson's Chemical Engineering Vol-1, 6th Ed, Elsevier (Butterworth and Heinemann).

b. Warren L. McCabe, Julian C. Smith, Unit Operations of Chemical Engineering, McGraw Hill.

c. Donald Q. Kern, Process heat transfer, Tata-McGraw-Hill.

d. Badger and Banchero, Introduction to Chemical Engineering, McGraw-Hill.

(2)

a. Course Name: Heat and Mass Transfer Lab
b. Course Code: 303120252
c. Prerequisite: This subject requires the knowledge of physics and heat and mass Transfer subjects.
d. Rationale: The content of this lab will help to understand the various laws related to adsorption and absorption of crude oil and petroleum products. This also includes the various surface facilities operations used in oil industry for petrochemical purposes.

e. Course Learning Objective:

CLOBJ 1	To provide students with the necessary skills to conduct experiments on conduction and convection of heat; collect data, perform analysis and interpret results to draw valid conclusions through standard test procedures.
CLOBJ 2	To determine thermal properties and performance of radiation heat transfer, heat exchanger, vapour compression refrigerator and air conditioner.
CLOBJ 3	Conduct experiments on conduction, convection and radiation of heat; collect data, perform analysis and interpret results to draw valid conclusions through standard test procedure.
CLOBJ 4	Determine thermal properties and performance of heat exchanger, vapour compression refrigerator and air conditioner.

f. Course Learning Outcomes:

CLO 1	Understand the practical concept of heat exchanger using convection methods
CLO 2	Learn the practical aspects of thermal conductivity in solids
CLO 3	Perform the different mass –transfer co-efficient for liquid and gas samples.
CLO 4	Demonstrate the diffusion co-efficient of various sample using Fick's law

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	0	2	1	-	-	20	-	30	50

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

h. Text Book and Reference Book:

a. Petroleum Engineering: Drilling and Well Completion,Carl Gatlin (1960); Prentice Hall; 1st Ed
b. Applied Drilling Engineering, Society of Petroleum Engineers. Bourgoyne , Adam T. Jr., Martin E. Chenevert, Keith K. Millheim and F.S. Young Jr., Richardson, T
c. Oil Well Drilling Engineering Principles and Practices, Rabia (1986); Kluwer Law International.

k. Experiment List:

Exp.No.	Name of the Experiment
1	Determination of thermal conductivity of solids
2	Emissivity measurement apparatus
3	Heat transfer through composite wall
4	Heat transfer through natural convection
5	To determine the % extraction of diluted aqueousorganic solution using suitable solvent.
6	Determine mass transfer co-efficient of liquid (water) evaporation to atmospheric air at elevatedtemperature.
7	To determine the Overall Heat transfer coefficientfrom shell and tube
8	To determine the diffusion co-efficient of CCl_4 in air& it's variation with temperature.

(3)

a. Course Name: Drilling Engineering-II

b. Course Code: 303120253

c. Prerequisite: Basics of Physics and Maths and in addition to the concepts of drilling engineering.

d. Rationale: This subject deals with the various advanced operations of drilling engineering using different horizontal and multilateral technology. Also how drilling is done in offshore conditions taking all the well kick parameters in account.

e. Course Learning Objective:

CLOBJ 1	To analyse the necessity of directional drilling and understand working of deflection tools.
CLOBJ 2	To understand the basics of directional well planning and surveying procedure.
CLOBJ 3	To understand the basics of special methods of drilling.
CLOBJ 4	Ability to plan and monitor a directional well trajectory and perform trajectory calculations based on surveying data.
CLOBJ 5	Analyse and plan the underbalanced drilling procedure using appropriate tools
CLOBJ 6	In detail knowledge about the Deflection Tools, Orientation of deflection tools, Mud Motors, RSS.

f. Course Learning Outcomes:

CLO 1	Learn the various trajectory of well profile done in oil industry.
CLO 2	understand the various parameters required to make the advanced profile.
CLO 3	Analyze the different concepts to make a successful drilling in onshore and offshore areas.
CLO 4	Rephrase the concepts the MWD and LWD technology in oil industry

g. Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
3	1	0	4	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Directional Drilling** Directional Drilling Technology, Objectives of Directional Drilling. Tools for deflection & orientation. Directional well profiles and well path – deflection & corrections Motor Types: PD motors and Turbodrills; their description, power calculations and applications. Directional drilling problems & their remedies. Auto and Verti-track systems: Rotary steerable motors and geo-steering tools.	29%	13
2.	**Horizontal Well Drilling** Horizontal Well Drilling, Introduction of Horizontal well drilling: objectives & selection, drilling techniques and different well profiles, special mud requirements and their characteristics. Measurements while Drilling: objectives, MWD / LWD tools, Telemetry system and data interpretation Well Surveying: Objectives & methods. surveying analysis & calculations for well coordinates	29%	13
3.	**Offshore Drilling** Offshore oil and gas operations & ocean environment. Offshore fixed platforms, Wave forms and characteristics. Interaction with offshore structural elements. Environmental prediction and loading. Offshore structure. Fixed, mobile and floating. Fixed platform, Steel and concrete gravity structures. Interaction with floating vessels. Jack-up, drill ships and semi submersibles.	22%	10
4.	**Well Control Principles& Procedures** The Anatomy of a KICK, Kicks - Definition, Kick Control (a) Dynamic kick control (b) Other Kick control methods- Driller & Engineer methods of kick control.	20%	09
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Bourgoyne , Adam T. Jr., Martin E. Chenevert, Keith K. Millheim and F.S. Young Jr.,Richardson, TX (1991) Applied Drilling Engineering, Society of Petroleum Engineers.

2. Joshi, S. D. (1991) Horizontal Well Technology, Penn Well Publishing.

3. Adam, N. J. (1980) Well control Problems and Solutions. Petroleum Publishing Company

4. Baker, R. (1998) A Premier of Offshore Operations Petroleum Extension Service,

(4)

a. Course Name: Elements of Reservoir Engineering Lab

b. Course Code: 303120254

c. Prerequisite: This subject requires the knowledge of petroleum geology and reservoir engineering theoretical aspects.

d. Rationale: This lab includes the various operations regarding the fluid flow thru porous media. They will learn the various petro-physical properties and fluid properties and calculate the reserves.

e. Course Learning Objective:

CLOBJ 1	To impart knowledge in the basic concepts like PVT analysis for oil, Material balance applied to oil reservoir, Darcy's law and applications, well inflow estimation for stabilized flow conditions.
CLOBJ 2	To make them suitable as reservoir engineers for petroleum industry.
CLOBJ 3	Learn to estimate the reserves of various sands of the reservoir from well data.
CLOBJ 4	Students can able to calculate the formation damage and can recommend suitable stimulation operations to reverse the wells
CLOBJ 5	Students will learn to calculate the basic rock properties like Porosity, liquid and gas permeability.

f. Course Learning Outcomes:

CLO 1	Perform the saturation using core samples.
CLO 2	Understand the calculations behind the permeability measurement of different fluids in a core sample.
CLO 3	Demonstrate the pressure sensing in a well bore using BHP Charts.
CLO 4	Design the core sample for analysing the various properties in the lab.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	0	2	1	-	-	20	-	30	50

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

h. Text Book and Reference Book:

1. Fundamentals of Reservoir Engineering – L. P. Dake – Elsevier, 17th Edition, 1998
2. Applied Petroleum Reservoir Engineering (Second Edition)- B. C. Craft and M. F. Hawkins Revised by Ronald E. Terry – Prentice Hall.
3. Worldwide Practical Petroleum Reservoir Engineering Methods – H. C. "Slip" Slider – Penn-well Publishing Company.
4. dvance Reservoir Engineering- Tarek Ahmed and Paul D. McKinney – Gulf Professional Publishing– Elsevier -2005

i. Experiment List:

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

(5)

a. **Course Name:** Elements of Reservoir Engineering
b. **Course Code:** 303120255
c. **Prerequisite:** Basics of Physics, Mathematics and Petroleum Geology.
d. **Rationale:** The working tools of the reservoir engineer are subsurface geology, applied mathematics, and the basic laws of physics and chemistry governing the behaviour of liquid and vapour phases of crude oil, natural gas, and water in reservoir rock.

e. Course Learning Objective:

CLOBJ 1	Recognise the main terminology, concepts, and techniques that apply to reservoir engineering founded on a theory-based understanding of mathematics and the natural and physical sciences.
CLOBJ 2	Apply a critical-thinking and problem-solving approach toward the main principles of reservoir engineering demonstrated through the appropriate and relevant assessment.
CLOBJ 3	Apply theoretical and practice skills in data analysis used for real problems through case studies based on empirical evidence and the scientific approach to knowledge development.
CLOBJ 4	Perform, analyses, and optimize a material balance/decline curve/water influx exercise by using commercial software that is commonly used in the industryto develop competency in the use of technology.
CLOBJ 5	Describe characterization of rock/formation properties and fluids.
CLOBJ 6	Describe fluid flow and mass balance in the reservoir.

e. Course Learning Outcomes:

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

f. Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
3	1	0	4	60	-	20	20	-	100

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

g. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Reservoir Rock Properties** Porosity and permeability determination, combination of permeability in parallel & series beds, porosity permeability relationship, fluid saturation determination and significance, effective and relative permeability, wettability, capillary pressure characteristics, measurements and uses. Coring and Core Analysis	24%	11
2.	**Reservoir Fluids:** Phase behavior of hydrocarbon system, ideal & non ideal system, equilibrium ratios, reservoir fluid sampling, PVT properties determination, different correlations and laboratory measurements, data reduction, evaluation and application.	20%	09
3.	**Flow of Fluids through Porous Media:** Darcy's law, single and multiphase flow, linear, radial & spherical flow, steady state & unsteady state flow, GOR, WOR equations.	24%	11
4.	**Reservoir Drives and Reserve Estimation** Reservoir drive mechanics and recovery factors, Reserve resource & reserve concept, Different reserve estimation techniques: Volumetric, MBE, decline curve analysis.	32%	14
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Fundamentals of Reservoir Engineering – L. P. Dake – Elsevier, 17th Edition, 1998
2. Applied Petroleum Reservoir Engineering (Second Edition)- B. C. Craft and M. F. Hawkins Revised by Ronald E. Terry – Prentice Hall.
3. Worldwide Practical Petroleum Reservoir Engineering Methods – H. C. "Slip" Slider – Penn-well Publishing Company.
4. Advance Reservoir Engineering- Tarek Ahmed and Paul D. McKinney – Gulf Professional Publishing– Elsevier -2005

(6)

a. Course Name: Production Operations-I

b. Course Code: 303120257

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

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

e. Course Learning Objective:

CLOBJ 1	Learn the production flow system from reservoir to surface and the mechanical energy balance equation associated with production engineering.
CLOBJ 2	Students study the Artificial lift (gas lift and various pumping methods) and problems associated with production of formation fluids.
CLOBJ 3	Study on the Formation damage/production impairment prediction, prevention and removal and problem Diagnosis and workover concepts
CLOBJ 4	Provide insight on production engineering including the basic physics that governs the process and common problems associated with oil and gas production.
CLOBJ 5	Describe the objectives, options and layout of surface production facilities for onshore and offshore fields. Explain the selection, sizing and operation of primary separation systems
CLOBJ 6	List the principal types of formation damage and their treatment. Compare and contrast the various well intervention and stimulation techniques available for production wells

f. Course Learning Outcomes:

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

g. Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
3	1	0	4	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Well Equipment and Completion Design:** Well Head Equipment, Christmas tree, valves, hangers, flow control devices, packers, tubular and flow lines, Well completion Methods, Perforating Oil & Gas Wells - Conventional and Unconventional techniques viz. through tubing and tubing conveyed underbalanced perforating techniques, type size and orientation of perforation holes. Well activation, use of compressed air & liquid Nitrogen. Down-hole equipment selection, servicing, installation & testing, smart wells-intelligent completions	27%	12
2.	**Well Servicing & Workover:** Workover system, workover rigs and selection, rig less workover including Endless/ Coiled tubing unit, minor & major workover jobs-diagnosis & remedial measures water shut off and gas shut off- Chemical treatment and conformance control. Wire-line operations, Workover & completion fluids - types & selection, Formation damage, Workover planning & economics, asphaltene, wax ,Sand control techniques, Formation Sand Size analysis, optimum gravel - sand ratio, gravel pack thickness, gravel selection, gravel packing fluid & gravel pack techniques.	20%	09
3.	**Production System Analysis & Optimization:** Self-flow wells - PI & IPR of self-flowing and artificial lift wells, production testing - back pressure test, flow after flow test & isochronal test, surface layout, test design & analysis of test data. Production characteristics of Horizontal and multilateral wells - coning, IPR & skin factor. Multiphase flow in tubing and flow-lines. Sizing, selection and performance of Tubing, chokes and surface pipes. Production Optimization – Nodal System analysis.	26%	12
4.	**Introduction to Artificial Lift Techniques** Principle and application of artificial lift methods- Rod Pump (SRP/PCP), Gas Lift (Continuous/Intermittent), Electric submersible Pump (ESP), Hydraulic lifts (Jet Pump) etc.	27%	12
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Dr. GuoBoyun , Computer Aided Petroleum Production Engineering
2. H Dale Begg , Production Optimization , OGCI Publication,tulsa.
3. Kermit Brown, Technology of artificial lift method –. Vol2a ,2b. Penwell publishing company, Tulsa.

(7)

a. Course Name: Probability, Statistics and Numerical Methods

b. Course Code: 303191251

c. Prerequisite: Basic concepts of Statistics, Probability and Fundamentals of Calculus.

d. Rationale: The course provides introductory numerical, statistical and probability methods.

e. Course Learning Objective:

CLOBJ 1	Demonstrate understanding of the importance of assumption checking for valid statistical analysis, and be able to perform assumption checking.
CLOBJ 2	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
CLOBJ 3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
CLOBJ 4	Analyse and evaluate the accuracy of common numerical methods.
CLOBJ 5	Interpret results from the application of standard statistical and numerical methods.
CLOBJ 6	Demonstrate understanding of the probability and statistical foundations of data analysis.

f. Course Learning Outcomes:

CLO 1	Understand the Importance of numerical method in real world problem where analytic methods fails.
CLO 2	Formulate and solve problems involving random variables.
CLO 3	Apply statistical methods for analysing experimental data
CLO 4	Derive numerical methods for various mathematical operations and tasks, such as interpolation, integration, the solution of linear and nonlinear equations, and the solution of differential equations

g. Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
4	0	0	4	60	-	20	20	-	100

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

h. Course Content:

Sr.	Topic	Weightage	Teaching hours
1	**Correlation, Regression and Curve Fitting:** Correlation and Regression t, Rank correlation Curve Fitting by The Method of Least Squares- Fitting of Straight Lines, Second Degree Parabolas and More General Curves.	18%	11
2	**Probability and Probability Distributions:** Probability Spaces, Conditional Probability, Bayes' Rule, Discrete and Continuous Random Variables, Independent Random Variables, Expectation and Variance of Discrete and Continuous Random Variables, Distribution and Their Properties: Binomial Distribution, Poisson Distribution, Normal Distribution	23%	13
3	**Testing of Hypothesis:** Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Test for single mean, difference of means, Test for ratio of variances, Chi-square test for goodness of fit and independence of attributes	26%	15
4	**Solution of a System of Linear Equations, Roots of Algebraic and Transcendental Equations:** Gauss-Jacobi and Gauss Seidel Methods, Solution of Polynomial and Transcendental Equations tBisection Method, Newton-Raphson Method and Regula Falsi Method	11%	7
5	**Finite Differences and Interpolation:** Finite Differences, Relation between Operators, Interpolation using Newtons Forward and Backward Difference Formulae. Newtons Divided and Lagranges Formulae for Unequal Intervals.	11%	7
6	**Numerical Integration:** Trapezoidal rule, Simpsons 1/3rd and 3/8th Rules, Gaussian Quadrature Formulae. Numerical solution of Ordinary Differential Equations: Taylors Series, Euler and Modified Eulers Methods. Runge- Kutta Method of Fourth Order for Solving First and Second Order Equations.	11%	7
	Total weightage and hours	100%	60

i. Text Book and Reference Book:

a. Numerical Methods in Engineering & Science with Programs in C and C++ (TextBook) Dr. B. S. Grewal; Khanna Publishers.

b. Introduction to Numerical Analysis C.E. Froberg; Addison-Wesley.

c. Introduction to Probability (TextBook) P. G. Hoel, S. C. Port and C. J. Stone,; UBS Publishers,.

d. Fundamentals of Mathematical Statistics (TextBook) S.C. Gupta and V. K. Kapoor; Sultan Chand & Sons

8.

a. Course Name Professional Grooming & Personality Development
b. Course Code: 303193252
c. Prerequisite: Knowledge of communication theories and basic management skills are essential.
d. Rationale: Acquiring soft skills, life skills and aptitude skills are crucial for organizational communication as well as employability respectively.
e. Course Learning Objective:

CLOBJ 1	Students will develop clear and articulate verbal communication skills.
CLOBJ 2	Students will enhance non-verbal communication, including body language and facial expressions.
CLOBJ 3	Students will be able to understand the importance of personal grooming and hygiene in a professional setting.
CLOBJ 4	Students will be able to understand and apply proper business etiquette in various professional settings.
CLOBJ 5	Students will be able to develop emotional intelligence to understand and manage one's own emotions and those of others.
CLOBJ 6	Students will be able to cultivate leadership qualities and skills to inspire and influence others positively.
CLOBJ 7	Students will be able to understand and practice professional etiquette in various business settings.

f. Course Learning Outcomes:

CLO 1	Identity and develop soft skills required for personal and professional growth.
CLO 2	Develop professional etiquette & desired behaviour at the workplace.
CLO 3	Speak and participate effectively in oral organizational communication.
CLO 4	Improve comprehensive skills for reading.
CLO 5	Know how to be assertive in professional environment.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	1	0	1	-	100	-	-	-	100

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

h. Course Content:

Sr. No.	Content	Weightage	Teaching hours
1	**Self-Development and Assessment**: Various self-assessments for personal and professional development skills that are relevant to career development: • Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record, Remember, Guess, Think, Communicate, Relate, and Dream	25%	4
2	**Corporate Etiquette**: Tips and guide to develop personality and gain various etiquettes manners, case studies and activities. • Telephone etiquette • Etiquette for foreign business trips • Etiquette for small talks • Respecting privacy • Learning to say 'No'	25%	4
3	**Public Speaking**: It's process of communicating information to an audience and is helpful in career advancement. Effective Public speaking skills includes: • Choosing appropriate pattern • Selecting appropriate method • Art of persuasion • Making speeches effective • Delivering different types of speeches	20%	4
4	**Reading Skills Activity & Reading Comprehension**: Aims to improve students' Comprehensive Skills in English Language by getting them involved in reading activity and providing practice for reading comprehension.	15%	2
5	**Listening Skills- Inquiry Based Listening Questions**: Aims to improve students' listening skills in English Language providing them practice of various types of inquiry based listening tracks. Students will listen and will be able to find out details from the conversations.	15%	1
	Total weightage and hours	100%	15

j. Reference Books:

1. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.
2. Communication Skills Kumar S and Lata P; New Delhi Oxford University Press
3. Practical English Usage MICHAEL SWAN
4. A Remedial English Grammar for Foreign Student F.T. WOOD
5. On Writing Well William Zinsser; Harper Paperbacks,2006; 30th anniversary edition
6. Oxford Practice Grammar, John Eastwood; Oxford University Press

Semester 5

(1)

a. Course Name: Applied Petroleum Reservoir Engineering

b. Course Code: 303120301

c. Prerequisite: Basics of Reservoir Engineering and Material Balance equation is required.

d. Rationale: This course gives an idea about the reservoir management and reflects the idea behind the steps that are important for Enhanced oil recovery.

e. Course Learning Objective:

CLOBJ 1	Understanding of reservoir drive mechanism and production behavior of oil & Gas reservoir.
CLOBJ 2	Water flooding: microscopic efficiency of immiscible displacement, macroscopic displacement efficiency of linear waterflood, fractional flow and frontal advancement, immiscible displacement in two dimensions, displacement pattern and sweep efficiency, waterflood design, role of reservoir geology in the design and operation of water floods, introduction to EOR.
CLOBJ 3	Radial steady state and transient flow, linearization of equations for small and constant compressibility; well in flow equation; steady state and pseudo steady state solution
CLOBJ 4	Fluid flow behavior through porous media • Solution of diffusivity equation for steady, pseudo-steady and transient state and their significance
CLOBJ 5	Natural water influx, application of water influx theory and Estimation of water encroachment into reservoir using different water influx models.
CLOBJ 6	Reservoir drive mechanisms: solution gas drive, gas cap drive, natural water drive, compaction drive and pore compressibility

f. Course Learning Outcomes:

CLO 1	Illustrate generalized equation of oil and gas
CLO 2	Analyze the Different techniques for pressure maintenance
CLO 3	Describe the Idea about different development plan and scheme
CLO 4	Understand the Evaluation of water flooding performance

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Overview of applied reservoir engineering** Reservoir management Generalized Oil & Gas MBE and its modification Drive Mechanism and recovery factors; production behaviour of oil & gas reservoirs	26%	12
2.	**Drive Mechanism and recovery factors;** production behaviour of oil & gas reservoirs Performance prediction of depletion drive, gas cap drive, water drive and combination drive Water influx : steady and unsteady state models	26%	11
3.	Reservoir pressure maintenance techniques, their advantages and limitations Immiscible Displacement processes: Theory & practices- Buckley Leverette treatment of fractional flow and frontal advance equations, water flood performance	24%	11
4.	Introduction to oil & gas field development: Rational development plan, Rate and order of drilling well, well spacing & pattern, selection of development scheme, economic aspect of development of oil and gas fields.	24%	11
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Integrated Petroleum Reservoir Management- A team approach: Abdus Satter & Ganesh C. Thakur; Penwell Publishing Company, Tulsa, Oklahoma.

2. Development of oil and gas fields: Dr. Sant Kumar; Allied Printers, Dehra Dun, 248001, India

(2)

a. Course Name: Petroleum Geochemistry Lab

b. Course Code: 303120302

c. Prerequisite: The student should have basic understanding of Crude oil characterization.

d. Rationale: This subject dealt with various experimental setup related to flow behavior of crude oil.

e. Course Learning Objective:

CLOBJ 1	Awareness of the role played by the petroleum geochemist in the oil and gas industries, especially in petroleum systems analysis and appraisals of hydrocarbon prospectively.
CLOBJ 2	Understanding of the principles, applications and limitations of the main analytical techniques used in petroleum geochemistry, and an advanced understanding of some of these techniques.
CLOBJ 3	Learn the different maturity tools used in geochemistry and how to interpret and use maturity data to evaluate thermal history of source rocks and calibrate thermal history of sedimentary basins.
CLOBJ 4	Examine the different geochemical techniques used for the fluids (oil and gas samples), including interpretive pitfalls.
CLOBJ 5	Learn how to perform oil-oil and oil-source rock correlations.

f. Course Learning Outcomes:

CLO 1	Revise the various Composition of petroleum and its products
CLO 2	Correlate petroleum composition with thermodynamic properties.
CLO 3	Develop various unit operations to co-relate data of oil and Gas
CLO 4	Analyse the various compositional characteristics of crude oil

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	0	2	1	-	-	20	-	30	50

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

h. Text Book and Reference Book:

1. Kula C.Misra (2012) Introduction to Geochemistry: Principles and Applications Illustrated Ed. By John Wiley & Sons,2012

2. Jim Brooks &Dietrich Welte (2018) Advances in Petroleum Geochemistry: Vol-1, Edition-1 by Elsevier.

3. Leverson, Geology of Petroleum, CBS Publishers & Distributors

i. Experiment List:

Exp.No.	Name of the Experiment
1	To determine the cloud point and pour point ofgiven samples
2	To determine the aniline point of a given samples ofpetroleum products
3	To determine the percentage purity of refinery products by auto distillation apparatus
4	To determine the viscosity of a given sample by SayBolt viscometer
5	To determine the smoke point of a given sample
6	To determine the flash point & fire point of petroleum refinery products by semi-automatic Pensky & Martin apparatus
7	To determine the moisture content of the givenliquid fuel sample using dean and stark apparatus
8	To determine the acid number of given oil samples
9	To determine the calorific value of given samples byBomb Calorimeter

(3)

a. Course Name: Petroleum Geochemistry
b. Course Code: 303120303
c. Prerequisite: Knowledge of Organic Chemistry and Geology.
d. Rationale: Students will learn about the source rock study and the potential of the source rock to generate petroleum in a field. Petroleum Geochemistry helps learns students the basic concepts of generation, migration, accumulation, petroleum composition and how to dramatically improve exploration success.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamentals of source rock, oil, and gas geochemical analysis, including their interpretive pitfalls.
CLOBJ 2	Discuss various geochemical techniques, e.g. sampling, preparation, TOC determination, Rock-Eval pyrolysis and microscopy, including interpretive pitfalls.
CLOBJ 3	Understand how to interpret source rock data, including source rock richness, potential and type, and how to distinguish between different types of source rocks, their kinetics and quality (e.g. oil- versus gas- prone source rocks).
CLOBJ 4	Explain what type and quality of hydrocarbons can be predicted from each type of source rock.
CLOBJ 5	Understand how to assess post-migration fluid alterations (e.g., evaporative fractionation, biodegradation, geo-chromatography, and other reservoir alteration processes)
CLOBJ 6	Develop an understanding on how gas samples can be evaluated and demonstrate how geochemistry can be used to assist explorationists in their de-risking block and basin petroleum evaluation.

f. Course Learning Outcomes:

CLO 1	Revise the various Composition of petroleum and its products
CLO 2	Correlate petroleum composition with thermodynamic properties.
CLO 3	Develop various unit operations to co-relate data of oil and Gas
CLO 4	Analyse the various compositional characteristics of crude oil

g. Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Composition:** Paraffins, Cycloparaffins or Naphthenes, Aromatic Hydrocarbons, Olefin Hydrocarbons, Sulphur Compounds, Nitrogen Compounds, Oxygen Compounds, Organo-Metallic Hydrocarbons; H/C Ratio of Hydrocarbons; Kerogens: Formation, Composition and Digenesis. Classification of Crude Oils: Physical, Chemical and Genetic Classification of crude oil.	25%	12
2.	**Oil Fields Brines:** Composition, Classification, Origin and alteration of Oil Field Brines; Importanceof Oil Field water analysis, Effects of water circulation on Hydrocarbons Properties of Hydrocarbons: Density, Viscosity, Surface Tension, Color, Fluorescence, Cloud Point and Pour Point, Aniline Point, Optical Properties, Flash Point, Refractive Index and Calorific Value	26%	12
3.	**Hydrocarbon Thermodynamics:** Liquid Phase Behavior, Molecular Behavior; Changes in Phases with Changes in Pressure Temperature; Pure Hydrocarbons, Hydrocarbon Mixtures, Low Shrinkage Gas, High Shrinkage - Gas, Retrograde Condensate Gas, Wet and Dry Gas. Analytical Techniques: Quantitative and Qualitative Steps in Analysis of Petroleum; Analytical Methods in Geochemistry for Reservoir Rocks and Fluids;	24%	10
4.	**Separation of Crude Oil:** Distillation and Classification of Petroleum; First, Second and Third Generation Petrochemicals; Miscellaneous Petrochemicals; Petrochemical Industry in India; Integrated Petrochemicals Complex; Use of Natural Gas as Petrochemical	25%	11
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Kula C.Misra (2012) Introduction to Geochemistry: Principles and Applications Illustrated Ed. By John Wiley & Sons,2012
2. Jim Brooks &Dietrich Welte (2018) Advances in Petroleum Geochemistry: Vol-1, Edition-1 by Elsevier.
3. Leverson, Geology of Petroleum, CBS Publishers & Distributors

(4)

a. Course Name: Natural Gas Engineering
b. Course Code: 303120305
c. Prerequisite: The students should learn production operations and midstream process for understanding gas processing and engineering.
d. Rationale: This course dealt with the components and equipment for removal of natural gas in oil field industry. Different process of natural gas processing with varied industrial applications is implemented in this course.
e. Course Learning Objective:

CLOBJ 1	Understand the Natural Gas Significance in Global energy scenario, its composition and utilization.
CLOBJ 2	Learn the Phase behaviour of Natural gas and Calculate Natural Gas Properties based on its composition.
CLOBJ 3	Design surface compression, dehydration, sweeting units required for natural gas processing.
CLOBJ 4	Able to learn about the transportation, storage and metering process of natural gas and conversion of natural gas to CNG and LPG
CLOBJ 5	Understand the LNG and CNG value chain LNG liquefaction plant and shipping, LNG regasification, LNG Plant
CLOBJ 6	In details the Phase behaviour of Natural gas and Calculate Natural Gas Properties based on its composition.

f. Course Learning Outcomes:

CLO 1	Learn Petroleum and natural gas engineering concepts to project design
CLO 2	Evaluate concepts of engineering design as applied to petroleum and natural gas projects
CLO 3	Review processing methods for various forms of natural gas
CLO 4	Understanding the process of extraction of gas from liquids

g. Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
2	0	0	2	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Introduction-** Defining Gas processing, Historical background, General processes concerning gas Processing: Water and Hydro Carbon Liquid Separation, Dehydration, H2 S Removal and elemental Sulfur extraction, Carbon Di Oxide (CO2) removal, Mercury Removal. Gas processing for pipeline transportation (Corrosion protection, limits for water , H2S and CO2 contents).	25%	8
2.	**Introduction to Refrigeration/ Cryogenic Process for separation / processing of Gases:** Refrigeration Cycle, Cascade refrigeration processes (Multiple pure component system and Mixed Refrigeration system), Turbo Expander and System, Advanced Refrigeration system	25%	7
3.	**Extraction of components in Natural gas and /or liquids:** Helium Extraction, Nitrogen Removal, Propane and Butane (LPG) Extraction, Ethane Extraction, NGL component extraction from NGL liquids by Fractionation process, NGL Extraction from Gas Mix, Introduction to use of natural gas liquid (NGL), its components for manufacture of value-added products. :C2, C3 and C4	25%	8
4.	**Gas processing:** LNG Production (limits of Water, CO2, H2S and Mercury contents etc.), LNG Production process, LNG Storage, LNG Transportation & Regasification	25%	7
	Total weightage and hours	100%	30

i. Text Book and Reference Book:

1. Gas Production Engineering by Sanjay Kumar
2. Handbook of Natural Gas Transmission and Processing by Saeid Mokhatab, Will

(5)

a. Course Name: Offshore Engineering

b. Course Code: 303120307

c. Prerequisite: Students should have the basic idea of Drilling engineering and Production operations.

d. Rationale: This course dealt with the various platforms that are used in offshore areas for drilling and production of oil and gas. Various problems and its remedies are also discussed in this course about the stability of offshore platforms.

e. Course Learning Objective:

CLOBJ 1	Understand offshore oil and gas operations and ocean environment. Sea floor marine soils, Geotechnical aspects. Various forces acting on offshore structure; Stability of offshore structure.
CLOBJ 2	Learn about the offshore fixed platforms, mobile units, Station keeping methods like mooring & dynamic positioning system.
CLOBJ 3	Difference in drilling from land, from fixed platform, Jackup, ships and semi submersibles. Use of conductors and risers. Deep sea drilling. Well completion. Deep water applications of subsea technology: drilling rig, well construction issues.
CLOBJ 4	Comparing the applications and limitations of the various fixed and floating offshore drilling/production structures.
CLOBJ 5	Understand the offshore production processing, transportation and storage and deep-sea technologies, SPM and SBM.
CLOBJ 6	Learn about the well abandonment methods and environmental concerns and emerging technologies.

f. Course Learning Outcomes:

CLO 1	Learn offshore oil and gas operations
CLO 2	Description about fixed and mobile types of platforms.
CLO 3	Evaluate various methods and completion equipment in offshore operation.
CLO 4	Understand the principles of water flooding performance

g. Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
3	0	0	3	60	-	20	20	-	100

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

g.Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Introduction to offshore oil and gas operations. Sea States and Weather:** Meteorology, oceanography, ice, sea bed soil. Buoyancy and stability. Offshore Fixed Platforms: Types, description and operations.	20%	10
2.	**Offshore Mobile Units:** Types, description and installation. Station keeping methods like conventional mooring & dynamic positioning system. Offshore Drilling: Difference in drilling from land, from fixed platform, jackup, ships and semi submersibles. Use of conductors and risers. Deep sea drilling. System etc.,	30%	14
3.	**Offshore Well Completion:** Platforms and subsea completions, Deep water applications of subsea technology. Offshore Production: Oil processing platforms, gas processing platforms, water injection\ platforms, storage, SPM and SBM, transportation and utilities. Deep water technology: Introduction, definition & prospects. Deep water regions, Deep water drilling rig – selection and deployment, Deepwater production system.	30%	14
4.	**Emerging deep water technologies:** special equipment and systems, Remote operation vessels (ROV). Divers and Safety: Principles of diving use of decompression chambers, life boats. Offshore Environmental Pollution and Remedial Measures.	20%	7
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Handbook of offshore engineering, S. K. Chakrabarti, Volume 1 & 2, Elsevier, 2005.
2. Hydrodynamics of offshore structures, S. K. Chakrabarthi, WIT Press

(6)

a. Course Name: Oil and Gas Field Development and Planning

b. Course Code: 303120331

c. Prerequisite: Characteristics of Reservoir Engineering.

d. Rationale: This course dealt with Planning of field development, Appraisal and Exploration.

e. Course Learning Objective:

CLOBJ 1	Understand a detail understanding on different activities performed in a field from exploration to abandonment phase.
CLOBJ 2	Learn broad knowledge on petroleum economics and learn to make economic decisions.
CLOBJ 3	Gained knowledge on developing, managing and improving the asset value by different reservoir management practices.
CLOBJ 4	Understand about various activities that are performed during different phases (i.e., exploration, appraisal, development, production & abandonment) in life cycle of a hydrocarbon field.
CLOBJ 5	Learn to prepare a cash flow statement and balance sheet; and calculate NPV. Students will learn on how to select a economically feasible project among multiple options based on NPV.
CLOBJ 6	Learn about: flow assurance (i.e., it's importance, different flow assurance problems encountered during production and ways to mitigate the flow assurance); and factors and procedure to be adopted to design a well.

f. Course Learning Outcomes:

CLO 1	Learn different steps in field development
CLO 2	Evaluate Description and characterization of reservoir
CLO 3	Identify Dynamic behaviour of well for both vertical and horizontal
CLO 4	Express Idea about management of project and organization

g. Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Brief overview on field development, Difference between oil and gas field development, The Field Life Cycle:** Gaining Access, Exploration Phase, Appraisal Phase, Development Phase, Production Phase, Decommissioning. Petroleum Agreements & Bidding: Invitations to bid, Motivations and form of bid, Block Award, Fiscal System, Farm-in & Farm-out, Unitization and Equity determination. NELP & OALP, PSC.	27%	12
2.	**Reservoir Description:** Data Gathering, Data Interpretation Field Appraisal: Importance of Appraisal, Identifying and quantifying sources of Uncertainty, Cost benefit calculations for Appraisal. Reservoir Dynamic Behavior: Fluid Flow studies, PVT data, Drive Mechanisms. Gas Reservoirs: Gas sales profiles; Influence of Contracts; movement of GWC during production, Pressure response, Fluid displacement in the Reservoir, Estimation of Reserves, Reservoir Simulation, Estimating the Recovery Factor, Estimating the Production Profile.	27%	12
3.	**Well Dynamic Behavior in Vertical and Horizontal Wells:** Estimating thenumber of Development Wells, Fluid flow near the wellbore. Importance of Surface Facilities in Field Development	23%	11
4.	**Project & Contract Management:** Phasing & Organization, Planning & Control,Cost Estimation & Budgets, Types of Contracts. Petroleum Economics: Basic principles of Development Economics, Project Cash flow, Revenue & expenditure items, CAPEX-OPEX, Sensitivity Analysis, Managing the Producing Field: Subsurface, surface facilities, Internal & External factors.	23%	10
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Integrated Petroleum Reservoir Management- A team approach: Abdus Satter & Ganesh C. Thakur; Penwell Publishing Company, Tulsa, Oklahoma

2. Development of oil and gas fields: Dr. Sant Kumar; Allied Printers, Dehra Dun, 248001, India

(7)

a. Course Name: Petroleum Economics

b. Course Code: 303120335

c. Prerequisite: The student should have basic understanding of Unit Operations of petroleum industries.

d. Rationale: Unit operation plays a vital role in petroleum industries with rapid rate of increase in the advancement of knowledge, it is important that the students should know the relevant application for equipment design. It has been observed conclusively that practice in using the reference literature and software has helped the students to secure jobs and also to perform better in profession.

e. Course Learning Objective:

CLOBJ 1	This course is designed to provide students with necessary economic knowledge. It will cover general aspects the upstream and the downstream segments
CLOBJ 2	Learn about the all-key topics including Pricing, Market, International Oil Trading, Cash Flow techniques, Time value of money, Risk and Uncertainty, Economic Analysis and others will be considered, some of them with practical details.
CLOBJ 3	To give broad understanding of petroleum economics and prepare students to make economic analysis and evaluations
CLOBJ 4	To encourage students' participation and interaction and fostering atmosphere of tolerance and respect and develop economic sensitivity of engineers
CLOBJ 5	Get an understanding of the petroleum economics in all its aspects: reserves, investments, players, costs, benchmarking and etc. and be able make simplified forecast of oil production
CLOBJ 6	Understanding of different kind of international agreements and especially Production Sharing Agreement and be able to build a simplified economic model of upstream project

f. Course Learning Outcomes:

CLO 1	Learn Basic idea about asset and various development steps
CLO 2	Observe Feasibility of project in terms of economic aspects
CLO 3	Interpret Idea about various stages of a project
CLO 4	Illustrate Structure of project organization

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Definition of Petroleum Asset;** Exploration Asset and ProductionAsset; Steps for the development of project	15%	7
2.	**Economic feasibility of project using order of magnitude cost estimates:** Asset cost estimation, and Product cost Estimation. Cash Flows: Time value of money, investment, costs, sales, profits, taxes, depreciation. Profitability Analysis: Rate of return, payback period, Comparing investment alternatives and replacements, and application of compound interest calculations.	30%	13
3.	**Stages of a Project, Project Planning and Scheduling:** Schematic Representation of Project Management, Pitfalls in Project Planning, Milestones and Milestone Planning, Project Organogram, Work Breakdown Structure (WBS), Hierarchical Plan, Project Network, Activity Floats, Programme Evaluation & Review Technique (PERT), Critical Path Method (CPM), Project Control, Decision Making, Project Reporting, Project Meetings, Project Failure and Success; Asset Resourcing; Asset Closure and Documentation; Joint Venture Organizations, Main Contributing Factors For Successful Projects, Management of Projects, Organization Management Functions, Project Management Team, Desirable Characteristics, Competencies of Project Manager, Duties of A Project Manager, Project Team	40%	17

4.	**Project organization:** Project structures, Cost monitoring, Time scheduling/monitoring of dates, P&IDs, Measurement and Control engineering, Layout and building design, Documentation, Erection, Commissioning	15%	8
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Ramaraju Thirumalai, 'Project Management in Emerging Environment of Globalization', Himalaya Publishing House.
2. Richard D Seba, 'Economics of Worldwide Petroleum Production', Pennwell Publication
3. Plant Design and Economics for Chemical Engineers, Max S. Peters, Klaus D. Timmerhaus, McGraw-Hill, Inc.

(8)

a. Course Name: Sedimentary and Petroleum Geology

b. Course Code: 303120333

c. Prerequisite: Characteristics of sedimentary rock and their interpretation.

d. Rationale: Students will learn the various characteristics of sedimentology and stratigraphy and will provide an integrated view of sedimentology and stratigraphy. The student will able to learn stratigraphic relationship through lithology and seismic characteristics.

e. Course Learning Objective:

CLOBJ 1	Know the basic of geology, its scope and its various branches and gain the knowledge about the history of Earth's development,
CLOBJ 2	Introduce fundamental aspects of Earth and Planetary system and its related changes with time. This course will emphasize the knowledge on the solar system and planets, Geological time-scale.
CLOBJ 3	Associate the naturally occurring landforms with erosive and depositional action of the rivers, wind and glaciers.
CLOBJ 4	Learn the various processes of weathering and the processes resulting in their formation of soil.
CLOBJ 5	Know the solar system; Earth's structure and composition, geological timescale, weathering.
CLOBJ 6	Know the process of soil formation, Geospheres, depositional and erosional features associated with various natural agencies.

f. Course Learning Outcomes:

CLO 1	Identification and Classification of Sedimentary Rocks
CLO 2	Study of source rock characteristics, reservoir properties, trapping mechanisms, and migration pathways.
CLO 3	Develop hydrodynamics of depositional environment
CLO 4	Understanding of geophysical environment based on physical chemical variable

g.Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Introduction to Sedimentology:** Sedimentology and earth cycling. A brief history and Application in Petroleum, Exploration Clastic grains & identification of parental rocks, Classification of sediments andsedimentary rocks, Gravel and conglomerate, Sand and sandstone, Clay, silt and mudrock Textures and analysis of terrigenous clastic sedimentary rocks	25%	11
2.	**Hydrodynamics of Depositional Environments:** Sedimentary Environments - Erosional & Depositional. Outlineof recognition / reconstruction of ancient depositional environments. Limitations of reconstruction of ancient depositional environments. Importance of inorganic primary sedimentary structures & sedimentary textures in interpretation of hydrodynamic conditions of depositional environments.	25%	11
3.	**Diagenesis:** Diagenetic processes, Clastic diagenesis, Carbonate diagenesis, Sedimentary Environments: Concept of Sedimentary Environment, Classifications of Sedimentary Environments, Study of Sedimentary Environments based on physical, chemical, biological & geomorphic variables: Continental / Non- Marine-Desert, Alluvial fans, Fluvial, Lacustrine &Glacial, Transitional-Delta, Estuarine, Beach & Clastic shelves, Marine- Continental shelf, slope, Abyssal plains & Pelagic	25%	12
4	**Introduction to Stratigraphy** Evolution, scope and Importance of Stratigraphy, Standard Stratigraphic Classification and Nomenclature, IUGS Classification, Elements of Stratigraphy with their Units Description of Each Unit: Chrono Stratigraphy, Lithostratigraphy, Bio Stratigraphy; Magneto Stratigraphy, Chemo Stratigraphy, Sequence Stratigraphy, Seismic Stratigraphy;	25%	11
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Principle of sedimentology and stratigraphy fourth edition, Sam Boggs Jr.
2. Basic petroleum geology, Peter K. link
3. Petroleum formation and occurrence, B.P Tissot D.H. Welte

a. Course Name Professionalism & Corporate Ethics
b. Course Code: 303193304
c. Prerequisite: Basic knowledge of SWOT analysis and understanding of the fundamentals of communication are essential.
d. Rationale: Soft skills and ethics are essential for career growth.
e. Course Learning Objective:

CLOBJ 1	Student will define and articulate the principles of professionalism in a corporate context.
CLOBJ 2	Student will be able to develop the ability to analyse ethical dilemmas and make informed decisions.
CLOBJ 3	Student will apply ethical decision-making models to real-world business scenarios
CLOBJ 4	Student will evaluate the impact of corporate activities on various stakeholders, including the community and the environment.
CLOBJ 5	Student will be able to understand and practice proper business etiquette in various communication channels.
CLOBJ 6	Student will be able to develop skills in resolving conflicts ethically and professionally.

f. Course Learning Outcomes:

CLO 1	Identity and develop soft skills required for personal and professional growth.
CLO 2	Develop professional etiquette & desired behaviour at the workplace
CLO 3	Speak and participate effectively in oral organizational communication
CLO 4	Improve comprehensive skills for reading.
CLO 5	Know how to be assertive in professional environment

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	1	0	1	-	100	-	-	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1	**Ethics in Engineering**: • Scope of engineering ethics • Accepting & sharing responsibility • Responsible professionals and ethical corporations • Resolving ethical dilemmas • Case studies	20%	5
2	**Group Discussion**: • Communication core • Definition, types, process, guidelines • Mock round -1	15%	3
3	**Introduction to B-School Tests**: Students will be able to solve verbal questions from the following exams. In these sessions students will learn to distinguish betweennational & international level of Management exam. • GMAT • CAT	15%	2
4	**Listening Skills- Advanced Level**: Demonstrate ability to listen more than two minutes of audio clips &solve questions based on it.	10%	1
5	**Preparing Brochures**: Students will learn how to establish the purpose of writing & determineaudience they are writing for.	15%	2
6	**Agenda & Minutes of Meeting**: Students will be able to explain what an agenda & minutes of meetingare and why they are useful.	15%	1
7	**Reading Comprehension; Intermediate level**: Students will develop their ability to skim for main idea(s). They willable to make use of contextual clues to infer meaning of unfamiliarwords from context and will be able to solve questions based on it.	10%	1
	Total weightage and hours	100%	15

g. Reference Books:

1. Business Correspondence and Report WritingSHARMA, R. AND MOHAN, K.

2. Ethics in Engineering Practice and Research Caroline Whitbeck, Cambridge UniversityPress

3. Technical Communication : Principles And Practice Sangeetha Sharma, Meenakshi Raman; Oxford University Press

4. How to prepare for verbal ability and readingcomprehension for the CAT Arun Sharma, Meenakshi Upadhyay, TATAMcGRAW HILL

Semester 6

(1)

a. Course Name: Surface Production Operations

b. Course Code: 303120351

c. Prerequisite: The subject requires the knowledge of Production operations–I and some basics of Reservoir Engineering.

d. Rationale: This course dealt with the production facilities that are require for successful completion of oil and gas processing and also the layout of various transportation and storage facilities on surface.

e. Course Learning Objective:

CLOBJ 1	To understand the physical properties and phase behaviour of crude oil and natural gas that govern production operations
CLOBJ 2	To describe field processes for treating and conditioning full well-stream production for sales or final disposition.
CLOBJ 3	To name the wide range of equipment used to process, treat, transport, and store oilfield produced fluids.
CLOBJ 4	To understand the basics of oilfield corrosion prevention, detection and treatment.
CLOBJ 5	To describe how to determine and minimize pressure drop in pipelines, valves and pressured vessels Internal workings of separators, pumps, compressors, valves and other treating equipment.
CLOBJ 6	To understand the wide range of produced fluid volume measurement and metering devices and describe treating equipment whether located downhole, on the surface, offshore platform or sea floor

f. Course Learning Outcomes:

CLO 1	Understand the scope and areas of oil and gas processing.
CLO 2	Formulate the ideas behind design of the separation facilities.
CLO 3	Functions to the empirical data and understand the concept of separation of gas and other by-products
CLO 4	Apply the basic concepts of production operation to generate production graph.

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Separation and Treatment of crude oil:** Classification of separators, Components of separator, Types of separators, Liquid level controland relative advantages / disadvantages of different types of separators, Dehydration & Desalting of Oil, Deemulsification, Effluent Treatment, and Design of Separator.	30%	15
2.	**Storage and metering:** Storage and metering of Oil and Gas Storage tank for Oil, storage of LPG, Underground storage, Measurement-metering of Oil and Gas	25%	11
3.	**Transportation:** Gathering, Collector and Trunk pipeline system, Scale & Paraffin Deposition and their Mitigation, Flow improver (Pour point depression and Drag reducer, heat treatment), pigging in pipe lines.	25%	11
4.	**Oil Processing in Offshore Mooring System:** Offshore Installations – Fixed Platform substructures, Comparison of Onshore and Offshore Oil Processing System.	20%	8
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

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

(2)

a. Course Name: Formation Evaluation
b. Course Code: 303120353
c. Prerequisite: This subject requires the knowledge of Geology and Petroleum Exploration.
d. Rationale: This course dealt with the various lithological parameters for a sedimentary basin. Various evaluation techniques are discussing here so to check a proper co-relation regarding the petro-physical properties for a formation. This also gives an idea of the fluid properties of reservoir.
e. Course Learning Objective:

CLOBJ 1	Know the logging operations and data acquisition for logging while drilling and open hole logging and the physics of various logging tools.
CLOBJ 2	Describe different rock properties such as porosity, permeability and saturation based on basic definition.
CLOBJ 3	Interpret individual and combination of wire-line log data for lithology and fluids. Interpret different wire-line log data by cross-plotting.
CLOBJ 4	Estimate hydrocarbon volume in the reservoir based on reservoir properties and know the main applications and limitations of the different measurements
CLOBJ 5	Perform a quick qualitative interpretation to determine possible interest zones.
CLOBJ 6	Estimation of porosity from a single log, Estimation of Shale content; Gross Pay vs. Net Pay, Multiple porosity methods and Water Saturation determination.

f. Course Learning Outcomes:

CLO 1	Relate the key features for analysis of co-relation charts
CLO 2	Demonstrate the various Petro-logical equipment for analysing the different formations
CLO 3	Distinguish various approaches for data interpretation of various logs.
CLO 4	Assess the applications of reserve calculations using various Petro analysis data.

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Introduction to Formation Evaluation:** Mud Logging and Coring Introduction to petroleum formation evaluation: Basic concepts, direct Methods: Mud logging, Hydrocarbon staining on the cuttings, Lithology and texture of cutting samples, Evaluation of geopressured zone by mud logging, Coring techniques and analysis; Indirect Methods: LWD/MWD & Wireline Logging, Instruments/Tools details, Processes of recording and representation (Log charts with tracks). Correlation of core and logging data	30%	13
2.	**Open Hole Logging Tool physics:** Measurement principles and data interpretation of the following including quantitative and qualitative analysis techniques: Calliper log; Electrical logs – SP and Resistivity logs (conventional, induction and micro devices), Radioactive Logs – Gamma Ray (natural and spectral), Neutron, Density and Elemental capture spectroscopy logs; Sonic Logs including Dipole shear sonic, Nuclear magnetic resonance (NMR).	25%	11
3.	**Data Integration and Formation Evaluation:** Quantitative Analysis methods for lithology, shale volume, saturation from various logs	20%	10
4.	**Cased Hole Logging and Production Logging:** CBL /VDL logs, Advance Logging tools including Casing Inspection tools, Formation micro imaging tool, , Proppant Tracer Log, Ultra sonic imaging tool; Production Logging: Introduction, type of tools, principles, limitations & applications	25%	11
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Malcom Rider, Second Edition, 2002: The Geological Interpretation of well logs, RiderFrench Consulting limited
2. Oeberto Serra & Lorenzo Serra, 2004 : Well logging - data acquisition and applications, Edition Serralog, France
3. Jorden J R and Campbell F. L., , SPE, New York, 1986: Well Logging Vol. 1 and 2

(3)

a. Course Name: Oil and Gas Well Testing
b. Course Code: 303120355
c. Prerequisite: This subject requires the knowledge of basics of reservoir engineering with emphasis to applied reservoir engineering.
d. Rationale: This course dealt with well Testing allows the acquisition of data on the hydrocarbon properties, reservoir temperature, pressure, drainage area, shape, water-to-oil and gas-to-oil ratios.

e. Course Learning Objective:

CLOBJ 1	This subject teaches students about the importance of well-testing analysis and its objectives of well testing is; to see if the well will flow or not, to see what fluid a well would produce, to see if the well would flow naturally or to be pumped, to the surface, to see what rates of flow were possible.
CLOBJ 2	To check existence of communication between different wells, to determine reservoir and flowing pressure, to determine reservoir parameters and to detect no flow boundaries if they exist.
CLOBJ 3	Analyse and interpret well test data for determination of petrophysical parameters in dynamic flow conditions around a well.
CLOBJ 4	Understand important of safety and precautions against accident at the time of well testing and also understand standard procedure to control of well
CLOBJ 5	Students will learn various techniques of pressure transient analysis, part of the reservoir engineering discipline. The course will be based on a mathematical foundation of partial differential equations.
CLOBJ 6	Many tests are performed on a single well, while others require changing rates or monitoring pressures in two or more wells. The wells in many tests can be either vertical or horizontal.

f. Course Learning Outcomes:

CLO 1	Understand the Importance and types of pressure tests.
CLO 2	Importance of Horner's plot in oil and gas well testing.
CLO 3	Knowledge of Well Testing Equipment and Procedures:.
CLO 4	Understanding of Well Test Analysis Methods

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Introduction of Well Test Analysis:** Importance and types of pressure tests, Pressure recorder: Measurement instruments used for bottom hole studies- Calibration of pressure recorders, Indicator diagram. Diffusivity equation, linearization and solution under semi steady state, steady state and applications. Constant Terminal Rate Solution, Line source solution.	25%	11
2.	**Oil Well Testing Pressure Transient Tests:** Horner's Plot, Pressure Build-up Test / Draw-down tests, RLT (Reservoir Limit Test), Determination of average reservoir pressure. Skin factor and average reservoir permeability, Drill Stem Testing: Equipment, DST Chart observation, analysis & interpretation, Wire line formation tests, Modular Dynamic Test.	25%	11
3.	**Gas Well Testing Russel:** good rich solution of diffusivity equation. Real gas pseudo pressure function and its use in diffusivity equation. Non-Darcy's effect and evolution. Gas Well testing: Multi rate test of gas well, pressure build-up and draw down in gas reservoir. Flow after flow (Multi-rate Test), isochronal & modified isochronal tests. Skin factor and average reservoir permeability. Determination of average reservoir pressure	30%	13
4.	**Advanced Pressure Transient Analysis:** Interference and pulse tests, Pressure Fall Off test in Injection wells. PBU / PDD in Horizontal wells. Principle of Superposition, Deconvolution of Pressure Data. Type Curves analysis, interpretation & their uses.	20%	10
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Well Test Analysis by John Lee,
2. Modern Well Test Analysis by R.C. Erlougher,
3. Fundamental of Reservoir Engineering by L.P. Dek,
4. Applied Reservoir Engineering by Craft and Hawkins
5. Well Testing Analysis by Mathews and Russell, 6. Gas Well Testing Handbook, Amanat U. Chaudhry

(3)

a. Course Name: Pump and Compressor

b. Course Code: 303120357

c. Prerequisite: This subject provides the knowledge of basics of pump and compressor and their applications.

d. Rationale: The application of the Pumps and compressor is found in many branches of engineering including mechanical and petroleum engineering. This subject provides the basic principles and the applications of Pumps and compressor in the fields of mechanical and petroleum engineering.

e. Course Learning Objective:

CLOBJ 1	Know the principles of compressor, pumps and gas turbine theory of operations
CLOBJ 2	Recognize different types of pumps, compressors and gas turbines
CLOBJ 3	Explain the functions and principles of operation of each major component of these machines and systems components
CLOBJ 4	Learn how to measure and control the performance and efficiency of these machines
CLOBJ 5	Understand and learn the principles of pump, compressor and gas turbine start-up procedures and introduce standard operating procedures for the package
CLOBJ 6	Know the procedure of how to maintain and inspect the compressor, pumps and gas turbine to develop skills in executing activities in a safe and right manne.

f. Course Learning Outcomes:

CLO 1	Understand the principle of Reciprocating engine
CLO 2	Evaluate the performance of the compressor
CLO 3	Understand working and operating conditions of centrifugal pump
CLO 4	Knowledge of Pump and Compressor Types and Applications

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
2	0	0	2	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Reciprocating Engine:** Two & four stroke engines, engine cycles and their comparisons. Natural Aspirated and Supercharged engines. Carburetion and Fuel Injection systems including MPFI system Supercharging & Turbo Charging, Engine cooling and lubrication. Engine testing and performance Emission and control mechanism.	20%	6
2.	**Gas Turbine Engines:** Fundamentals (Bayton cycle and Regeneration cycle) Combined cycle & waste heat recovery etc. Single and multi-shaft turbines Effects of intake compressor speed and air contamination	25%	7
3.	**Pumps:** Pumps classification & types Advantages & disadvantages, Basic principles – head, HP, Net Positive Suction Head (NPSH), Selection criteria, and Centrifugal multiple pump and stage installations and their characteristics. Pumping stations (series & parallel installations).Types of seal systems etc. Reciprocating pumps Pulsation dampening system, Various codes & standards	25%	7
4.	**Compressors:** Types, Advantages & disadvantages, Centrifugal Compressors, Specifying a compressor, Determination of HP & No of stages, Surge control & stonewalling, Reciprocating compressors, Components, Capacity control devices, Cooling & lubricating systems, API Specs; 11P & 618, Environmental Aspects:, Air pollution	30%	10
	Total weightage and hours	100%	30

i. Text Book and Reference Book:

1. Refrigeration and Air Conditioning Theory and Practice Pradhan & Soni

2. Modern Air Conditioning Practice Norman C.Harris

3. A Course in Refrigeration & Air Conditioning Domkundwar & Arora

4. Refrigeration and Air Conditioning G.S.Sawhney

a. Course Name: Energy Technology and Engineering

b. Course Code: 303120381

c. Prerequisite: This subject requires the knowledge energy engineering and implementation of sustainable energy solutions.

d. Rationale: In this subject emphasis is on challenges of designing, promoting and implementing of various forms of energy solutions within society's rapidly-changing energy-related industry cluster.

e. Course Learning Objective:

CLOBJ 1	Describe and analyse the relation between energy use, the gross national product, GDP, and" Human Development Index", HDI values
CLOBJ 2	Describe and analyse the occurrence of multiple aims, multiple stakeholders and an abundance of technical solutions concerning energy systems
CLOBJ 3	Describe and analyse different tools for energy systems including the concept sustainable development, systems view on energy, and economy tools for evaluation of energy systems
CLOBJ 4	Describe and analyse climate changes and availability of fossil fuels
CLOBJ 5	Describe and analyse different technologies to generate energy in stationary applications, including combustion of fossil fuels, carbon dioxide storage, nuclear power, solar energy, bioenergy and wind power
CLOBJ 6	Describe and analyse energy transformation for use in transport systems

f. Course Learning Outcomes:

CLO 1	Understanding of Energy Sources and Conversion Technologies
CLO 2	Formulate the design aspects of solar energy systems.
CLO 3	Analyse the wind energy conversion systems.
CLO 4	Design and Optimization of Energy Systems

g.Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**An Introduction to Energy Sources:** Energy sources (conventional & non-conventional), renewable energy resources, primary & secondary energy sources, energy chain, energy demand, national energy strategy & plan, energy management, energy audit & conservation	25%	11
2.	**Solid Fuels:** Wood & charcoal, peat, lignite, sub-bituminous & bituminous coals, semianthracite and anthracite coals, cannel & boghead coal, origin of coal, composition of coal, analysis & properties of coal, problem	25%	11
3.	**Energy Management and Audit Programme:** Supply side and demand side energy management, Boilers and Firing System, Steam, Condensation Systems, Energy Conservation and Management in power plant, Energy conservation in Buildings, Heating, Ventilation and Air Conditioning System, Degree day in energy use monitoring, Energy Conservation Opportunities, in chemical industries, Waste heat recovery, Co-generation, Energy Conservation in Agricultural Sector, Energy conservation in	25%	12
4.	**Basic concept of power plants:** types of power plants, thermal power stations, various components of thermal power stations, power plant cycles, fuel handling, combustion, waste disposal methodologies, economizers, turbo alternators, heat balance and efficiencies, hydroelectric power plant, various components	25%	11
	Total weightage and hours	100%	45

j. Text Book and Reference Book:

1. Energy Technology, Rao and parulker
2. Non-Conventional Sources of Energy by: G.D. Rai, Khanna Publisher

(5)

a. Course Name: Biomass Conversion and Utilization

b. Course Code: 303120385

c. Prerequisite: This subject requires the knowledge forms of renewable energy and oil field development and planning.

d. Rationale: The subject dealt with to impart the knowledge of basics of various methods to convert biomass into fuel and application of the biomass into daily life as well as in industry.

e. Course Learning Objective:

CLOBJ 1	Describe composition and energy-related properties of biomass and explain their impact on energy conversion processes.
CLOBJ 2	Analyze and compare the biomass availability and its potential on local and global scales.
CLOBJ 3	Compare and analyze state-of-the art biomass conversion technologies and future R&D trends for biomass utilization.
CLOBJ 4	Evaluate and differentiate biofuels and their importance for sustainable development.
CLOBJ 5	Design and assess biomass-based conversion technologies in an industrial context by using important key performance indicators.
CLOBJ 6	To provide in-depth knowledge of biomass as a renewable energy source as well as different conversion technologies.

f. Teaching & Examination Scheme:

Teaching Scheme			**Credit**	**Examination Scheme**					**Total**
				External		**Internal**			
Lect Hrs/ Week	**Tut Hrs / Week**	**Lab Hrs/**		**T**	**P**	**T**	**CE**	**P**	
3	0	0	3	60	-	20	20	-	100

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

g. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Biomass sources and classification:** Sources and Classification. Chemical composition, properties of biomass. Energy plantations Size reduction, Briquetting, Drying, Storage and handling of biomass.	25%	11
2.	**Operating parameters for biogas production:** Feedstock for biogas, Microbial and biochemical aspects- operating parameters for biogas production.	25%	11
3.	**Various biomass conversion processes:** Kinetics and mechanism- High-rate digesters for industrial waste water treatment. Thermo-chemical conversion of lignocelluloses biomass. Incineration, Processing for liquid fuel production.	25%	11
4.	**Principles of conversion and types of gasifiers:** Pyrolysis -Effect of particle size, temperature, and products obtained. Thermo-chemical Principles: Effect of pressure, temperature, steam and oxygen. Fixed and fluidized bed Gasifiers- Partial gasification of biomass by CFB.	25%	12
	Total weightage and hours	100%	45

h. Text Book and Reference Book:

1. Bio Energy by David Boyles, Elis Horwood Ltd.,
2. Renewable energy sources and conversion technology by N.K. Bansal, M. Kleemann, M. Heliss, Tata McGraw Hill 1990.
3. Direct Energy Conversion by R. A. Coombie, Pitman

a. Course Name: Employability Skills
b. Course Code: 303193353
c. Prerequisite: Basic knowledge of ethics, corporate etiquettes and understanding of the fundamentals of communication are essential.
d. Rationale: Interpersonal skills and employability skills are essential for better career.

e. Course Learning Objective:

CLOBJ 1	Students will be able to understand the importance of resume customization for different job applications.
CLOBJ 2	Students will develop strategies for identifying job opportunities through various channels.
CLOBJ 3	Students will demonstrate proficiency in preparing for job interviews.
CLOBJ 4	Students will build and expand a professional network using both online and offline channels.
CLOBJ 5	Students will be able to understand workplace communication dynamics, including formal and informal channels.
CLOBJ 6	Students will be able to apply time management techniques to prioritize tasks and meet deadlines.

f. Course Learning Outcomes:

CLO 1	Get ready for IELTS tests.
CLO 2	Develop a professional resume.
CLO 3	Get an understanding of the interview process.
CLO 4	Improve employability skills through mock tests.
CLO 5	Use soft skills during job interviews.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	1	0	1	-	100	-	-	-	100

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

h. Course Content:

Sr. no.	Topic	Weightage	Teaching hours
1	**IELTS Mock Test**: • To develop students English Learning and improve their employment prospects. • To create opportunity for students to study around the globe & give them Practice on : Listening Speaking Reading Writing	25%	5
2	**Resume Building**: • Cover letter & Resume Writing • Students will create a functional resume along with cover letter that they will be able to use when applying for a job, college or a scholarship.	25%	2
3	**Advanced Group Discussion: Mock Round**: • To provide students with an avenue to train themselves in various interpersonal skills. • To prepare students for the Group Discussion after the written test for employment or for admission to educational institutes. • To generate new ideas or new approaches for solving a problem. • To reach a solution on an issue of concern.	25%	4
4	**Personal Interview: Mock Round**: • Preparing For The Interview • Review Question • Employer's Expectation • Case Interview	25%	4
	Total weightage and hours	100%	15

i. Reference Books:

1. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.

2. Communication Skills and Soft Skills Suresh Kumar; Pearson Publication, 2010

3. Technical Communication : Principles And Practice Sangeetha Sharma, Meenakshi Raman; Oxford University Press

Semester 7

(1)

a. Course Name: Petroleum Engineering Design

b. Course Code: 303120401

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

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

e. Course Learning Objective:

CLOBJ 1	Fundamental concepts in petroleum production engineering. Determine the well head pressure, down-hole pressure and operating oil/ gas flow rates of the reservoir.
CLOBJ 2	Identify formation damage and find remedial methods to bring the well back into production. Reservoir fluids, efficient flow to the surface without damaging the reservoir dynamics/drive mechanisms.
CLOBJ 3	Screen, design and operate artificial lifts on reservoir pressure depletions. Sick well identification and remedial stimulation operation.
CLOBJ 4	Handle in case of any crisis at drilling/production installations.
CLOBJ 5	Process oil and gas before supply to refinery/consumers. Application of suitable artificial lifts on reservoir energy depletion.
CLOBJ 6	Contribute to reservoir management as production engineers to prolong the reservoir life with optimum production.

f. Course Learning Outcomes:

CLO 1	Develop understanding and skills of modelling fluid flow and heat transfer in the various components of multiphase production systems.
CLO 2	Learn advanced techniques for modelling well deliverability and multiphase flow in wellbores and pipelines.
CLO 3	Evaluate well performance improvement by artificial lift will be addressed
CLO 4	Apply the basic concepts of production operation to generate production graph.

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Development of Oil & Gas Fields** Selection of development scheme, economic aspect of development of oil and gas fields. Production variants, performance prediction, Recovery factor, Stages of preparation of development plans. Computation of economic indices viz. Capital investment, payout period, IRR, Profile, Economic life etc. Analysis of different variants based on technical and economic considerations. Economic development of Marginal fields.	26%	13
2.	**Design of oil and gas separation system** Design of two phase and three phase separators, Crude oil Treatment, Heater treaters, Electrostatic heater treaters, Design of heater treaters	26%	12
3.	**Basic principles and descriptions of Artificial lift techniques** Gas-lift - continuous and intermittent, chamber lift, plunger lift/sucker rod pumping, and hydraulic pumping - piston & jet type, Design of Continuous gas lift system (pressure operated valves) **-** graphical and analytical methods.	24%	10
4.	**Design of Intermittent gas lift system** single point injection standard tubing installation (Pressure operated valves) - graphical and analytical methods. Design of Sucker rod pumping system, Characteristics and Selection of electric submersible pumping/PCP systems.	24%	10
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

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

(2)

a. Course Name: Enhanced Oil Recovery Techniques
b. Course Code: 303120403
c. Prerequisite: This subject requires the basic Knowledge of reservoir engineering and well testing analysis.
d. Rationale: In this subject emphasis is on Understanding of secondary / tertiary recovery of crude oils of specific reservoirs following the selection criteria to which reservoir suits for specific EOR techniques. The subject provides Knowledge of maintenance of injection wells / Production wells and ignition of injection wells in case of thermal EORs.

e. Course Learning Objective:

CLOBJ 1	Display the knowledge and skills needed to solve reservoir engineering problems related to enhanced oil recovery.
CLOBJ 2	Apply integrated knowledge of math and basic sciences including geosciences to the solution of problems related to EOR performance predictions.
CLOBJ 3	Evaluate and apply the fundamental equations used for EOR applications.
CLOBJ 4	Analyze and apply the basic physics behind EOR processes and apply frontal advancement models for common EOR techniques.
CLOBJ 5	Develop research skills related to understanding and presenting on a current field-scale EOR operation.
CLOBJ 6	Apply integrated knowledge of math and basic sciences including geosciences to the solution of problems related to EOR performance predictions.

f. Course Learning Outcomes:

CLO 1	Understand the principles, mechanisms, advantages, and limitations of each EOR method.
CLO 2	Design and Optimization of EOR Projects:
CLO 3	Understand the Integration with Secondary Recovery Techniques
CLO 4	Understanding of Microbial EOR technique

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Introduction to EOR processes** Definition, Difference of IOR and EOR, Target oil resource for EOR, General Classification. Description and potential of different EOR processes	24%	10
2.	Microscopic and macroscopic displacement of fluids in a reservoir, Displacement efficiency in different system – linear, areal, volumetric, Definition and discussion of mobility ratio and mobility control processes for different types of fluids	26%	12
3.	**Candidates for EOR processes and Selection Criteria** Miscible/Immiscible displacement processes -water flooding, gas injection, micro-emulsion flooding Chemical Flooding - polymer flooding, Surfactant flooding, Micellar flooding related methods Thermal recovery processes- in situ combustion, hot-water injection, steam flooding, SAGD Microbial EOR	24%	10
4.	**Flow of immiscible fluids through porous media.** Continuity equation, equation of motion, solution methods Water flooding, Fractional flow equation, Frontal advance theory. Recovery efficiency, permeability heterogeneity. Water flooding performance calculations: Frontal advance method, viscous fingering method, Stiles method, Dykstra-Parsons Method, Water for water flooding.	26%	13
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Oeberto Serra & Lorenzo Serra, 2004 : Well logging - data acquisition and applications, Edition Serralog, France

2. Jorden J R and Campbell F. L., SPE, New York, 1986: Well Logging Vol. 1 and 2

(3)

a. Course Name: Reservoir Modeling and Simulation

b. Course Code: 303120405

c. Prerequisite: A good fundamental backup of knowledge of various hydrocarbon contracts and asset management.

d. Rationale: Requirements to measure its quantity and quality for allocation, custody transfer and fiscal purposes as well as for stock control and loss prevention.

e. Course Learning Objective:

CLOBJ 1	Students will be able to do derivation of partial differential equations for single phase and multiphase flow in porous materials, and numerical solution methods of these using finite difference methods.
CLOBJ 2	Students will understand the process of constructing and running a model whose behaviour assumes the appearance of actual reservoir behaviour. They will also be able to use common modeling tools for numerical prediction of reservoir behaviour.
CLOBJ 3	To provide a basic knowledge of how computer models are used in reservoir engineering to predict the flow of fluids through porous media. Through the simulation they will learn the estimation of field performance (e.g., oil recovery) under one or more producing schemes.
CLOBJ 4	To provide an overview of reservoir simulation software to conceptualize the complex nature of the reservoirs.
CLOBJ 5	To provide the concepts on how to create an algorithm to solve the model by applying numerical methods using the developed mathematical model & numerical model.
CLOBJ 6	To explain how to apply the conceptual, mathematical and numerical skills attained on field-scale problems; and classify limitations of the conventional techniques.

f. Course Learning Outcomes:

CLO 1	Interpret a simple mathematical model to represent the reservoir production capabilities using mathematics and fundamentals of fluid flow.
CLO 2	To enhance the complexity of mathematical model to represent realistic reservoir conditions
CLO 3	Develop working knowledge of model solution approaches using mathematical rules.

CLO 4	Studies parametric case and remedies to bypass numerical instabilities and stiff formulations

g.Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Reservoir Modeling** Introduction to Modeling – Geological Modeling, Types of Model & designing of various models depending on reservoir complexities, rock properties, fluid properties etc., Concept of Black Model and Compositional Model	25%	11
2.	**Reservoir Simulation** Introduction, Historical Background, Application of Simulator, Different models, Flow Conditions: Single phase, two phase & multiphase equations for one two- & three-dimensional models Special Concept: Explicit & implicit grid system, Finite difference & finite element method, Matrix solution, iterative method, stability criteria	25%	12
3.	**Data Preparation** Pesudo functions, Reservoir Model Solution Techniques: Implicit pressure and Explicit Saturation (IMPES); Implicit pressure & Implicit Saturation (IMPIS), Preview of Numerical Solution Methods: Direct & Iterative method	25%	11

4.	**History Matching** Mechanics and Parameter match Special Concepts: Coning and Compositional Models Simulation Optimization using Economic and Techno economic Evaluation Computation of Economic Indices viz. different variants based on technical and economic considerations Introduction to streamline simulation and comparison of conventional / streamline simulation	25%	11
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Crichlow, H. B. (1977) Modern Reservoir Engineering, A Simulation Approach, Prentice-Hall.

2. Franchi, J R. (2006) Principles of Applied reservoir Simulation, 3rd Edition. Gulf Professional Publication.

3. Aziz, K and Sattari, A (1979) Petroleum reservoir simulation, Applied Science Publishers

4. Peaceman, D. W. (1977) Fundamentals of numerical reservoir simulation, Elsevier Publication.

Semester 8

a. Course Name: Unconventional Energy Resources
b. Course Code: 303120451
c. Prerequisite: To understand the global significance and distribution of unconventional energy resources.
d. Rationale: With the knowledge gained on the different aspects of shale gas reservoirs such as organic geo-chemistry, mineralogy, petrophysical properties, geomechanics, reservoir engineering, the students will be able to evaluate and map unconventional energy resources in sedimentary basins. Further, they will be able to devise the production mechanisms to extract unconventional energy resources.
e. Course Learning Objective:

CLOBJ 1	Promote understanding of basic principles in Chemistry while retaining the excitement in Chemistry.
CLOBJ 2	Develop positive scientific attitude, and appreciate contribution of Chemistry towards the improvement of quality of human life.
CLOBJ 3	Inculcate values of honesty, integrity, cooperation, concern for life and preservation of the environment.
CLOBJ 4	Learn to handle in case of any crisis at drilling/production installations.
CLOBJ 5	Understand and explain general ways to save energy at a personal, community and global level. Understand and explain, in general terms, how passive solar heating, hydropower and wind power work.
CLOBJ 6	Define energy and identify the different types that exist. Define potential and kinetic energy. Relate specific energy types to different engineering projects. Describe the role of engineering in finding and testing various energy sources for electricity production.

f. Course Learning Outcomes:

CLO 1	Demonstration of different properties of NGH.
CLO 2	Knowledge of Hydraulic Fracturing and Horizontal Drilling
CLO 3	Categorize the reservoir characterization of CBM.
CLO 4	Gain the knowledge in petro-physical properties, pore pressure prediction, performance analysis, production and testing of shale gas reservoirs.

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	**Introduction** Energy Facts Survey of energy resources; Global vis-a`-vis Indian energy scenario – demand and supply, and future projection; relation between GDP and energy demand; introduction to conventional, unconventional, renewable, non-renewable energy resources in general, and unconventional hydrocarbon energy resources in particular; effect of use of various energy resources on environment/climate – Keeling curve; clean and sustainable energy resources; comparison between formations and mode of occurrences of various conventional and unconventional hydrocarbon energy resources.	25%	12
2.	**Oil Shale, Shale Gas, and Tar Sand** Oil Shale: Definition and prospect, geological conditions for formation of oil shale, oil shale recovery technology, ex-situ and in-situ extraction processes of shale oil, various retorting processes, processes leading to maximisation of shale oil production; Shale Gas: Definition and prospect, the conditions of formation of shale gas, debate over extraction of shale gas from the subsurface, environmental issues, American experience, Marcellus shale gas project – an example of success story of shale gas exploitation, methods of production, hydro fracturing, composition of fracking fluid, water management, shale gas – Indian perspective; Tar Sand: Definition and prospect, distinction between heavy oil and bitumen, mineralogy and properties of oil sand, elemental composition and properties of bitumen, methods of recovery of bitumen by mining and advanced in-situ processes.	25%	11

3.	**Gas Hydrate** Definition, History of Hydrate R&D, prospect, types of methane hydrate deposits, chemistry and structure of natural methane hydrate, Necessary Conditions for Methane Hydrate Formation, typical conditions of methane hydrate formation in nature vis-a`-vis different gas hydrate stability zones, physical properties of hydrates and ice, geology of methane hydrates, exploration for methane hydrates – geological, geochemical and geophysical, gas hydrate – Indian perspective	25%	11
4.	**Introduction to Coal Bed Methane** Definition and prospect, CBM, CMM, and AMM; an Overview on CBM vs. Conventional Reservoir – Gas Composition, Adsorption, Water Production, Gas Flow, Rock Physical Properties, Gas Content, Coal Rank, Gas Production. Fundamentals of Coal Geology: Genesis of Coal; Major Stratigraphic Periods of Coal Formation; Gondwana and Tertiary Coals of India; Influence of Coal Properties; Coal Chemistry – Molecular Structure, Macerals, Lithotypes, Functional Groups, Proximate Analysis, Ultimate Analysis; Significance of Rank – Definition and Measurement, Vitrinite Reflectance Measurement, Physical Properties, Volatiles Generated, Micropores.	25%	11
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Zou, C et al (2013) Unconventional Petroleum Geology, Elsevier;

2. Max, M. D. (2003) Natural Gas Hydrate in Oceanic and Permafrost Environments, Kluwer Academic Publication;

3. Nash, K. M. (2010) Shale gas Development, Nova Science Publishers, Incorporated;

4. Rogers, R. (1994) Coal bed methane: principles and Practices, PTR Prentice Hall

a. Course Name: Health, safety and Environment in Petroleum Industry
b. Course Code: 303120453
c. Prerequisite: A good fundamental backup of knowledge of safety standards and asset management and other core activities of petroleum industry is required.
d. Rationale: The main objective of this subject is to make students aware about the interrelation ship among various Environment, safety & health related hazard controlling and preventive methods and their right usage at right place in right quantity.

e. Course Learning Objective:

CLOBJ 1	Complete information about health and safety of employees and protection of the environment and awareness of best practices to follow at work to cause minimum pollution to the environment.
CLOBJ 2	knowledge of certain precautionary measures while working and handling machinery or other equipment to prevent occupational hazards and the necessary information to handle cargo and waste material in a controlled manner so as to minimise negative impact to the environment.
CLOBJ 3	Develop the required skill and capability to devise, implement and manage safety and health management systems in the organisation.
CLOBJ 4	Protection of employees through: providing safe working conditions, reducing occupational risks related to the performance of their duties. Workplace and functional regulations of safe work performance. Introduction of procedures in the fields of activity in which they are required.
CLOBJ 5	Prevent workplace injuries, illnesses, and deaths, as well as the suffering and financial hardship these events can cause for workers, their families, and employers. The recommended practices use a proactive approach to managing workplace safety and health.
CLOBJ 6	Understand all details of HSE issues linked to production, as well as to construction and maintenance works and Describe HSE management rules and individual responsibilities,

f. Course Learning Outcomes:

CLO 1	Study and implements practical aspects of environmental protection and safety at work

CLO 2	Proper implementation of Environment Health & Safety
CLO 3	To gain knowledge about occupational health related problems
CLO 4	To involves organized efforts and procedures for identifying workplace hazards and reducing accidents and exposure to harmful situations and substances

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs / Week	Lab Hrs/		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

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

h. Course Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	Physical Hazards Noise, Heat, Vibration, Illumination, Radiation, extreme climatic conditions etc, Chemical Hazards Hydrogen sulfide gas, Hydrocarbons, Ammonia, Chlorine, Formaldehyde, Hydrochloric Acid, Methanol, Sulphur, Sulphuric acid, Sodium Hydroxide, etc. Biological Hazards, Psychological Hazards, Ergonomic Hazards, Injuries, Burns etc Prevention & Remedial controls of Occupational Hazards In Oil & Gas Industry for each type of Hazards Engineering Control, Administrative Control, Medical Control, Use of Personal Protective Equipment (PPE) Understanding Fire: Fire triangle/tetrahedron, Stages of development of fire Flammability, Concept of flash / Fire point, volatility, Flammable Limits, Fire Detection; Fire signature, Smoke, Heat, Flame, Combustible Gas Detection Fire Prevention, Fire suppression , Process Safety: Safety Analysis Table, Safety Analysis Checklist & SAFE Chart(ref API 14 C)	20%	10

2.	Hazard & Risk Analysis Risk Matrix, HAZID, HAZOP, QRA (API 14 J, OISD) ,Safe Work Practices :PTW, MOC, SIMOPS etc (ref API RP 75,OISD, OMR) , Electrical Safety;, Classification of Hazardous locations, use of electricity I Hazardous area (Ref IER, OISD, OMR, API RP 500 & 14 F) Accident Investigations: Study of major accidents like Piper Alpha, Flixborough, Bhopal etc., Investigation techniques Emergency Response planning Audits & Inspection. Audit methodology, protocol, typical check lists for Drilling rigs, Work over activities, logging, etc (ref OISD Standards)	35%	15
3.	HSE Management System OISD, API RP 75, ISO 14000, ISO 9000, OSHAS 18000 Standards, OMR and Petroleum Rules (by PESO)	10%	5
4.	Environment Concepts: Effect on eco-system; Air, Water, & Soil of HC‟s. Impact of Exploration & Exploitation of Hydrocarbon on Environment Environmental studies (Off shore & On Shore) - Environmental Impact Assessment Oil Spills Control and their management. State, Government of India and international Maritime Environmental Rules & Regulations. Drilling / Oil Storage / Effluent water / waste (solid & sludge) treatments their disposal and remediation of soil etc. Upstream safety: Implementing Agency OISD (for on-land blocks) Directorate of Mine Safety (for Off Shore Blocks), Safety in Rig operation; Safety in Exploration and Production. Downstream Safety: Implementing Agency PNGRB; Safety Regulations (Technical Standard, Specification and Safety Standards T4S), Emergencies, Mutual Aida; Emergency Response and Disaster Management Plan ERDMP).	35%	15
	Total weightage and hours	100%	45

i. Text Book and Reference Book:

1. Less, F. P., Loss Prevention in the Process Industries, 2nd ed., Butterworth Heinemann, UK.

2. Peavy, H. S., Rowe, D. R. and Tchobanoglous, G., Environmental Engineering, McGraw Hill, New York.

3. Sanders, R. E., Chemical Process Safety, Butterworth Heinemann, UK, Year.

4. Marchell, V. and Ruchemann, S., Fundamentals of Process Safety, Institution of Chemical Engineers, Warwickshire, UK.