SCHEME OF EXAMINATION

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SYLLABUS

for

B.Tech III Year (PETROLEUM ENGINEERING)

(Effective from the session: 2020-21)

Uttrakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula
B Tech III Year (V Semester)
[Petroleum Engineering]
W.E.F. Academic Session 2020-21

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work &Sessional		L	T	P	
1.	BPET501 BPEP501	DC	Petroleum Production Operation-II	100	30	20	30	20	200	3	0	2	4
2.	BPET-502 BPEP502	DC	Applied Petroleum ReservoirEngineering	100	30	20	30	20	200	3	1	2	4
3.	BPET-503 BPEP -503	DC	Unit Operations	100	30	20	30	20	200	3	1	2	4
4.	BPET -504	DE	Departmental Elective	100	30	20	-	-	150	3	0	0	3
5.	BPET -505	OE	Open Elective	100	30	20	-	-	150	3	0	0	3
6.	BPEP -506	D Lab	Software Lab	-	-	-	30	20	50	0	0	2	1
7	BPET -507	DLC	Evaluation of Internship-II completed at II year level	-	-	-	-	50	50	-	-	4	2
8		IN	Internship –III	To be completed any time during Fifth/ Sixth semester. Its evaluation/credit to be added in Seventh semester									
			Total	500	150	100	120	130	1000	13	2	12	**21**

Departmental Electives		**Open Electives**	
BPET504(A)	Formation Evaluation	BPET 505(A)	Principle of Management
BPET504(B)	Non-Conventional Petroleum Resources	BPET 505(B)	Drilling Fluids and Cementation
BPET504(C)	Process Instrumentation	BPET 505(C)	Innovation and Entrepreneurship

Fifth Semester
Petroleum Production Operation-II (BPET-501)

L T P
3 0 2

Course Objective

- The students should be able to describe the well completion techniques as well as the well activation methods currently used.
- The students should be able to review the different production tests and describe their significance
- To understand well investigation techniques and remediation of well production problems.

Course Outcome

- Understand and apply production logging operations.
- Do problem well analysis and apply new techniques to sustain production rates
- The students should be able to describe the overview of stimulation techniques and their selection factors.
- The student should be able to understand the well production problems and be able to provide remedies.
- The students should be able to gain an understanding of well servicing and workover operations**.**

Unit 1 **[6]**
Extraneous gas and water entry into well bore, source identification and control measures.

Unit 2 **[10]**
Sand production and control, sand control techniques,produce sand analysis,gravel size selection, gravel packing fluid and gravel packing techniques.

Unit 3 **[10]**
Wall work-over problems,rig selection,rig-less work over,coiled tubing system, work overfluid design,planning and economics.

Unit 4 **[8]**
Oil and gas separation system and process, optimization.

Unit 5 **[6]**
Crude oil Storage, underground gas storage, effluent treatment and disposal.

Reference Books:

1. Arnold K. and Stewart M., “Surface Production Operations”, Vol. I and II, Gulf Publishing Company, 1986.
2. Mian, M.A., “Petroleum Engineering Hand Book for Practicing Engineers” Vol. I and II, Pennwell Publications, 1992.
3. Galambhor and Guo, “Petroleum Production Engineering a Computer Assisted Approach”,
4. Construction of Offshore and Marine Structures - Ben C. Gerwick, Jr.
5. An Introduction to Offshore Engineering - Angus Mather.
6. Wireline operations and procedures – Book 5 of vocational training series – American Petroleum Institute.
7. Production logging – Theoretical and interpretive Elements by A.D.Hill.

Applied Petroleum Reservoir Engineering (BPET-502)

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COURSE OBJECTIVE

- To help the students understand the fundamentals and relevance of reservoir engineering in the broader context of Oil/Gas Field Exploitation, and have in-depth knowledge of vital aspects of elements of reservoir engineering in particular.
- To enable students to understand fluid properties existing in hydrocarbon reservoir and apply laws of fluid flow through porous media and their applicability under various field conditions.
- To empower students with the resource analysis expertise through extensive evaluation of hydrocarbon reservoir with respect to reserve estimations, recovery factors and ensure a positive economic gain.

COURSE OUTCOME

- Gain the knowledge of reservoir properties of rocks
- Calculate the properties of reservoir fluid.
- Gain insight into vapor – liquid, liquid – solid phase equilibrium during oil & gas production.
- Understand the phenomenon of multiphase flow system in porous media and Equations for
- The calculation of required parameters applied in Reservoir Engineering.
- Understand and explain different drive mechanisms and recovery factor of a Reservoir.
- Calculate reserves of oil and gas by volumetric and material balance and acquire the basics knowledge of Reservoir Modeling Software's Ability to apply plant layouts and understanding the application

Unit 1 **[6]**

Gas, gas condensate and oil reserves, identification from fluid composition, production characteristics, reservoir drive mechanics.

Unit 2 **[8]**

Material balance equation: generalized and specific form for different drive systems, drive type identification, rock and fluid compressibility factor, recovery factor estimation.

Unit 3 **[6]**

Performance prediction,water influx estimation, drive-index, reservoir pressure maintenance, choice and system.

Unit 4 **[10]**

Immiscible displacement process, fractional flow and fractional displacement process in linear reservoir, Buckeley and Leverttreatment, reservoir water flood performance.

Unit 5 **[10]**

Oil and gas field development, injection-production wells distribution pattern and characteristics, optimum well spacing from techno economics analysis of field performance, well and field production rate estimation, investment and operation cost, profitability estimation.

Reference Books

1. Dandekar Y. Abhijit, Petroleum Reservoir Rock and Fluid Properties.
2. Mattax, C.C. and Dalton, R. L, Reservoir Simulation, SPE Monograph Volume 13, 1990. Practical Reservoir Engineering Part-1 and Part-2, By E.H. Timmerman PennWell books
3. Petroleum Reservoir Engineering by AMYX et all, Mc Grow-Hill Book Company,
4. Tarek, Ahmed, Reservoir Engineering Hand Book Second Edition: Gulf Professional Publication New Delhi, 2010
5. B. C. Craft – M. Hawkins Applied Petroleum Reservoir Engineering, Third Edition,
6. Revised by Ronald E. Terry & J. Brandon Rogers, Prentice Hall, New York, 2014.

Unit Operations (BPET-503)

L T P
3 1 2

COURSE OBJECTIVE

- This course is designed to introduce a basic study of the phenomena of heat transfer
- To carry out thermal design/ heat transfer process design for heat exchange systems.
- Recognition of the challenges of designing processing equipment for compressible fluids.
- The principles involve the estimation of overall heat transfer coefficients, heat transfer surface area, pressure drop involved in single-phase and multi-phase flow regimes.
- The ability to determine heat transfer coefficients and the ability to size heat exchangers.
- The ability to apply the principles of transport phenomena to the analysis of a wide range of processing equipment including evaporators, fluidized beds, and chemical reactors
- To understand the phenomenon of distillation, extraction and absorption processes

COURSE OUTCOMES

- The course will help the student to understand the concept and proceses involved in heat,mass and momentum transfer
- The course will help the student to understand about the selection and design of a equipment for the process of heat and mass transfer
- To gain the knowledge of phenomenon of distillation, extraction and absorption processes

Unit 1 **[8]**

Momentum, heat and mass balance in multi-component system, heat transfer process: Modes of heat transfer, heat flow through solid and fluid steady and unsteady state heat transfer.

Unit 2 **[6]**

Mass transfer and application, phase equilibrium, diffusion andinter-phase mass transfer.

Unit 3 **[8]**

Distillation: batch and continuous distillation, differential distillation, flash distillation,vacuum, molecular and steam distillation, principles of azeotropic and extractive distillation, introduction to multi component distillations ystem.

Unit 4 **[8]**

Extraction:liquid-liquid extraction,solid-liquidextraction, Equipment used for single stage and multistage continuous operation, analytical and graphical solution of single and multistage operation, super crtical fluid extraction

Unit 5 **[8]**

Absorption,drying,crystallization, humidification, stage and continuous contact mass transfer units, plate column,packed bed and fluidized bed.

REFERENCE BOOKS

1. Introduction to Fluid Mechanics, Fox, R.W. and A.T.Mc.Donald, 5th Edition, John Wiley& Sons, 1998.
2. Chemical Engineering, Vol-1: Fluid flow, Heat Transfer and Mass Transfer, J.M.Coulson and J.F.Richardson,Pergamon Press, 4th Edition,1990.
3. Fluid Mechanics for Chemical Engineers, Noel De Nevers, Tata McGraw-Hill, 2011.
4. Fluid Flow for Chemical and Process Engineers, Bragg R and F. A. Holland, 2nd Edition,
5. Unit Operations of Chemical Engineering, McCabe, W.L., J.C Smith and Peter Harriott, 7th Edition, McGraw-Hill, 2005.
6. Heat Transfer, Y.V.C. Rao, Universities Press (India) Pvt. Ltd., 2001.

Formation Evaluation BPET-504(A)

L T P
3 0 0

Course Objective

- To understand purpose, principles and applications of different logging tools.
- To apply quick look methods of log interpretation.
- To analyse open hole logs and integrate log and core data to obtain properties of rocks and fluid
- The objective of the course is to provide the basic knowledge of well logging and its requirement.

Learning Outcomes

- Apply different logging methods for the evaluation of subsurface formations Apply principles of mud logging in the recognition of oil and gas show
- Apply principles of physics in the recognition and calculation of different parameters of formations
- Proficiency in well logging tools and interpretation of well log data
- The borehole environment and their effect on log measurement
- The different open hole well log and their principle, and application in reservoir characterization

Unit 1 **[6]**
Direct methods, core evaluation, mud and cutting analysis, significance.

Unit 2 **[8]**
Indirect methods, SP logs, principles and applications, resistivity logs, principles, electrodes systems, normal, lateral, latero logs, non-electrode system, induction log, principles and application.

Unit 3 **[8]**
Resistivity departure curves, origin and application, acoustic logs, ultrasonic wave velocity propagation through formation and relevant factors, wave amplitude and relevant factors, CBL.

Unit 4 **[8]**
Radioactivity logs, natural gamma-ray and neutron-log, principles, system and application. Special logging methods, casing inspection tools, formation micro scanner, NMR log, logging high angle wells.

Unit 5 **[10]**
Interpretation and analysis, formation types, thickness and sequence construction, fluid saturation determination, standard interpretation methods, cross-plotting methods, neutron-density, sonic density, clean and shaly sand interpretation.

Reference Books:

1) Asquith George & Krygowski Daniel, 2004, Basic Well Log Analysis. USA. AAPG,
2) Whitaker A., 1985 “Formation Evaluation” IHRDC.
3) Lynch E. J., 1976, “Formation Evaluation”, EBD Edition.
4) Rider, M. H., “The Geological Interpretation of Well Logs” John Wiley Publishing Company
5) Log Interpretation, Vol. I to IV and Document VIII; Schlumberger, 1979.
6) John H. Doveton, 2014, Principles of Mathematical Petrophysics, Oxford University Press, 273 pp.
7) Stefan M. Luthi, 2001, Geological Well Logs: Their Use in Reservoir Modelling, Springer, 381 pp.

Non-Conventional Petroleum Resources BPET-504(B)

L T P
3 0 0

Course Objectives:

- Introducing students to newer hydrocarbon resources including coalbed methane, methane hydrates, and shale oil/gas
- Teaching exploitation strategies for these emerging energy resources
- To understand the geographic distribution of unconventional hydrocarbon resources

Learning Outcomes:

- Familiar with newer resources for fossil fuel
- Exposure to contemporary energy recovery processes
- Apply the concepts related to exploration and development of Shale Gas Reservoirs.
- Apply the concepts related to exploration and development of Coal Bed Methane.
- Understand and apply the concepts related to formation of gas hydrates.
- Understand and apply different conversion processes for the production of hydrocarbons

Unit 1 **[8]**

Introduction and present status of coal bed methane. Formation and properties of coal bed methane. Thermodynamics of coal bed methane. Drilling, completion and logging of coal bed methane wells.

Unit 2 **[8]**

Hydro-fracturing of coal bed methane seam, production, installation and surface facilities, well operation and production equipment, treating and disposing produced water, testing of coal bed methane wells.

Unit 3 **[8]**

Introduction and present status of gas hydrates, formation and properties of gas hydrates. Thermodynamics of gas hydrates. Phase behavior of gas hydrates. Kinetics of gas hydrates. Drilling and completion of gas hydrates wells. Prevention and control of gas hydrates.

Unit 4 **[6]**

Gas hydrates accumulation in porous media. Gas extraction from gas hydrates. Uses and applications of gas hydrates.

Introduction and present status of shale gas. Formation and properties of shale gas. Drilling and completion of shale gas. Uses and application of shale gas, Prevention and control of shale gas. Environmental issues in shale gas exploration. Future prospects of shale gas.

Reference Books

1. Carrol John, 2003, Natural Gas Hydrates: A guide for engineers, Gulf Publications, 289 pp
2. Farooqi Ali, S M, Jones S A and Meldau R F, Practical Heavy Oil Recovery, SPE, 1997, 434 pp.
3. James T. Bartis, Frank Camm, David S. Ortiz, Producing Liquid Fuels from Coal, Prospects and Policy Issues. NETL, DOE, USA, 2008, 198 pp
4. Warner, H.R., 2009, Emerging and Peripheral Technologies, Society of Petroleum Engineers, Handbook, Volume VI, 629 pp.
5. Pramod Thakur, Steve Schatzel and Kashy Aminian, (Editors), 2014, Coal Bed Methane: From Prospects to Pipeline, Elsevier

PROCESS INSTRUMENTATION BPET 504(C)

L T P
3 0 0

COURSE OBJECTIVE

To get an overview of various recording, indicating and signaling instruments, transmission of instrument readings, instrumentation diagrams, control center, process analysis and digital instrumentation.

COURSE OUTCOME

- To learn the basic elements of an instrument and its static and dynamic characteristics.
- To study various types of industrial thermometers.
- To learn basic concepts of various types of composition analysis.
- To learn various types of instruments for measurement of pressure, vacuum, head, density,level and flow measurement**.**

UNIT-I:

Fundamentals: Elements of instruments, static and dynamic characteristics-Basic concepts of response of first order type instruments.Industrial Thermometers I: Mercury in glass thermometer-Bimetallic thermometer-Pressure spring thermometer, Static accuracy and response of thermometry.

UNIT-II:

Industrial Thermometers-2: Thermo electricity-Industrial thermocouples-Thermo couple wires-Thermo couple wells and response of thermo couples; Thermal coefficient of resistance-Industrial resistance-thermometer bulbs and circuits-Radiation receiving elements-Radiation photo electric and optical pyrometers.

UNIT-III:

Composition analysis: Spectroscopic analysis by absorption, emission, mass and color measurement spectrometers-Gas analysis by thermal conductivity, analysis of moisture.Pressure, vacuum and head: Liquid column manometers-Measuring elements for gaugepressure and vacuum-indicating elements for pressure gauges-Measurement of absolute pressure-Measuring pressure in corrosive liquids-Static accuracy and response of pressure gauges.

UNIT-IV:

Density and specific gravity measurements- Direct measurement of liquid level-Pressure measurement in open vessels-Level measurements in pressure vessels-Measurement of interface level-Density measurement and level of dry materials.

UNIT-V:

Flow Meters: Head flow meters-Area flow meters-Open channel meters-Viscosity meters-Quantity meters-Flow of dry materials-Viscosity measurements.

REFERENCE BOOKS

1. Principles of Industrial Instrumentation, Patranabis, 2nd Edition, Tata Mc Graw-Hill,1996.

2. Process Control and Instrumentation Technology, Curtis D. Johnson, 3rd Edition, Prentice Hall, 1988.

3. Process Instrumentation Applications Manual, Bob Connell, 2ndEdition, Mc Graw-Hill,1995.

4. Industrial Instrumentation, Donald P.Eckman, CBS, 2004.

5. Instrumentation and Control Systems, K.Padmaraju, Y.J. Reddy, McGraw Hill Education, 2016.

Principle of Management BPET 505(A)

LTP 300

COURSE OBJECTIVE

- To enable the students to study the evolution of Management.
- To study the functions and principles of management.
- To learn the application of the principles in an organization.
- To enable the effective and barriers communication in the organization
- To study the system and process of effective controlling in the organization

COURSE OUTCOMES

- Students will be able to have clear understanding of managerial functions like planning, and have same basic knowledge on international aspect of management.
- To understand the planning process in the organization
- To understand the concept of organization
- Demonstrate the ability to directing, leadership and communicate effectively
- To analysis isolate issues and formulate best control methods

UNIT 1

INTRODUCTION TO MANAGEMENT: Theories of management: Traditional behavioral, contingency and systems approach. Organization as a system.

UNIT 2

MANAGEMENT INFORMATION: Interaction with external environment. Managerial decision making and MIS.

UNIT 3

PLANNING APPROACH TO ORGANIZATIONAL ANALYSIS: design of organization structure; job design and enrichment; job evaluation and merit rating. 3

UNIT 4

MOTIVATION AND PRODUCTIVITY: Theories of motivation, leadership styles and managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control. Japanese management techniques. Case studies.

Suggested Books:

1.Schermerhorn,; Management and Organisational Behaviour essentials, Wiley India
2. Koontz: Essentials of Management, PHI Learning.

3. Hirschey: Managerial Economics, Cengage Learning.

4.A V Rau: Management Science, BSP, Hyderabad

5.Mote, l Paul and Gupta: Managerial Economics Concepts & Cases, TMH, New Delhi.

6.Stephan R Robbins Fundamental of Management, Pearson

Drilling Fluids and Cementation BPET-505(B)

LTP 300

Course Objective

- To provide basic knowledge about different types of drilling fluids and their applications.
- To provide the basic knowledge of oil and gas well cementing procedure.

Learning Outcomes

- Ability to select the proper drilling fluid compatible to the well.
- Ability to design and selection of proper cement slurry compatible to an oil and gas well.
- The aspects of drilling fluid rheology and its role in drilling

Unit 1 **[8]**

Types of drilling fluids, water base and oil base, components of drilling fluid systems, bentonite types and hydration characteristics, properties, specific gravity, viscosity.

Unit 2 **[6]**

Fluid-loss characteristics,filtrate resistivelycaking characteristics.

Unit 3 **[8]**

Oil-base drilling fluid system, saline mud system, Additives used to control drilling fluid systems.

Unit 4 **[10]**

Oil-well cements, compositions, cement slurry components, setting and rheological behavior of cement slurry, strength characteristics of set cement- mass additives used to modify cement slurry characteristics.

Unit 5 **[8]**

Cement- slurry preparation and down hole displacement processes and system.

REFERENCE BOOKS

1. Applied Drilling Engineering, Adam T. Bourgoyne Jr. et al., SPE Text Book Series, 1991
2. Drilling Engineering: A Complete Well Planning and Approach, Neal J. Adams, Pennwell, 1985.
3. Oil Well Drilling Engineering: Principles and Practice, H Rabia, Springer, 1986

Innovation and Entrepreneurship BPET-505 (C)

LTP 300

COURSE OBJECTIVE

- Acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities .
- To develop the ability of analyzing and understanding business situations in which entrepreneurs act and to master the knowledge necessary to plan entrepreneurial activities.
- Develop the ability of analyzing various aspects of entrepreneurship – especially of taking over the risk, and the specificities as well as the pattern of entrepreneurship development and, finally, to contribute to their entrepreneurial and managerial potentials.

COURSE OUTCOMES

- Key concepts underpinning entrepreneurship and its application in the recognition and exploitation of product/ service/ process opportunities
- Key concepts underpinning innovation and the issues associated with developing and sustaining innovation within organizations
- How to design creative strategies for pursuing, exploiting and further developing new opportunities
- Issues associated with securing and managing financial resources in new and established organizations

UNIT 1

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT 2: Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT 3: Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity,

UNIT 4: Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

Reference Books

1.Khanka. S.S., “Entrepreneurial Development” S.Chand& Co. Ltd.,Ram Nagar, New Delhi, 2013.

2. Donald F Kuratko, “ Entreprenuership – Theory, Process and Practice”, 9th Edition, Cengage Learning 2014.

3. Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.

4. Mathew J Manimala, “Enterprenuership theory at cross roads: paradigms and praxis” 2nd Edition Dream tech, 2005.

5. Rajeev Roy, ‘Entrepreneurship’ 2nd Edition, Oxford University Press, 2011.

6. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.

Petroleum Production Operation Lab-II (BPEP-501)

L T P
0 0 2

(Minimum 8 experiments from the following to be conducted)

List of Experiments:

1. Study of fluid flow characteristics in a multiphase system (effective permeability vs saturation)
2. Study of immiscible displacement characteristics for oil/water and oil/gas systems.
3. Determination of displacement characteristics of rocks under polymer/ surfactant flooding.
4. Determination of Formation Volume Factor ($B_{o)}$, Viscosity (μ_o) and gas – oil ratio of crude oil under a given pressure – volume- temperature condition.
5. Pressure – volume- temperature based characteristics of crude oil.
6. Determination of gas flow rate by Orifice meter.
7. Continuous and intermittent gas lifts by Demonstration Model.
8. Regulation of flow through Diaphragm Valve.
9. Studies related to Bottom Hole characteristics and operational mechanisms.
10. Study on Wax Controlling Production System.

Applied Petroleum Reservoir Engineering Lab (BPEP 502)

L T P
0 0 2

(Minimum 8 experiments from the following to be conducted)

List of Experiments:

1. Determination of effective porosity by gas expansion method.
Equipment: Helium Porosimeter (Nitrogen gas can be used in place of helium).
2. Determination of porosity and pore size distribution by mercury injection.
Equipment: Mercury Porosimeter.
3. Measurement of surface tension & interfacial tension with the ring Tensiometer.
Equipment: Tensiometer.
4. Determination of fluid density using Pycnometer and hydrometer methods.
Equipment: Pycnometer and hydrometer.
5. Liquid viscosity measurement using capillary tube viscometer (Ostwald type).
Equipment: Capillary tube viscometer.
6. Determination of capillary pressure of reservoir rock (core) using porous plate method.
Equipment: Capillary pressure cell.
7. Measurement of contact angle (between oil, water and solid surface) using imaging method.
Equipment: The image system set-up.
8. Measurement of air permeability.
Equipment: Constant head Permeameter with the Hassler cell.
9. Absolute permeability measurement of water.
Equipment: The Darcy apparatus.

10. Determination of relative permeability of oil-water using unsteady state method.
Equipment: Relative permeability apparatus.
11. Determination of relative permeability of gas-oil using unsteady state method.
Equipment: Relative permeability apparatus.

Unit Operations Lab (BPEP 503)

L T P 0 0 2

(Minimum 8 experiments from the following to be conducted)

List of Experiments:

1. To study about different types of heat exchangers.
2. To determine the liquid diffusion coefficient of benzene solution in distilled/de-ionized water.
3. To study and perform liquid-liquid extraction experiment.
4. To study and perform liquid-solid extraction experiment.
5. To study and perform the distillation experiment for batch distillation.
6. To study and perform the distillation experiment for continuous distillation.
7. To study and perform the adsorption experiment.
8. To study and perform the drying experiment.
9. To study and perform the adsorption experiment.

New Scheme of Examination as per AICTE Flexible Curricula
B Tech III Year (VI Semester)
[Petroleum Engineering]
W.E.F. Academic Session 2020-21

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work &Sessional		L	T	P	
1.	BPET 601 BPEP601	DC	Offshore Drilling and Production Practices	100	30	20	30	20	200	3	1	2	5
2.	BPET 602 BPEP602	DC	Petroleum Engineering Design -I	100	30	20	30	20	200	3	0	2	5
3.	BPET-603 BPEP603	DC	Enhanced Oil Recovery Methods	100	30	20	30	20	200	3	1	2	5
4.	BPET -604	DE	Departmental Elective	100	30	20			150	3	0	0	3
5.	BPET-605	OE	Open Elective	100	30	20			150	3	0	0	3
6	BPEP -607	P	Minor Project -I					50	50	0	0	4	2
7	BPEP -608	P	Open Source Lab	-	-	-	30	20	50	0	0	2	1
		IN	Internship –III	To be completed any time during Fifth/ Sixth semester. Its evaluation/credit to be added in Seventh semester									
Total				500	150	100	120	130	1000	15	2	12	24

Departmental Electives		**Open Electives**	
BPET604(A)	Waste Water Management	BPET 605(A)	Natural Gas Engineering
BPET 604(B)	Oil and Gas Well Testing	BPET 605 (B)	Directional Well Drilling Technology
BPET 604(C)	Computational Fluid Dynamics	BPET 605 (C)	Renewable Energy Technology

SIXTH SEMESTER

BPET-601 OFFSHORE DRILLING AND PRODUCTION PRACTICES	L	T	P
BPEP-601	3	1	2

Course Objectives:

- To complement the Learning of On-land Drilling and Production operations with Offshore knowledge since Offshore operations contribute 20-30% of Total Oil and Gas production
- To appreciate the extra challenges faced in the harsh Offshore Environments where all
- equipment and personnel are working on a remote location.
- Introduce different types of deep-water offshore structures and challenges.
- Introduce concept of wave theory for linear waves.
- Estimation of wave loads on small bodies.
- Estimation of different types of loads on offshore structures such as gravity, wind, wave and current loads.
- Detailed design of fixed offshore structures.
- Concepts of floating structures.
- Fundamental aspects of semisubmersible, TLP, spar and installation methodologies. learn about the challenges faced in working Subsea especially in deeper waters

Course Outcome:

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

- Appreciate the challenges faced in Offshore environment due to Sea States, Weather, Geo Hazards, Sea bed survey
- Evaluate Various types of Fixed Structures and Mobile structures used for Drilling and Production, their advantages, disadvantages
- Discuss issues associated with Mobile Units like Buoyancy and Stability, Anchoring & Mooring, Emergency Disconnect, Station Keeping

Unit 1 [8]

Physical Environment

Overview of physical ocean environment, geotechnical aspect–sea floor, marine soil composition and properties of sea water, seawater corrosion, offshore rigs, floating drilling vessels. Fixed offshore structures, wind, wave, current and other forces acting on offshore structures.

Unit-2 [6]

Field Operations

Station keeping, conventional mooring system, spread mooring system, design considerations, operations, equipment and functions, Dynamic positioning system, components, working. Floater well control, shut in procedures, well kill operations, subsea well head, BOP Stack.

Unit-3 [10]

Deepwater Drilling

Deepwater well construction problems and solutions, deep-water cementation, high temperature high pressure wells, casing and mud policy. Drilling logs, gas hydrate problems. Deepwater drilling operations, Riser system, components, riser tensioners, heave compensator, emergency disconnect and hang off, wellbore stability and rock mechanics, mud window for vertical, horizontal deep-water drilling. ROV

Unit-4 [10]
Offshore structures
Fixed steel structures, Concrete Gravity Base Structures, TLPs, Semi -submersible and Floating Production systems, SPM, SPAR Application. Depths and design limitations, Installation of offshore platforms, Typical Platform Layout, Process flow diagram, Static and Rotary Equipment. Safety systems.

Unit-5 [6]
Development and Production Operations
Risers for Production operations, Deepwater completion, Subsea completion, planning, production monitoring and control system.

Suggested Books:

1. Floater Operations – Exxon Mobil Training book
2. Technology of Offshore Drilling, Completion and Production - PennWell
3. Handbook of Offshore Oil and Gas Operations – James Speight
4. Offshore Structures: Design Construction and Maintenance, Mohamed A El-Reedy, Gulf professional Publication
5. Handbook of Offshore Engineering Volume I and II, Elsevier, 2006, 1213 pp. by Chakraborty S.K.
6. Offshore Rig Technology Catalogue – Schlumberger
7. Transocean Offshore Operations Manual – Transocean
8. Deepwater Horizon Accident report – Final Version
9. GE_hydril_Vetco Drilling systems catalogue - GE
10. Ship Stability for Masters and Mates, Barrass, C. B. and D. R. Derret, 7th Edition, Butterworth-Heinemann, 2012.
11. Construction of Marine and Offshore Structure, Gerwick, Jr., C., 3rd Edition, CRC Press, 2007.

Suggested Experiments:

1. Determination of Distillation characteristics of Crude Oil, Gasoline, Diesel and Kerosene.
2. Determination of Reid Vapor Pressure of Crude oil & Gasoline.
3. Determination of Viscosity of Diesel and Transformer oils.
4. Determination of Smoke Point of Kerosene.
5. Determination of Carbon Residue of petroleum oils.
6. Determination of Flash & Fire points of gasoline, kerosene and other products.
7. Estimation of Water content in petroleum products.
8. Estimation of Calorific value of solid, liquid and gaseous fuels.
9. Determination of Aniline point of Gasoline and Diesel oil.
10. Determination of Softening point of bitumen.
11. Determination of Cloud & Pour Points of petroleum products.
12. Detection of Corrosiveness of petroleum products

BPET-602 PETROLEUM ENGINEERING DESIGN I	L	T	P
BPEP-602	3	0	2

Course Objectives:

The students will be made to learn:

- Knowledge of subsurface equipment below well head.
- Planning and designing of well completion after testing of the hydrocarbon zones available.
- Knowledge of subsurface circulating equipment and packers.
- Testing of multi zones in a well with DST/RFT with logging tools as well as surface testing equipment.
- The students are made to learn the design of all types of separators, pumps &
- compressors, heat exchangers, oil treaters, desalters, gas treating systems, different types of valves and flaring systems
- Fundamental concepts in petroleum production engineering.
- Reservoir fluids, efficient flow to the surface without damaging the reservoir dynamics/drive mechanisms.
- Various surface equipment's for process oil and gas after flow from wells. Sick well identification and remedial stimulation operations.
- Application of suitable artificial lifts on reservoir energy depletion.
- Crisis management.

Course Outcome:

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

- Imparting knowledge on material of construction and mechanical design of the petroleum equipment.
- Determine the well head pressure, down-hole pressure and operating oil/ gas flow rates of the reservoir.
- Identify formation damage and find remedial methods to bring the well back into production.
- Screen, design and operate artificial lifts on reservoir pressure depletions.
- Handle in case of any crisis at drilling/production installations.
- Process oil and gas before supply to refinery/consumers.
- Contribute to reservoir management as production engineers to prolong the reservoir life with optimum production.

Unit I: [10]

Choice of well profile: drill string and casing design. Rig choice for load and installed power.

Unit II: [8]

cement slurry design. Mud-circulation system, Bit choice.

Unit III: [8]

Drilling policy specification for a given well location, depth, orientation.

Unit IV: [6]
Profile and policy specification for deviated well.

Unit V: [8]
Specification of casing head and well head system.

Suggested Books:

1. Petroleum and Gas Field Processing, H.K. Abdel- Aal, Mohamed Aggover, M.A. Fahim, Marcel Dekkar Inc., 2003.
2. Surface Production Operations, Ken Arnold, Maurice Stewart, Butterworth Heinemann, Vol 1 & 2, 1999.
3. Well Performance; Michael Golan; Norwegian university of science and technology.
4. Production optimization; H. Dale Beggs; OGCI and Petroskills publications.
5. Petroleum Production Engineering: A Computer Assisted Approach, BoyunGuo, William C. Lyons, Ali Ghalambor, Elesevier Science & Technology Books, 2007.
6. Petroleum Production Systems, M.J. Economides, A.Daniel Hill &C.E.Economides, Prentice Hall, 1994.
7. Engineering Data Book, 12th Edition (Electronic), FPS Version, Volume I & II, Gas Processers Suppliers Association (GPSA), 2005.

Suggested Experiments:

1. Oil- Water separator.
2. Gas- Oil-Water separator.
3. Lean / rich amine heat exchanger.
4. Air cooled heat exchanger.
5. CO_2 and H_2S absorber unit using, MEA/DEA amine solution.
6. Stripping unit.
7. Single stage flash vaporization unit.
8. Three stage flash vaporization unit.
9. Liquid pumping system & simulation of water-hammer phenomena.
10. Gas Compressor unit.

BPET-603 ENHANCED OIL RECOVERY METHODS	L	T	P
BPEP-603	3	1	2

Course Objectives:

The students will be made to learn:

- Main objective of course to help the students understand the basic concepts of Enhanced
- Oil Recovery for incremental oil gain.
- To enable students to understand establish a good level of confidence in different recovery
- Processes, and they can use the simulator to perform a variety of numerical exercises, with the goal for enhancing petroleum recovery while minimizing cost.
- To empower the students with the expertise and better understanding of Enhanced Oil Recovery Process to maximize recovery after primary and secondary recovery from mature fields.
- To expose students to a wide variety of research areas and concerns in and around Enhanced Oil Recovery and new techniques such as Suitable Microbial Flooding in High Water Cut and Highly Viscous Oil Reservoir for improved Oil Recovery.
- To expose the students with necessary engineering skills such as solving engineering problems in a professional way, using appropriate commercial Softwares viz., Black Oil Simulators (IMEX, WINPROP, GEM & Star- CMG & ECLIPSE-100, Eclipse -500 Schlumberger) through Demo & Exercises for data analysis and better understanding of Numerical simulations for different Enhanced Oil Recovery Processes etc.

Course Outcome:

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

- Acquire the Basic knowledge of Drive Indices for selecting proper Enhanced oil recovery in petroleum reservoirs.
- Estimate the quantity of oil or gas present in the reservoir by different methods i.e. reserve estimation and Decline Curve.
- Apply the uses of geological, well productivity, well spacing and hydro dynamical parameters for developments of oil & gas fields.
- Understand the phenomenon of various multiphase flows and transport models in Reservoir Simulation.
- Apply investment decisions in those fields where production enhancement are needed.
- Acquire the Basics knowledge of Reservoir Modeling Softwares.

Unit 1 [6]

Introduction to EOR, Reservoir Engineering aspects of enhanced recovery methods, Principles and Mechanism, Screening criteria, Macroscopic displacement of fluids, Areal sweep efficiency, Vertical sweep efficiency Displacement efficiency, mobility ratio, well spacing.

Unit 2 [8]

Water flooding, Fractional flow equation, Frontal advance theory, Concept of pattern flooding, recovery efficiency, permeability heterogeneity, Polymer flooding

Unit 3 [10]

Flow of miscible fluids, Conditions of miscibility, miscible displacement processes. Carbon dioxide flooding Surfactant flooding, Mobilization of residual oil, Adsorption on solid and liquid interface, micelles and micro-emulsion, Micellar flooding.

Unit 4 [8]

Miscible displacement processes – miscibility condition, high pressure gas injection,

enriched gas injection, LPG flooding, alcohol flooding.

UNIT 5 [8] Thermal Recovery processes: Hot water flooding, steam flooding, cyclic steam injection, in-situ combustion, air requirement; combustion front monitoring, microbial oil recovery.

Suggested Books:

1. Bradley H B, Petroleum Engineering Handbook, third edition, SPE, 1992.
2. Enhanced Oil Recovery, Larry W. Lake, Prentice Hall, 1998.
3. Green D W and Willhite G P, "Enhanced Oil Recovery", SPE, 2003, 556 pp
4. Enhanced Oil Recovery; Teknica; Teknica Petroleum Services Ltd.; Calagry, Alberta..
5. Applied Enhanced Oil Recovery, Aural Carcoane, Prentice Hall, 1992.
6. Enhanced Oil Recovery Processes and Operations, E.C. Donaldson, G.V.Chillingarian, T.F. Yew, Elsevier, 1998.
7. Basic Concepts in Enhanced Oil Recovery Processes, Marc Baviere, SCI, 1991.
8. Enhanced Oil Recovery: Proceedings of the Third European Symposium on Enhanced Oil Recovery, F. John Fayers, Elsevier, 1981.
9. Enhanced Oil Recovery, Marcel Latil, Editions Technip, 1980.
10. Fundamentals of Enhanced Oil Recovery, H. R. Van Pollew and Associates, PennWell, 1980.
11. Enhanced Recovery of Residual and Heavy Oil, M. M. Schumacher, Noyes Data Corp., 1980.
12. Recent Advances in Enhanced Oil and Gas Recovery, IstvanLaktos, Academy Kiado, 2001.
13. Enhanced Oil Recovery, Don W. Greew, G. Paul Willfite, Society of Petroleum Engineers, 1998.
14. Enhanced Oil Recovery: Field Planning and Development Strategies, Vladmir Alvarado, Eduardo Marriglee, Gulf Professional Publishing, 2010.
15. Modern Chemical Enhanced Oil Recovery: Theory and Practice, Gulf Professional Publishing, 2011.
16. Enhanced Oil Recovery, Teknica, Teknica Petroleum Services Ltd., 2001.

Suggested Experiments:

1. Measurement of drilling fluid weight.
2. Measurement of mud viscosity.
3. Measurement of pH of mud.
4. Determination of mud rheology (Viscosity, Gel strength, and Yield point).
5. Determination of the loss of liquid from a mud.
6. Measurement of a drilling mud cake and evaluate resistivity.
7. Measurement of the effect of adding bentonite on mud properties.
8. Drilling fluid contamination test (Salt, Gypsum & Cement contamination) and their effect on the drilling fluid properties.
9. Measurement of solid and liquid content and emulsification characteristics of drilling fluid.
10. Measurement of Oil, water, solid and clay content.
11. Measurement of water ratios for Portland cement slurry.
12. Measurement of compressive strength of cement test moulds and effect of temperature and pressure on setting of the slurry.

DEPARTMENTAL ELECTIVES

BPET-604 (A)	WASTE WATER MANAGMENT	L 3	T 0	P 0

Course Objectives:

- Outline planning and the design of waste water collection,conveyance and treatment systems for a community/town/city.
- Provide knowledge of characterization of waste water generated in a community.
- Impart understanding of treatment of sewage and the need for its treatment.
- Summarize the appurtenance in sewage systems and their necessity.
- Teach planning and design of septic tank and imhoff tank and the disposal of the effluent from these low cost treatment systems.
- Effluent disposal method and realize the importance of regulations in the disposal of effluents in rivers.

Course Outcomes:

By the end of successful completion of this course, the students will be able to:

- Plan and design the sewerage systems.
- Characterization of sewage.
- Select the appropriate appurtenances in the sewerage systems.
- Selection of suitable treatment flow for sewage treatment.
- Identify the critical point of pollution in a river for a specific amount of pollutant disposalinto the river.

UNIT-I:

Introduction to Sanitation: Systems of sanitation- relative merits and demerits - collection and conveyance of waste water - Classification of sewerage systems-Estimation of sewage flow and storm water drainage- Fluctuations-types of sewers- Hydraulics of sewers and storm drains design of sewers- Appurtenances in sewerage- Cleaning and ventilation of sewers.

UNIT-II:

Pumping of wastewater: Pumping stations-location- components- Types of pumps and their suitability with regard to wastewaters.

House Plumbing: Systems of plumbing-sanitary fittings and other accessories-one pipe and two pipe systems-Design of building drainage.

UNIT-III:

Sewage characteristics: Sampling and analysis of waste water-Physical, chemical and Biological examination-Measurement of BOD & COD- BOD equations.

Treatment of sewage: Primary treatment- Screens-grit chambers- grease traps- floatation sedimentation-Design of preliminary and primary treatment units.

UNIT-IV:

Secondary treatment: Aerobic and anaerobic treatment process -comparison.

Suspended growth process: Activated sludge process, principles, Design and operational problems, modifications of activated sludge processes, oxidation ponds, aerated lagoons.

Attached Growth process: Trickling Filters-Mechanism of impurities removal-classification-

Design -operation and maintenance problems; RBCs, Fluidized bed reactors.

UNIT-V:

Miscellaneous Treatment Methods: Nitrification and Denitrification- Removal of phosphates- UASB- Membrane reactors- Integrated fixed film reactors. Anaerobic Processes: Septic Tanks, Imhoff tanks- Working principles and Design-Disposal of septic tank effluent-FAB Reactors

Suggested Books

1. Waste water Engineering Treatment and Reuse, Metcalf & Eddy, Tata McGraw- Hill edition.
2. Elements of Environmental Engineering, K.N. Duggal, S. Chand & Company Ltd. New Delhi, 2012.
3. Environmental Engineering, Howard S.Peavy, Donald R. Rowe, Teorge George Tchobanoglus- Mc-Graw-Hill Book Company, New Delhi, 1985.
4. Wastewater Treatment for Pollution Control and Reuuse, Soli.JAreivala, Sham R Asolekar, Mc-GrawHill, New Delhi; 3rd Edition.
5. Industrial Water & Wastewater Management, KVSG MuraliKrishna. Environmental Engineering-II: Sewage disposal and Air pollution Engineering, Garg, S.K.,: Khanna publishers.
6. Sewage Treatment and Disposal, Dr.P.N.Modi&Sethi.
7. Environmental Engineering, Ruth F. Weiner and Robin Matthews- 4thEdition Elsevier, 2003.
8. Environmental Engineering, D. Srinivasan, PHI Learning Pvt., Ltd., , New Delhi,2011

BPET-604(B)	OIL AND GAS WELL TESTING	L	T	P
		3	0	0

Course Objectives:

The students will be made to learn:

- Principles of Fluid Flow for steady state, semi steady state & non steady state conditions.
- Diffusivity Equation Derivation & Solutions, Radius of investigation, principle of superposition, Horner's approximation.
- Drill Stem Testing: Equipment, DST chart observation and preliminary interpretation. Well preparation for testing, Multiple well testing. Effect of reservoir heterogeneities & Well bore conditions, fractured reservoir application.
- Pressure Transient Tests: Drawdown and buildup-test analysis, determination of permeability and skin factor, Analysis of pressure-buildup tests distorted by phase redistribution, Well-test interpretation in hydraulically fractured wells, Interpretation of well-test data in naturally fractured reservoirs, Wellbore effects, Multilayer reservoirs, Injection well testing, Multiple well testing, Wireline formation testing. Wireline while drilling formation testing. Interference testing, Pulse testing,
- Well-test analysis by use of type curves: Fundamentals of type curves, Ramey's type curve, McKinley's and Gringarten et al type curves.
- Gas well testing: Basic theory of gas flow in reservoir, Flow-after-flow test, Isochronal test, etc.
- Applications of well testing: Well testing in horizontal wells, Extended Reach wells & multi-laterals wells, tests with and without flow measurement.
- Computer–aided well test analysis: Derivative plot, diagnostic plot evaluation, data preparation, nonlinear regression, Introduction to well testing software.

Course Outcome:

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

- Apply the knowledge of Basic Triple Combo Log and Tool responses
- To do Quick Look Analysis on Log Data sets
- Explain the purpose of other Logs like Acoustic, NMR, Electrical Imaging in Open Hole
- Interpret Cement Bond Log and basic Production Logs.
- Understand basic Well Testing options and interpret Diagnostic Well Tests

Unit 1 [6]

Introduction to Oil and Gas well testing**,** Drill stem testing, RFT, Wire-line Testing System, Interpretation

Unit 2 [6]

Flow of compressible fluid through porous media, unsteady state, semi-steady state fluid flow equations, diffusivity equation, Solution techniques

Unit 3 [10]

Pressure-transient tests: pressure draw-down, build-up test, interpretations; skin factor.

Unit 4 [8]

Multi-rate test, Reservoir limit test, Injection and fall-off test, interference testing, pulse

testing.

Unit 5 [10]
Type curves: generation and interpretation, Gas well testing, fractured wells, dual porosity reservoirs.

Suggested Books:

1. Formation Evaluation: Richard Bateman
2. Basic Log Analysis: Asquith
3. Cased Hole and Production Log Analysis: Jim Smolen
4. Reservoir Engineering Handbook Chapter 6: Tarek Ahmed
5. Modern Well Test Analysis: Roland Horne
6. Schlumberger Log Interpretation Chartbook
7. Halliburton Log Interpretation Chartbook
8. Fundamentals of Well Log Interpretation: Oberto Serra

BPET-604(C)	COMPUTATIONAL FLUID DYNAMICS	L	T	P
		3	0	0

Course Objectives:

- Understanding the governing equations of fluid dynamics and the difference between conservation and non-conservations form of equations.
- Various methods available for solutions of partial differential equations.
- Use of boundary conditions for solutions of these equations.
- Understanding the role of finite elemental methods for solutions of fluid dynamics problems.
- Understanding the concept of stability.
- Understanding various software's available for solving fluid dynamics problems.

Course Outcomes:

The students will be able to:

- Use of finite difference method and finite volume method for practical applications.
- Use of software tools available for arriving at some problems of interest.
- Distinguish different flow regimes while performing numerical analysis.
- Use of source and vortex panel method of inviscid flow to practical problems.
- Arrive at pressure and flow distribution for complicated flow systems.

UNIT-I:

Basic Philosophy of CFD: Governing equations of Fluid Dynamics, Incompressible Inviscid flows sources and vortex panel methods.

UNIT-II:

Mathematical properties of fluid dynamic equations – Discretization of partial differential equations, Courant-Friedrichs-Lewy (CFL) condition: Stability of numerical solution of simple convection equation for one-dimensional flows, Introduction to Finite-Difference and Finite-Volume methods.

UNIT-III:

Transformations and Grids, Explicit finite Differential methods – Some selected applications to Inviscid and viscous flows.

UNIT-IV:

Boundary layer equations and methods of solution.

UNIT-V:

Implicit time dependent methods for Inviscid and viscous compressible flows, with a discussionof the concept of Numerical dissipation.Introduction to finite element methods in computational fluid dynamics – Weighted residualformulation – Weak formulation – Piece wise defined shape functions – Numerical integration –Partial construction of a weak formulation – Examples.

Suggested Books:

1. Computational Fluid Dynamics: An Introduction, John F. Wendt, John David Anderson, Springer, 2009.
2. Computational Fluid Dynamics – The Basics with Applications (1-5 Chapters), John D.Anderson, Jr., McGraw – Hill, Inc., New York, 1995.
3. Numerical Heat Transfer and Fluid flow, S.V. Patankar, Taylor & Francis, 1980.
4. An Introduction to Computational Fluid Dynamics: The Finite Volume Method,

Versteeg, H.K., and Malalasekera W., 2nd Edition, Prentice Hall, 2007.
5. Computational Fluid Flow and Heat Transfer, Muralidhar, K. Sundarajan, T.,

NarosaPublishing House, 1995.

OPEN ELECTIVES

BPET-605 (A)	NATURAL GAS ENGINEERING	L	T	P
		3	0	0

Course Objective

- To understand physical and chemical properties of natural gas.
- To understand and analyze the process by identifying systems and apply the degree of freedom analysis.
- To perform the steady state material balances on the subsets of the process or the entire
- process in order to estimate the flow rate and compositions without reactions and with reactions.
- To enable students to understand basic concepts of energy balance for different processes.

Course Outcome

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

- Calculate the properties of natural gas at the given temperature and pressure data.
- Analyze the conditions for hydrate formation, inhibition and prevention
- Compare the different methods used for dehydration of Natural gas.
- Estimate the removal and recovery options of acid gases from the natural gas.
- Analyze the recovery of heavy hydrocarbons (Ethane plus components) from the natural gas.

Unit 1 [8]

Introduction: Composition of Natural Gas, Utilization of Natural Gas, Natural Gas Industry, Natural Gas Reserves, Types of Natural Gas Resources, Future of the Natural Gas Industry.

Properties of Natural Gas: Physical properties of natural gas and hydrocarbon liquids associated with natural gas. Reservoir aspects of natural gas**.**

Unit-2 [6]

Gas Compression: Types of Compressors, Selection, Thermodynamics of Compressors, Compression calculations. Heat and Mass Transfer Principles and Applications in Natural Gas Engineering, Use of Mollier Diagrams**.**

Unit-3 [8]

Gas Flow Measurement: Process control and instrumentation in natural gas processing plants.

Natural Gas Processing: Field separation and oil absorption process, Refrigeration and low temperature processing, Liquefaction Process, Dehydration of Natural Gas, Sweetening of Natural gas and Sulphur recovery. Processing for LPG, CNG, system, Conversion of gas to liquid.

Unit-4 [6]

Unconventional gas: Coal Bed Methane, Natural Gas Hydrate, Basin Centered Gas, Tight Gas Sands, Shale Gas. Current Technology for Shale Gas and Tight Gas Exploration and Production

Unit-5 [6]

Issue and Challenges to Enhance Supply of Natural Gas.

Suggested books

1. Fundamentals of Natural Gas Processing; L.L. Faulkner. Natural Gas Engineering Handbook; Guo and Ghalambor.
2. Fundamentals of Natural Gas Processing; L.L. Faulkner.
3. Natural Gas Engineering Handbook; Guo and Ghalambor.
4. Kumar, S., (1987) Gas Production Engineering, Gulf Publishing Company, Texas. ISBN: 0872015777
5. Ikoku, Chi U., (1984) Natural Gas Production Engineering, John Wiley & Sons Inc. ISBN: 0894646397.
6. Campbell, J. M., (1998) Gas Conditioning and Processing (Vol I, II, III), Campbell & Co., USA. ISBN: 9996395420
7. Arnold, K. and Stewart, M., (1989) Surface Production Operations-2, Gulf Publishing Company, Houston. ISBN: 0884158225.

BPET-605 (B) DIRECTIONAL WELL DRILLING TECHNOLOGY	L 3	T 0	P 0

Course Objectives:

This course introduces fundamentals of horizontal wells by dealing with reservoir and production characteristics of horizontal wells and respective challenges.

The students will be able to:

- Understand the basics of horizontal wells and its reservoir properties.
- Have knowledge of different types of horizontal wells.
- Differentiate between horizontal and vertical fractured wells.
- Understand the testing and flow performance using different equations.
- Gain knowledge on critical rates of flow and challenges during different rates of flow like gas and water coning.

Course Outcomes:

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

- Have an overview of horizontal well technologies.
- Perform flow performance calculations of horizontal wells.
- Perform mathematical solutions to transient well testing for different flow regimes.
- Solve challenges for different flow rates.
- Design a horizontal well.

UNIT – 1 Types of deflection tools, tool orientation, Directional well profiles, Well path deflection & correction.Positive displacement motors and Turbo-drills - motor description, Power calculation and applications. Auto-track and verti-track system. Rotary Steerable motors, Geo-steering tools.Horizontal well objectives and selection, Different profiles, Drilling techniques, Mud requirements & characteristics, casing and drill string requirements and completion programs.

UNIT – 2 Slant Hole Drilling: Objectives and selections, Well profiles and applications. Down the Hole Well Surveying:Well surveying objectives, surveying methods, Surveying Analysis methods and calculations for well coordinates..

UNIT-3: Objectives of MWD/ LWD, MWD tools, Telemetry system and data interpretation. Directional Drilling Problems and Their Remedies

UNIT-4 Introduction- Limitations of horizontal wells-Horizontal well applications- Drilling techniques- Horizontal well length based upon drilling techniques and drainage area limitations- Completion techniques.

UNIT-5 Skin factor- Skin damage for horizontal wells- Effective wellbore radius r'_w- Productivity index, *f*- Flow regimes- Influence of areal anisotropy.

Suggested Book:

1. Horizontal Well Technology, S. D. Joshi, PennWell Publishing Company, 1991.
2. Introduction to Directional Drilling; Raymond de Verteuil and Iain McCourt; Schlumberger.
3. Drilling Engineering-A complete well planning approach; Neal J. Adams; PennWell publishing Company; Tulsa, Okhlama.

4. Well Engineering and Construction; Hussan Rabia.
5. Horizontal Wells: Formation Evaluation, Drilling and Production Including Heavy Oil
6. Recovery, Roberto Aguilera, G. M. Cordell, G. W. Nicholl, J. S. Artindete, M. C. Nq., Gulf Publishing Co., 1991.

BPET-605 (C)	RENEWABLE ENERGY TECHNOLOGY	L	T	P
		3	0	0

Course Objectives:
To impart the necessity of finding alternative energy sources for automobiles. To understand merits and demerits, performance characteristics of various sources of fuels and their comparison.

Course Outcomes:
The students completing the course will be able to understand the ever increasing quality of life. This phenomenon imposes high demand on conventional fossil fuels. Hence search for alternate fuels is a continuous phenomenon. The student will have an overviewof various alternate fuels along with their merits and limitations

UNIT-I:
Introduction: Need for non-conventional energy sources. Energy alternative: solar, photo-voltaic, Hydrogen, Bio mass. Electrical - their merits and demerits.
Solar photo-voltaic conversion, Collection and storage of solar energy, Collection devices, flat plate collectors, concentrating type collectors, Principles and working of photo-voltaic Conversion, Applications to automobiles.

UNIT-II:
Energy from Bio mass: Photosynthesis, Photosynthetic oxygen production, Energy plantation. Bio gas production from organic waste, Description and types of Bio gas plants, Application and limitations - Merits and demerits performance characteristics and their comparison.

UNIT-III:
Hydrogen Energy: Properties of hydrogen, Sources of Hydrogen, Thermodynamics of water splitting production of hydrogen, Electrolysis of water;,Thermal decomposition of water. Thermo-chemical production, Biochemical production.

UNIT-IV:
Hydrogen fuel, Storage and transportation methods, Applications to engines modifications necessary, precautions and safety measures - Performance characteristics in engine and their comparison.
Electric Automobiles: Design considerations, limitations. Opportunities for improvement Batteries, problems. Future possibilities, capacities, types, material requirement.

UNIT-V:
Applicability of electric cars, major parts, battery charging, HVAC, requirements, comparative use of fuel and energy;, Availability of energy for recharging; Impacts on use of fuel and energy; Impact on urban air quality, impact on price, material requirement traction motors and types Hybrid vehicle, benefits, types of HEVs, hybrid maintenance and service. Use of turbines in cars, arrangement, control merits and de-merits, Design of turbochargers for automobiles, their usefulness

on the performance, Use of fuel cells in automobiles.

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Suggested Books:

1. Non-conventional Sources of Energy, G.D. Rai, Khanna Publications.
2. Electric Automobiles, William Hamilton, PHI.
3. Alternative Fuel Technology, Erjavec and Arias, Cengage Learning
4. Solar Energy, S.P. Sukhatme, Tata McGraw Hill.
5. Energy Technology, S. Rao & B.B. Larulekar, Khamma Lab.
6. Principles of Solar Engineering, Frank Kreith& Jan F. Krieder, McGraw Hill.
7. Solar Energy -thermal Process, J.A. Duffie& W.A. Beckman, McGrawHill.