Uttarakhand Technical University, Dehradun

Scheme of Examination as per AICTE Flexible

CurriculumEvaluation Schemes for B. Tech 4th Year

W.E.F. Academic Session 2020-21

VII &VIII SEMESTER

Bachelor of Technology (B. Tech.)

in

[Petroleum Engineering]

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

B Tech IV Year (VII 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 &Session al		L	T	P	
1.	BPET 701	DC	Petroleum Engineering Design-II	100	30	20			150	3	0	0	3
2.	BPET-702 BPEP-702	DC	Reservoir Simulation	100	30	20	30	20	200	3	0	2	4
3.	BPET-703	DE	Departmental Elective	100	30	20	-	-	150	3	0	0	3
4.	BPET-704	OE	Open Elective	100	30	20	-	-	150	3	0	0	3
5.	BPEP-705	D Lab	Simulation lab/Virtual Lab	-	-	-	30	20	50	0	1	2	2
6.	BPEP-507	IN	Internship III	-	-	-	-	50	50	-	-	2	1
7.	BPEP-706	P	Minor Project-2	-	-	-	50	50	100	0	0	4	2
Total				400	120	80	110	190	900	12	1	10	18
NSS/NCC													

Departmental Electives		Open Electives	
BPET703(A)	Petroleum Refining and Petrochemicals	BPET 704(A)	Remote Sensing & GIS
BPET703(B)	DisasterManagement	BPET 704(B)	Fundamentals of Rocks Mechanics
BPET703(C)	Corrosion Engineering	BPET 704(C)	Well performance and artificial lift techniques

***Students may also earn credits of open elective through NPTEL/Swayam.**

B Tech IV Year (VIII 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 801	DC	Health, Safety and Environmental Management in Petroleum Industry	100	30	20			150	3	1	0	4
2	BPET 802 BPEP-802	DC	Fluid Flow through Porous Media	100	30	20	30	20	200	3	1	2	5
3	BPET-803	DE	Departmental Elective	100	30	20			150	3	0	0	3
4.	BPET-804	OE	Open Elective	100	30	20			150	3	0	0	3
5	BPEP-805	S	Open source Lab					50	50	0	0	2	1
6	BPEP-806	P	Major Project				100	100	200	0	0	8	4
Total				400	120	80	50	200	900	12	2	12	20

Departmental Electives		**Open Electives**	
BPET-803 (A)	Well Stimulation	BPET-804 (A)	Oil and Gas marketing and resource management
BPET-803 (B)	Oil and Gas Transportation System	BPET-804 (B)	Geophysical Method
BPET-803 (C)	Industrial Economics	BPET-804 (C)	Big Data Analytics

7thSEM

BPET-701	Petroleum Engineering Design - II	L	T	P
		3	0	0

Objectives:

Objective of this course is to present the basic concepts and techniques necessary to design, specify, and manage oilfield surface production facilities. It provides a clear understanding of the equipment and processes used in common separation in oil and water treating systems, as well as the selection of piping and pumping systems.

Course Outcome:

- Ability to select diameter and length of separators to be used.
- Codes and standards (as per API) followed for designing various equipment.
- Knowledge of types of storage tanks used in petroleum industry.
- Detailed knowledge of surface facilities in oilfield
- Knowledge of operating pressure conditions for different pressure vessels used.

Detailed Content:

UnitI:

Specification of optimum production rate from a well.

UnitII:

Specification of optimum separation process and system for a given type of oil production.

Unit III:

Design of gas-lift valve string for continuous and intermittent gas-lift systems.

UnitIV:

Design of sucker-rod pumping system.

UnitV:

Choice of submersible centrifugal pump capacity and power.

Suggested Books:

1. Economides M. J.; Hill A. D.; Economides C. E.; Petroleum Production Systems; Prentice Hall, Petroleum Engineering Series.

2. Heriot Watt engineering – Production Technology – II.

3. Allen Thomas, and Alan Roberts; 1989, Production Operations, Volume 1 and 2; 3rd Edition, Oil and Gas Consultants International, Inc. 303 pp. and 363 pp.

4. Cholet H, 2000, Well Production Practical Handbook; Technip Editions; France, 540

5. Danish Ali, 1998, PVT and Phase Behavior of Petroleum Reservoir Fluids. Elsevier, 400 pp.

BPET-702 Reservoir Simulation BPEP -702	L	T	P
	3	1	2

Objectives:

- To understand the principles of refrigeration and airconditioning.
- To calculate the cooling load for differentapplications.
- To select the right equipment for a particularapplication.
- To design and implement refrigeration and air conditioning systems usingstandards.
- Energy Conservation andManagement.

Course Outcome:

- Interpret the working principles and applications of refrigerationsystems.
- Interpret the vapour compression refrigeration system and identify methods for Performance improvement.
- Demonstrate the working principles of air, vapour absorption, thermoelectric and estimate the condition of steam and performance of vapour power cycle and vapour compressioncycle.
- Analyze air-conditioning processes using the principles of psychrometry and estimate various essential properties related to Psychrometry andprocesses.
- Evaluate cooling and heating loads in an air-conditioningsystem.

Detailed Content:

Unit1

Model type: Physical, analog and mathematical. Single-phase, multi-phase inone, two- and three-dimension mathematical model for reservoir fluid flow. Grid blocks and Grid orientation.

Unit2

Model Equations: Black oil and composition oil models, Pseudo functions. Data Preparation: Rock, fluid, mechanical, production and validation.

Unit3

Solution Techniques: Analytical andnumerical methods, explicit and implicit methods of discretization, finite-difference and finite element method, linearization, solution of simultaneous equations.

Unit4

Stability criteria, Iterative methods, IMPES & IMPIS methods. Numerical dispersion. Grid

and time step size selection. History matching: Manual and automated system Reservoir performance using simulationapproach.

Unit5

Simulating special processes: Compositional simulation, Miscible displacement, chemical and polymer flooding, thermal recovery processes.

Suggested Books:

- Reservoir Simulation Clavin C Matt
- Practical Reservoir Simulation Carlson M R
- The mathematics of reservoir simulation Richard E Ewing
- Fundamental of Numerical Reservoir Simulation- Donald W Paceman
- Reservoir Simulation: Mathematical Technical in Oil Recovery
- Basic Applied Reservoir Simulation T Ertekin

Suggested Experiments:

Reservoir simulation is a process of generating an artifact that require the knowledge of reservoir engineering, enhanced oil recovery and transport through porous media on Partial differential equation and programming sill.

- To develop the code or solve the simultaneous equation.
- To study and solve the ordinary differential equation.
- To study and solve the partial differential equation.
- To study the pressure transient analysis (fracture carbonate reservoir)
- To simulate the equation of smart/low salinity water flooding
- To develop the model of thermal enhanced oil recovery
- To develop and simulate the model of microbial enhanced oil recovery.
- To solve the equation of flow through coal bed methane reservoir
- To solve the equation of Darcy equation for porous media
- To study and develop black oil model.

BPET-703 (A) Petroleum Refining and Petrochemicals	L	T	P
	3	0	0

Objectives:

- It gives knowledge about basic geology, hydrocarbon systems, petroleum exploration, productiontechnology and the flow properties of oil and gas in a porous medium
- Transport and processing facilities for oil and gas, with an emphasis on instrumentation, multi-phase, separation and safety technology

Course Outcome:

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

- Understand origin of petroleum, its composition, overall refinery structure and various petroleum refinery products
- Acquire knowledge about assay of crude oil and important physical properties of petroleum products
- Demonstrate Crude Oil Processing & Refining, various Fractionations of Petroleum processes,and its applications in chemical industries.
- Identify various Treatment techniques of Gasoline, Kerosene, Lubes & Wax
- Comprehend with Catalytic Cracking & Thermal Processes

Detailed Content:

Unit1

Crude oil evaluation, choice of crude types for a product mix.

Unit2

Distillation system: pipe still heater, distillation column, heat exchangers condenser,reflux control, pressure control, vacuum distillationsystem.

Unit3

Otherrefiningprocesses:cracking,reforming,alkylation,isomerization,hydroprocessing.

Unit4

Specialty products: Lube oil production, propane de-asphalting, solvent extraction, dewaxing, coke and carbon black production.

Unit5

Petro-chemical feed stock: BTX, olefins: method ethane and butane treated products from natural gas, storage, and safety measures: Floating roof tank, spherical storage vessels; fire safety measures.

Suggested Books:

1. A Text on Petrochemicals' by B.K. Bhaskara Rao, 3rd Edition, Khanna Publishers, New Delhi.
2. Petrochemical processes', Vol.2, 2nd edition, by A. Charnel and G. Lefebvre, Gulf publishing company.
3. Shreve's chemical process industries', 5th edition, by George T. Austin, McGraw Hill Publishers

BPET-703 (B) Disaster Management	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

On successful completion of this course students will be able to:
1. Design and justify research methodology for data collection.
2. Demonstrate understanding of research code of conduct and ethical approval process.
3. Utilize appropriate research methodology to collect data.
4. Critically analyse the collected data and draw conclusions accordingly.
5. Present research findings and conclusions in an academically appropriate manner.

Course Outcome:

1. Identify and refine an appropriate research question;
2. Apply principles of research design to the question, and select an appropriate methodology;
3. Design and manage a piece of original project work;
4. Select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify this design
5. Discuss the ethical dimensions of your research and obtain appropriate ethical approval if needed
6. Synthesize knowledge and skills previously gained and apply these to an in-depth study
7. Establish links between theory and methods within your field of study
8. Present your findings in an appropriate written format.

Detailed Content:

Unit1

Concepts of safety – Hazard classification chemical, physical, mechanical, ergonomics, biological and noise hazards – Hazards from utilities like air, water, steam. Hazard identification - Safety Audits - Checklists - What if Analysis – HAZAN – HAZOP - Vulnerability models - Event tree and Fault tree Analysis - Past accident analysis - Flixborough - Mexico - Bhopal - Madras - Vizag accident analysis.

Unit 2

Hazops: Principles - Risk ranking - Guide word - Parameter - Deviation – Causes - Consequences - Recommendation - Coarse HAZOP study - Case studies - Pumping system -Reactor System - Mass transfersystem.

Unit3

Introduction to Consequence Analysis - Fire and Explosion models: Radiation - Tank on fire - Flame length –Risk analysis- Radiation intensity calculation and its effect to plant, people

&property, UCVCE -Explosion due to - Deflatration - Detonation - TNT, TNO & DSM model – Over pressure. Methods for determining consequences effects: Effect of fire- Effects of explosion - Risk contour - Flash fire - Jet fire - Pool fire - BLEVE - Fire ball.

Unit4

Safety in plant design and layout – Safety provisions in the factory act 1948 – Indian explosiveact 1884 – ESI act 1948 – Advantages of adopting safety laws.Safety measures in handling and storage of chemicals – Fire chemistry and its control –Personnel protection – Safety color codes ofchemicals.

Unit5

Risk Management & ISO14000: Overall risk analysis - Generation of Meteorologicaldata

-Ignition data - Population data. Overall risk analysis – E and FI model— Disaster managementplan – Emergency planning – Onsite and offsite emergency planning – Risk management – Gasprocessing complex, refinery – First aids

Suggested Books:

1. Fellows, R. F., & Liu, A. M. (2015). Research methods for construction. John Wiley & Sons. Bryman, A., & Bell, E. (2015).
2. Business research methods. Oxford University Press, USA.Yin, R. K. (2013). Case study research: Design and methods. Sage publications.
   Fowler Jr, F. J. (2013).
3. Survey research methods. Sage publications.Chen, H. X. (2012).
4. Approaches to quantitative research: A guide for dissertation students. Oak Tree Press.
5. Denicolo, P., & Becker, L. (2012). Developing research proposals. Sage.
   Biggam, J. (2015McGraw-Hill Education (UK).Naoum, S. G. (2012).

BPET-703 (C) Corrosion Engineering	L	T	P
	3	0	0

Objectives:

- To understand the objective and scope of pipeline.
- To study the factors influencing oil, gas and refined products as pipeline design
- To understand theory and different formulae of the flow of fluids in oil/gas pipelines
- To study basic equations for the flow of fluids through pipes.
- To study Construction and Maintenance of pipelines along with corrosion protection and control.
- To study offshore pipeline.
- To understand design and control of Sag and Over bend.
- To study Hydrates, Wax & Scale.
- To study Crude conditioning and use of additives to improve flow conditions.

Course Outcome:

- The student should be able to understand about crude/gas/refined product transportation.
- The student should be able to understand different formulae of the flow of fluids in oil/gas pipelines.
- The student should be able to understand about Newtonian and non-newtonian fluids through pipeline.
- The student should be able to understand about general equipment (pipes, valves and fittings).

1. The student should be able to understand the offshore pipeline and the method of underwater welding.
2. The student should be able to understand the Formation and prevention of hydrates, wax & scale.

Detailed Content:

Unit1

Corrosion in oil and gas production. Introduction to corrosion control. Definitions: Materialsinvolved. Basic corrosion principles, corrosion rate. Electrochemical reactions. Electrodepotentials-passivity-temperature-pressure-velocity-conductivity-pH-dissolved gases.

Unit 2

Forms of corrosion-uniform-pitting-Galvanic erosion-Intergranualar and weld corrosion, selectiveLeaching, stress corrosion. Hydrogen embitterment-Fatigue. Role of oxygen in oil filedcorrosion-downhole and surface equipment-water flood Removal of oxygen, analysis andcriteria forcontrol.

Unit3

Role of carbon dioxide (CO_2) in corrosion-Effect of temperature and pressure Corrosion of

welltubing and other equipment. Role of hydrogen sulphide (H_2S)-Corrosion in downhole, surface,storage andpipelines.

Unit4

Corrosion prevention-Cathodic protection. Principles of operation-applications Galvanic systems, corrosion prevention-coatings-corrosion prevention inhibitors-types of corrosion inhibitors-choice and selection.

Unit5

Oil treatment corrosion-crude oil properties-desalting-distillation and other processing casehistories, sweetening processes-subsea systems corrosion. Inspection and corrosionmonitoring case history-oil storage tank corrosion-Oilfield and oil treating facilities-offshoreplatforms-down hole equipment.

Suggested Books:

- *AlkazrajiDuraid, (2008) A quick guide to pipeline engineering Woodhead Publishing Limited*
- *Vincent, Jecqes (2010) Fundamentals of Pipeline Engineering, Gulf Publishing*
- *Antaki, G. A. (2003) Piping and Pipeline Engineering , Marcell Dekker.*

BPET-704 (A)	Remote Sensing and GIS	L	T	P
		3	0	0

Objectives:

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

- Design and justify research methodology for data collection.
- Demonstrate understanding of research code of conduct and ethical approval process.
- Utilize appropriate research methodology to collect data.
- Critically analyse the collected data and draw conclusions accordingly.
- Present research findings and conclusions in an academically appropriate manner.

Course Outcome:

- Identify and refine an appropriate research question;
- Apply principles of research design to the question, and select an appropriate methodology;
- Design and manage a piece of original project work;
- Select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify this design
- Discuss the ethical dimensions of your research and obtain appropriate ethical approval if needed
- Synthesize knowledge and skills previously gained and apply these to an in-depth study
- Establish links between theory and methods within your field of study
- Present your findings in an appropriate written format.

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Detailed Content:

Unit-1

Introduction, Basic Principles, Electromagnetic (EM) Energy Spectrum, EM Radiations and the Atmosphere, Interaction of EM radiations with Earth's Surface, Types of remote sensing systems, Remote Sensing Observation Platforms, Satellites and their characteristics

Unit-2

Geostationary and sun-synchronous, Earth Resources Satellites, Meteorological satellites, Sensors, Types and their characteristics, Across track and Along track scanning, Applications of Remote Sensing.Geographical Information System (GIS)

Unit 3

Definition, GIS Objectives, Hardware and software requirements for GIS, Components of GIS, Coordinate System and Projections in GIS, Data structure and formats, Spatial data models – Raster and Vector, Data inputting in GIS, Data base design - editing and topology

creation in GIS,

Unit-4

Linkage between spatial and non spatial data, Spatial data analysis – significance and type, Attribute Query,Spatial Query, Vector based spatial data analysis, Raster based spatial data analysis,

Unit-5

Errors in GIS, Integration of RS and GIS data, Digital Elevation Model, Network Analysis in GIS, GIS Software Packages.

Suggested Books:

- "Surveying", Punmia, B.C., Vol. I &II, Laxmi Publications New Delhi
- "Surveying" Kanetkar T.P. and Kulkarni S.V., Vol. I&II
- Surveying S K Duggal : Vol 1 & 2 , TMH
- "HigherSurveying", Chandra, A.M. New Age International Publishers, Delhi

BPET-704 (B)	Fundamental of Rock Mechanics	L	T	P
		3	0	0

Objectives:

- Stress and strain: force and stress; principal stresses and stress invariants; plane problems and biaxial stress; displacement and strain; geomechanics conventions
- Rock mass structure and characterization: types of structural features; geomechanical properties of discontinuities; structural data collection and presentation; rock mass classification.
- Rock strength and deformability: concepts and definitions; isotropic and anisotropic rock behavior (uniaxial and multiaxial); behavior of discontinuous rock masses; shear strength of discontinuities.

Course Outcomes:

- The objectives of the course are for the students to develop an understanding of the engineering properties of rocks,
- Geological and engineering rock classifications, rock failure theories, in-situ stresses in rock, and the fundamental concepts and principles of rock mechanics.
- This course is the pre-requisite for Rock Mechanics II which covers the applications of rock

Unit 1

General Geology: Importance of Engineering. Geology applied to Engineering. Practices, Weathering, definition, types and effect. Geological works of rivers, wind, glaciers as agents of erosion,transportation and deposition.

Unit 2

Rocks & Minerals : Minerals, their identification, igneous, sedimentary & metamorphic rocks.
Classification of rocks for engineering purposes. Rock quality designation (RQD).

Unit 3

Engineering properties of rocks and laboratory measurement : Uniaxial compression test,tensile tests, permeability test, shear tests, size and shape of specimen rate of testing. Confiningpressure, stress strain curves of typical rocks. Strength of intact and fissured rocks, effect ofanisotropy, effect of saturation and temperature

Unit 4

In-situ determination of Engineering Properties of Rock masses: Necessity of in-situ tests, uniaxialload tests in tunnels and open excavations, cable tests, flat jack test, shear test, pressure tunneltest. Simple methods of determining in situ stresses,bore hole test

Unit 5

Stresses around borehole, and borehole failure criteria:

Stresses around a borehole – general linear elastic solution Stresses around a borehole in a poro-elastic formation, Borehole failure criteria

Reservoir Compaction: Subsidence and well problems

Compaction of the reservoir, Stress changes in depleting reservoirs, Consolidation Theory

Suggested Books:

1. Mechanics principles in the design of foundations, slopes and underground openings in rock.
2. The Brady and Brown textbook (below) is highly recommended, however, as lecture instruction closely follows the textbook structure and content. A copy is available on reserve at the Yukon College library.
3. Brady BHG, Brown ET. 2004. Rock mechanics for underground mining. 3rd ed. AZ Dordrecht, The Netherlands: Kluwer Academic Publishers. 626 p

BPET-704 (C) Well Performance and Artificial Lift Techniques	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

- Understanding of work over and stimulation operations.
- Work over operation design and field application

Course Outcome:

- Understand different oil and gas well problems and their work over solutions
- Ability to select appropriate work over and stimulation techniques for improving well production

Detailed Content:

Unit1:

Introduction to work over and well stimulation operations: challenges and solutions

Unit 2:

Work over operations. Work over fluids, fluid loss and formation damage. Scraping, and well circulation

Unit 3:

Production packers and packer calculation, and well activation. Repair of wells, and paraffin and scale removal. Planning and evaluation of work over jobs. Corrosion, bacteria & scale control.

Unit 4:

Well treatment: acidizing of oil and gas wells. Hydro-perforation. Hydraulic fracturing. Stimulation designing, prop pants and their placement. Thermal stimulation techniques.

Unit 5:
Artificial lift equipment, horizontal and multilateral well completion systems.

Suggested Books:

1. Petroleum Production Systems, Economides et al., Prentice Hall, 2012.
2. Production Operations II, Thomas O. Allen and Alan P. Roberts, Pennwell, 2012
3. Well Control Problems Solutions, Neal J. Adams, Pennwell, 1980
4. Oil Well Drilling Engineering: Principles and Practice, H Rabia, Springer, 1986

8thSEM

BPET-801 Health, Safety and EnvironmentalManagement in Petroleum Industry	L	T	P
	3	0	0

Objectives:

To understand the health, safety and environmental management in petroleum industry

Course Outcome:

- The students should be able identify the safety procedures that should be taken while working on Drilling Rigs.
- The students should know the necessary measures that should be taken by the executing agency and owner to prevent fire hazards.
- The students should be able identify the various safety awareness & training program that are implemented to reduce the risk at workplace.
- To describe and identify various functions of Oil Industry Safety Directorate (OISD)
- To identify the major cost elements of Health, Safety and Environment operations.

Detailed Content:

Unit1

Health hazard: Toxicity, physiological, asphyxiation, respiration and skin effects. Effects of sour gases (H_2 S and CO) on human health. Effect of corrosive material and atmosphere during sand control, fracturing and acidization operation.

Unit2

Safety analysis: Operational risk in drilling, production and handling of oil and Gas, fire Hazard: safety in drilling, production operations. Manual and automatic shutdown systems blow down systems. Gas leakage, fire detection and suppression systems. Hazard and failure mode analysis: disaster and crisis management.

Unit3

Environment Health and Safety Management, Impact of oil and gas on air, water and soil pollution, impact of drilling and production operations, offshore problems, oil-spill control. Environmental impact assessment. Waste treatment & Management methods, effluent water treatment and disposal. Contaminated soil remediation.

Unit4

Noise pollution and remediation measure. Industrial Accident & prevention: Safety sampling, Accident and Safety Audit; Legal requirements, Disaster Planning, and control. Safety in offshore operations.

Unit5

Gas detection fire detection and suppression, personal protection measures. Occupational Physiology: Respiratory and skin effect. HSE regulation; oil mines regulations.

Suggested Books:

- Less, F. P., Loss Prevention in the Process Industries, 2nd ed,Butterworth Heinemann, UK.
- Peavy, H. S., Rowe, D. R. and Tchobanoglous G. (1985), Environmental Engineering, McGraw Hill, New York.
- Sanders, R. E., Chemical Process Safety, 3rd ed. Butterworth Heinemann, UK, Year.
- NFPA, API 14 G & OISD Standards.

- Marchell, V. and Ruchemann, S. (2001), Fundamentals of Process Safety, Institution of Chemical Engineers, Warwickshire, UK

BPET-802 BPEP-802	Fluid Flow through Porous media	L	T	P
		3	1	2

Objectives:

- To study the flow through the porous media for oil and gas storage system.
- To understand the boundary value problems for solution of the related equation

Course Outcome:

- This course starts with a brief introduction to porous media and terms like permeability, porosity and the corresponding relation.
- Then, the most fundamental forms governing equations namely, Darcy equation and Brinkman equation to describe fluid flow inside porous media will be discussed.
- Finally, this course introduces universally accepted interface conditions at a porous liquid interface.
- The course is focused on the achievement of a clear and rigorous understanding of the fundamental properties, concepts and theories which are of importance in treating storage and multiphase fluid flow in sub-surface porous media, with or without heat transfer, mass transfer, and/or chemical reactions.

Detailed Content:

Unit1

The physical medium relevant physical phenomena. Pore scale versus continuum scale, fluid and porous matrix properties.

Unit2

Mathematical models of porous media: network models, Statistical descriptors, Fractal models, effective medium, mixture theory, double porosity models.

Unit3

Balance principals: mass momentum and energy conservation, equations of motion, Darcy's law. Constitutive theory.

Unit4

Boundary values problems: well-posed problems, boundary condition, common solution procedures.

Unit5

Immiscible multiphase flow surface chemistry, thermodynamics of interphase, interfacial tension, capillary pressure, simultaneous of two fluids Surface phenomena: adsorption wetting thin films. Transport through membranes. Miscible displacement and dispersion.

Suggested Books:

- Muskat M and Wycoff R D, The flow of homogeneous fluids through porous media.
- Ahmed T, Reservoir Engineering Handbook, Gulf Publishing, Houston.
- Khillar, K and Fogler, S (1998) Migration of fines in porous media. Kluwer Acedemic Publication.

- Panfilov, M (2000) Macroscale models of flow through highly heterogeneous porous media Kluwer Acedemic Publication.

Suggested Experiments:

1. Derivation of Diffusivity equation.
2. Understanding the concept of types of flow regimes.
3. Determination of permeability using Liquid permeameter.
4. Determination of water saturation using Archie's equation.
5. Determination of porosity of rock sample using Archie's equation.
6. Relative permeability determination.
7. Calculation of formation resistivity factor.
8. Determination of bubble point and dew point of multi-component mixtures using ASPEN/HYSYS or similar software.
9. Calculation of reserves using volumetric method.
10. Experimental determination of vapour – liquid equilibrium for binary mixtures.

BPET-803 (A) Well Stimulation	L	T	P
	3	0	0

Objectives:

- This subject will introduce about chemical properties of oil bearing formations, and rock composition
- It will also talk about the hydraulic fracture and will productivity.

Course Outcome:

- Student will knowledge about chemical properties of oil bearing fluid
- They will also study the physical properties such as mechanical, thermal and chemical.
- The course will also introduce about designing and optimization of the well productivity.

Detailed Content:

Unit1

Chemical Properties of Oil-bearing formations and fluids; Rock composition & mineralogy, clays, surface charge, charge exchange capacity, formation water, crude oils.

Unit2

Physical properties of formation materials: Mechanical properties and Thermal properties. Chemical and Mechanical properties of injected fluids: polymer solution. Entry hole diameter, Perforating for Hydraulic fracturing.

Unit3

Hydraulic Fracturing: Dynamic fracture Geometry: Orientation, vertical, horizontal and penny-shaped Fluid loss, fracture conductivity, Proppant fracturing, acid fracturing.

Unit4

Well Productivity: design and optimization of fracturing processes, Acidization: Methods, Rates of reaction, SandstoneAcidization Design consideration in Matrixacidizing.

Unit5

Designing Matrix aicidizing in carbonates. Acid additives. Sand Control, Gravel Packing. Sand consolidation.

Suggested Books:

1. Robert S. Schechter, Oil Well Stimulation, Prentice Hall, 1990.
2. A. Richard Sinclair, Well Stimulation Treatments, 2nd Ed., Well Service and Workover Series, 2012.
3. Fred Aminzadeh, Hydraulic Fracturing and Well Stimulation, Wiley, 2019.

BPET-803 (B)	Oil and Gas Transportation system	L	T	P
		3	0	0

Objectives:

- To understand the transport of crude oil and gas.
- To calculate the pressure drop and study the size of pipe with pipeline e branching

Course Outcome:

- Student will get the knowledge about the transport mode of oil gas.
- Student will know about the pipeline branching and welding.
- The flow measurement instruments and control arrangement.

Detailed Content:

Unit1

Road and rail transport of crude oil & product. Tanker design, safety features. Oceanic transport of oil and liquefied natural gas: design of ocean-going tankers and safety features.

Unit2

Pipeline transport of oil and gas: Route selection, pipeline construction process and equipment: trenching, aligning, connecting pipes, corrosion protection, lowering & back filling.

Unit3

Flow of oil and gas: through pipelines. Pressure drops calculation types,sizing and location of pumps and compressor. Instrumentation and control.

Unit4

Flow measurement and control arrangement. Corrosion in pipelines: Types, chemical and electro-chemical process; coating, cathodic protection principle and design.

Unit5

Pipeline branching: Gas distribution control. Offshore pipeline: Sag and overbend; stinger and riser, under-waterwelding.

Suggested Books:

- A.P. Szilas, Production and Transport of Oil and Gas: Gathering and Transportation, Elsevier Science Ltd; 2nd Revised edition (1 January 1986).
- Alireza Bahadori, Oil and Gas Pipelines and Piping Systems 1st Edition Design, Construction, Management, and Inspection, Gulf Professional Publishing, 2016.
- Energy Supply and Pipeline Transportation by Mo Mohitpour
- Saeid Mokhatab, William A. Poe and James G. Speight, Handbook of Natural Gas

Transmission and Processing, Gulf Professional Publishing, 2006.

BPET-803 (C)Industrial Economics	L	T	P
	3	0	0

Course Objectives

• Provide students with the analytical skills required for understanding problems in industrial economics, including applications of game theory
• Examine the key questions on the internal organisation of firms
• Analyse various aspects of strategic interaction between firms and the determinants of industrial structure
• Provide students with the ability to apply economic models of firm behaviour to analyse questions in business strategy, competition policy and regulation.

Course Outcome

• Describe and explain the determinants of the size and structure of firms and the implications of the separation of ownership and control

Unit 1 [8]
Financial Accounts: Profit and loss account, Balance sheet; elements, preparation and analysis, depreciation,depletion accounting.
Unit 2 [8]
Equipment cost estimation, cost index, utilization,cash flow analysis, time value of money**,** discounting.
Unit 3 [8]
Profitability analysis, IRR, pay out time, present-worth estimation. Choice between alternative investments.
Unit 4 [8]
Cost index plant cost estimation. Operational cost estimation: Elements, Cost Index, Plant Cost estimation.
Unit 5 [8]
Taxation norms, accounting method, Risk and uncertainty accounting, Petroleum contracts; NELP Production sharing contract.

Suggested Books:

1. Petroleum Economics and Engineering, H. K. Abdel-Aal, Bakr A. Bakr, M.A. Al-Sahlawi, 2nd Edition, Marcel Dekker Inc., 1992.
2. Petroleum Economics, Jean Masseron, 4th Edition, Editions TECHNIP, 1990.
3. Varshney &Maheswari: Managerial Economics, Sultan Chand, 2009.
4. S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age international Publishers, Hyderabad 2013.
5. M. Kasi Reddy & Saraswathi, Managerial Economics and Financial Analysis, PHI New Delhi, 2012

BPET-804 (A) Oil and Gas Marketing and resource management	L	T	P
	3	0	0

Objectives:

- To understand the Oil and gas industry.
- To study the vision of India for future oil storage and production

Course Outcome:

- Management of the resource exploration.
- The marketing of the oil and gas
- Study the natural gas production and demand.
- To study the petroleum policy and taxation issue

Detailed Content:

Unit1

Introduction: The development of Oil & Gas Industry,Structure of oil & Gas Industry, Introduction to Indian Oil & Gas Industry, India hydrocarbon vision 2050. Petroleum resource classification, Analysis of resource management.

Unit2

Natural Gas: What is Natural Gas, Measuring Natural Gas, Pipeline quality Natural Gas. Demand, Supply & Storage of Natural Gas: Gas Production, Sources of demand in India, Supply system, Pipeline operations & network, Storage of Natural Gas, Liquefied Natural Gas Plant & Operations, Gas Scale pattern inIndia, Gas regulation in India,Gas trading and gaspricing.

Unit3

Coal Bed Methane: Introduction, Present status of Coal Bed Methane, CBM storage and scale, CBM pricing in India. Crude Oil production in Indi, Crude oil Specification, measuring /Custody transfer of crude Oil, Crude Oil transportation,Crude Oil production in India, Crude Oil refineries, products from CrudeOil.

Unit4

International & National Institution of Oil & Gas: OPEC, OIDB, DGH, PNGRB,CHT, PII, PPAC, PCRA. Petroleum Contracts: NEPL- Role & Background, Types of Contracts and fiscal components, production sharing contracts in India, CrudeOil trading and pricing, CBM Contracts and Shale GasContracts.

Unit5

Trade practices & Taxation: Norms on various trade practices, Element of Petroleum

Development Policy, Financial and taxation issue. Risk Management: Source of risk, managing risk by risk reduction, diversification, and uncertainty and decision analysis by decision tree.

Suggested Books:

- Xiaoyi Mu, The Economics of Oil and Gas, Agenda Publishing, 2019.
- Carmalt, S.W., The Economics of Oil, A Primer Including Geology, Energy, Economics, Politics, Springer International Publishing, 2017.
- Clo, Alberto, Oil Economics and Policy, Springer US, 2000.

BPET-804 (B) Geophysical Exploration Method	**L**	**T**	**P**
	3	**0**	**0**

Objective:

- This course aims to introduce students to the techniques used to measure and map geologic,
- Geophysical and geochemical characteristics of the lithosphere, with applications to mineral and energy exploration.
- It also aims to provide students with the theoretical background to each technique (including its strengths and limitations), the methods of data collection, analysis and interpretation and an appreciation of the exploration scenarios in which each technique may apply.

Course Outcomes:

- Demonstrated proficiency in common practical skills in resource exploration.
- The scientific basis of mineral, energy and natural resource exploration
- The generic characteristics of economic mineral and energy resources –geological, geophysical and geochemical anomalism
- The geochemical techniques (sampling media, sampling strategies,analytical techniques)

Detailed Content:

Unit 1:

Gravity and magnetic methods of exploration: Gravity field of the earth - factors effecting the gravity field of the earth; Rock densities - factors controlling rock densities; concept of gravity anomaly,classification of minerals and rocks.

Unit 2:

Gravity and magnetic data acquisition: Ground gravity and magnetic surveys - planning for mineral, hydrocarbon and groundwater exploration and regional geological mapping. Marine gravity and magnetic survey planning; Airborne survey procedures.

Unit 3:

Electric conduction in rocks - electrical properties of rocks and minerals - factors affecting resistivity. Ohm’s Law; Principle of resistivity surveying - Wenner, Schlumberger, dipole-dipole, half Schlumberger, Lee partition arrays - geometric factors.

Unit 4:
EM induction- primary-secondary fields, real and imaginary components; Artificial source methods - classification frequency domain EM-Turam, and Slingram methods

Unit 5:
Gravity and magnetic prospecting instruments: Basic Principles of Static gravimeters, static gravimeters, Nuclear, fluxgate, optical pumping magnetometers.

Suggested Books:

1. Philip Kearey and Michael Brooks, An introduction to geophysical exploration, 2000, Blackwell Science.
2. Telford W. M. et. al., Applied Geophysics, 1988, Oxford & IBH Publishing Co. Pvt . Ltd., New Delhi.
3. Milton B.Dobrin and Carl H.Savit, Introduction to Geophysical Prospecting, 1988, McGraw-Hill International Edition, Geology Series, New Delhi
4. Geosounding principles 1979: Patra HP and Mallick K, Elsevier publishers

BPET-804 (C) Big Data Analytics	**L**	**T**	**P**
	3	**0**	**0**

Course Objectives:

- Optimize business decisions and create competitive advantage with Big Data analytics.
- Introducing Java concepts required for developing map reduce programs.

Course Outcomes:

- Derive business benefit from unstructured data.
- Imparting the architectural concepts of Hadoop and introducing map reduce
- paradigm.
- To introduce programming tools PIG & HIVE in Hadoop echo system.

UNIT-I:
Data structures in Java: Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization

UNIT-II:
Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

UNIT-III:
Writing MapReduce Programs:A Weather Dataset, Understanding Hadoop API for

MapReduce Framework (Old and New), Basic programs of HadoopMapReduce: Driver code, Mapper code, Reducer code, Record reader, Combiner, Partitioner

UNIT-IV:
Hadoop I/O: The Writable Interface, Writable comparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, BytesWritable, NullWritable, ObjectWritable and GenericWritable, Writable collections, Implementing a Custom Writable: Implementing a Raw comparator for speed, Custom comparators

UNIT-V:
Pig:Hadoop Programming Made Easier; Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin

Suggested Books:

1. Big Java, Cay Horstmann, Wiley John Wiley & Sons, 4thEdition, INC.
2. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O'reilly.
3. Hadoop in Action, Chuck Lam, MANNING Publ.
4. Hadoop for Dummies, Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss.
5. Hadoop in Practice, Alex Holmes, MANNING Publ.
6. HadoopMapReduce Cookbook, SrinathPerera, ThilinaGunarathne.