

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

SEMESTER 7 th		Contact Hrs			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BCIE2-735	Petroleum Exploration & Production Operation	3	0	0	40	60	100	3
BCIE2-736	Petroleum Refining-III	3	0	0	40	60	100	3
BCIE2-737	Pipeline Engineering	3	0	0	40	60	100	3
BCIE2-738	Advanced Offshore Engineering	3	0	0	40	60	100	3
BCIE2-739	Chemical Process Plant Design-II	0	0	2	60	40	100	1
BCIE2-740	Training-III#	0	0	0	60	40	100	2
Total		12	00	02	280	320	600	15

In House / Industrial Training of 8 weeks during summer vacation after 6th semester.

SEMESTER 8 th		Contact Hrs			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BCIE2-841	Reservoir Modelling & Simulation	3	1	0	40	60	100	4
BCIE2-842	Enhanced Oil Recovery Techniques	3	0	0	40	60	100	3
Departmental Elective-II (Select any one)		3	0	0	40	60	100	3
BCIE2-860	Natural Gas Technology							
BCIE2-861	Drilling & Well Engineering							
BCIE2-862	Petroleum Economics							
BCIE2-863	Oil & Gas Processing System Design							
Open Elective-I (Select any one)		3	0	0	40	60	100	3
BCIE2- 843	Major Project	0	0	4	60	40	100	2
Total		12	01	04	220	280	500	15

7th Semester

MRSPETU

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Petroleum Exploration & Production Operation

Subject Code: BCIE2-735

**L T P C
3 0 0 3**

Duration: 36 Hrs.

Unit I

Distribution of Reserves: Worldwide distribution of oil and gas reserves, Subsurface data sampling and data interpretation, Measurement scaling.

Unit II

Origin of Hydrocarbons: Origin of hydrocarbons, accumulation and migration of hydrocarbons, Reservoir traps, International trending in oil & gas.

Unit III

Properties of Reservoir Rocks and Fluids: Properties of reservoir rocks and fluids, Rock – fluid interface, Reservoir description by direct and indirect methods, Oil and Gas in place.

Drilling Operations: Drilling of oil and gas wells, Classification of wells, Drilling operating systems, Drilling fluids, new trends in drilling Engineering.

Unit IV

Unit V: Well Stimulation: Well completions and stimulations, Gun perforating, Hydrocarbon production techniques, Hydrocarbon recovery mechanisms, artificial lift techniques, Secondary recovery.

Reference Books:

1. Bradley, "Petroleum Engineering Handbook", SPE.
2. Mian, M. A., "Petroleum Engineering Handbook for Practicing Engineer", Vol. I and II, Pennwell Publication, 1992.
3. Deshpande, B.G., "World of Petroleum", Wiley, 1990.
4. John, F., Cook, M., and Graham, M., "Hydrocarbon Exploration and Production", Elsevier, 1998

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Petroleum Refining-III

Subject Code: BCIE2-736

L T P C

Duration: 36 Hrs.

3 0 0 3

UNIT I

Octane Improver: TEL, MTBE, Viscosity Index Improver, Pour Point Depressor, Anti Oxidants and others.

UNIT II

Heavy oil Upgradation processes: Carbon rejection, hydrogen addition; Instability of petroleum products – distillate and residual products; Incompatibility in refining Operations.

UNIT III

Support Systems: Control systems, offsite systems, safety systems

UNIT IV

Quality Control, Planning & Economics: Quality control of products, Refinery operation planning, process evaluation and economics.

Books Recommended:

1. Jones, D.S.J. and Pujadó, P.R., Handbook of petroleum processing, Springer, The Netherlands, 2006
2. Nelson, W. L “Petroleum Refinery Engineering”, McGraw Hill Publishing Company Limited, 1985.
3. Watkins, R. N “Petroleum Refinery Distillations”, 2nd Edition, Gulf Publishing Company, Texas, 1981.
4. Parkash, S., Refining processes handbook, Gulf Professional Publishing, 2003
5. Hobson, G. D “Modern Petroleum Refining Technology”, 4th Edition, Institute of Petroleum, U. K.

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Pipeline Engineering

Subject Code: BCIE2-737

**L T P C
3 0 0 3**

Duration: 36 Hrs.

UNIT I

Objectives: Objective and scope of pipeline as a means of fluid transportation with special reference to crude oil/gas/refined products.

Design of Pipeline: Factors influencing oil, gas and refined products as pipeline design; Hydraulic surge and water hammer; specific heat of liquids; river crossing; pipe size and station spacing etc.

UNIT II

Fluid Flow: Flow of fluids in oil/gas pipelines; basic equations for the flow of fluids through pipes; different flow equations for laminar and turbulent flow of compressible and incompressible fluids (Newtonian); Introduction to the flow of Non-Newtonian fluids through pipes; multiphase flow and loop pipelines.

UNIT III

Construction & Maintenance: Construction and Maintenance of pipelines; Route location survey, materials; project specifications; general equipment specifications (Pipes, valves and fittings); Installation of expansion loops and thermodynamic tapping plant. Pigging, Pigging Technology; pig launcher and receiver, intelligent pigging, types of pigs.

UNIT IV

Corrosion protection and control: Design of cathodic protection system, Pipeline automation.

Hydrates, Wax & Scale: Formation and prevention; Crude conditioning and use of additives to improve flow conditions.

Distribution Network: City distribution network of oil/gas. Lease and custody transfer.

Books Recommended:

1. Piping & Pipeline Engineering, George A. Antaki
2. Pipeline Engineering, Henry Liu, Lewis Publishers.
3. Fundamentals of Pipeline Engineering, J. Vincent-Genod, Editions Technip.
4. Pipeline Engineering, Duraid Alkazraji, Woodhead Publishing Limited.

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Advanced offshore Engineering

Subject Code: BCIE2-738

**L T P C
3 0 0 3**

Duration: 36 Hrs.

UNIT I

Introduction: Deviations from onshore drilling, Challenges, Rig types: Jack-up, Semi-sub, Floaters
Deepwater Drilling: Introduction - History & Geology, Floating Drilling Rigs and chronological Advancements, Basic Floating Rig equipment, Rig Automation.

UNIT II

Dynamic Positioning: Types and Basic operations of a DP system, Major components of the DP system , DP rig vs. moored rig , Types of thrusters used by DP vessels, Basic layout of a power distribution system onboard a DP vessel and associated protection systems, Power management system. Watch Circles - Drive-off; Drift-Off.

Subsea Wellheads: Overview of Wellhead Components, Tool Description, Wellhead sizing.

UNIT III

Open Water Operations: Remotely operated vehicles: Wellhead components for open water operations, Guidance systems; Guideline system; Guideline less system; Mud mat, connector selection, Jetting structural casing versus cementing in a drilled hole , Operational Procedures, Special considerations , high currents, shallow water , flows, drill with mud – “pump and dump” concept , Special cementing operations.

Riser Systems: Riser system Components, Buoyancy, Riser Tensioners & Tensioning Criteria, Basic Riser Analysis, Riser Operations, Emergency Disconnect, High Current Operations.

UNIT IV

BOP System: Wellhead & LMRP Connectors, RAM preventers, Annular Preventers, Choke & Kill line valves, LMRP, Landing & latching the BOP, Control System, Back-up system, BOP Stack Testing, Diverter System.

Deepwater Casing & Cementation: Review of conductor and surface casing design, Casing design process flow, Casing seat Selection, Kick Tolerance, Burst, Collapse, Tensile and bucking criteria & Calculations, Software assisted Casing Design, Casing running, Casing connections, Cementing Procedures , Casing and liner cementing; squeeze cementing, Cementation Hardware.

Books Recommended:

1. Offshore Engineering, Subrata Chakrabarti, Elsevier.
2. Offshore Engineering & Production, Angus Mather, Seamanship International, 2011
3. Offshore Structures, Mohamed A. El-Reddy, GP Publishers.

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Chemical Process Plant Design-II

Subject Code: BCIE2-739

**L T P C
0 0 2 1**

Duration: 24 Hrs.

1. Design of Sieve Tray Column and column internals.
2. Design of Bubble Cap Column and column internals.
3. Design of Packed Column and column internals.
4. Specification sheet for fractionating column.
5. Design of Homogeneous Reactors.
6. Design of Heterogeneous reactors – Fixed bed.
7. Design of Heterogeneous reactors – fluidized bed.
8. Types of Flow Sheets.
9. Overview of plant layout.

The student is to appear in a viva-voce examination based on design report.

Books Recommended:

1. Coulson, Richardson & Sinnott R.K., Chemical Engineering Volume-6 – an Introduction to Chemical Engineering Design, 4th Ed., Elsevier Butterworth Heinemann, 2005
2. Perry R.H., Green D. W., Chemical Engineers' Handbook, 8th ed., Mc-Graw Hill, 2008
3. Coker A.K., Ludwig's Applied Process Design in Chemical & Petrochemical Plants- Vol 1, 4th Ed., Gulf Publication- Butterworth Heinemann, 2007
4. Siddiqui S., Ludwig's Applied Process Design in Chemical & Petrochemical Plants – Volume 2, 4th Ed., Gulf Publication, 2010
5. Ludwig E.E., Applied Process Design in Chemical & Petrochemical Plants- Vol 3, 3rd Ed., Gulf Publication- Butterworth Heinemann, 2001
6. Vilbrandt F.C., Dryden C. E., Chemical Engg. Plant Design, 4th Ed., McGraw Hill, 1959
7. Peters M.S. , Timmerhaus K.D., Plant Design and Economics for Chemical Engg., 5th Ed., McGraw Hill, 2003
8. Molyneux F., Chemical Plant Design –I, Butterworth Heinemann, 1963.

8th Semester

MRSPETU

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Reservoir Modeling & Simulation

Subject Code: BCIE2-841

**L T P C
3 1 0 3**

Duration: 45 Hrs.

UNIT I

Reservoir Modeling: Introduction to general modeling: Introduction to concept geological modeling, Types of model and designing of various models depending on reservoir complexities, rock properties, fluid properties – concept of back oil model, compositional model.

UNIT II

Reservoir Simulation Overview: Introduction, Historical background, application of simulator, various types of models.

Flow Conditions: Single phase, two phase and multiphase flow equations for one, two and three dimension models.

Data Preparation & Function: Types of data & their preparations, Pseudo functions.

UNIT III

Reservoir model Solution Techniques: Implicit Pressure and Explicit Saturation (IMPES), implicit pressure and implicit saturation (IMPIS).

Preview of numerical solution methods: Direct process, iterative process.

History Matching: Mechanics and parameters of match.

UNIT IV

Models simulation: Special Concept on Coning and Compositional Models simulation.

Economic and Techno-economic evaluation: Computation of economic indices viz. different variants base on technical and economic consideration.

Streamline Simulation: Introduction to streamline simulation & comparison of conventional & Streamline simulation.

Books Recommended:

1. Mattax Dalton, Reservoir Simulation”, SPE series, USA, 1990.
2. Bradley HB, Petroleum Engineering Handbook, 3rd Edition GPE, 1992.
3. Principles of Applied Reservoir Simulation, John R. Fanchi, GPU.
4. Practical Reservoir Simulation, Mike Carlson.

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Enhanced Oil Recovery Techniques

Subject Code: BCIE2-842

**L T P C
3 0 0 3**

Duration: 36 Hrs.

UNIT I

Fundamental of Enhanced Oil Recovery: Pore Geometry, Microscopic Aspects of Displacement, Residual Oil Magnitude and Mobilization, Buoyancy Forces and Prevention of Trapping, Wettability, Residual Oil and Oil Recovery, Macroscopic Aspect of Displacement.

UNIT II

Water Flooding: Properties, sampling and analysis of Oil Field Water; Injection waters; Water flooding – Sweep Efficiency, Predictive Techniques, Improved Water Flood Processes, Performance of some Important Water Floods.

UNIT III

Enhanced Oil Recovery Operations-1: Flooding – miscible, CO₂, polymer, alkaline, surfactants, steam

Enhanced Oil Recovery Operations-2: Gas injection, In-situ combustion technology, Microbial method

UNIT IV

Problems in Enhanced Oil Recovery: Precipitation and Deposition of Asphaltenes and Paraffin's, Scaling Problems, Formation of Damage Due to Migration of Fines, Environmental factor.

Books Recommended:

1. Donaldson, E.C. and G. V. Chilingarian, T. F. Yen, "Enhanced oil Recovery – I & II".
2. Fundamentals and Analysis, Elsevier Science Publishers, New York, 1985.
3. Lake, L.W., "Enhanced oil recovery", Prentice Hall, 1989.
4. Schumacher, M.M., "Enhanced oil recovery: Secondary and tertiary methods", Noyes Data Corp., 1978.
5. Van Poolen, H.K. "Fundamentals of enhanced oil recovery", Penn Well Books, 1980.

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Natural Gas Technology

Subject Code: BCIE2-860

**L T P C
3 0 0 3**

Duration: 36 Hrs.

UNIT I

Natural Gas Resources: Oil and gas reserves, Natural gas and associated gas, Outlook for world gas production, Indian Scenario. Future sources of natural gas – Coal Bed Methane and Hydrates, Composition of natural gas, Origin of hydrocarbon & non-hydrocarbon components, Formation of natural gas reservoirs, Sweet and sour gas.

UNIT II

Natural Gas Properties: Phase diagram of a reservoir fluid, Cricondentherm and Cricondenbar, Retrograde condensation, Dry gas, Wet gas, Condensate gas, associated gas, and Chemical components. Sampling methods for natural gas, Measurements taken during sampling. Volumetric properties of natural gas, Equations of state, Viscosity, thermal conductivity, surface and interfacial tension, Net and Gross Heating value – VLE calculations for natural gas.

UNIT III

Hydrates: Water-hydrocarbon systems, Hydrate structures, Thermodynamic conditions for hydrate formation, Kinetics of hydrate formation, Hydrate prevention.

Natural Gas Processing: Different specifications required for transport and use, Separation of condensates, Gas-Liquid separators and their design, Fractionation and purification operations, Dehydration methods, Hydrocarbon liquids recovery, Acid gas removal, Removal of nitrogen, helium and mercury, Integrated natural gas processing.

UNIT IV

Natural Gas Transport & Storage: Different gas chains – Pipeline transport systems, Steady state flow calculations for a pipeline, Pipeline thickness calculation, Welding problems in large diameter steel pipelines, Corrosion protection, Recompression stations, Types of compressors, Multiphase flow handling, Instrumentation, Monitoring and control, Safety considerations, Expansion systems. Flow measurement. LNG transport chain, Natural gas liquefaction, LNG carriers. Natural gas storage- Cryogenic and Underground.

Natural Gas Outlets: Downstream utilization technologies for natural gas in petrochemical, fertilizer and power sectors, Lower hydrocarbons Upgradation technologies, Methane conversion technologies.

Books Recommended:

1. A. Rojey, C. Jaffret, “Natural Gas Production, Processing, Transport”, Second Editions Technip, 1994.
2. Chi U. Ikoku, “Natural Gas Production Engineering”, John Wiley and Sons, 1984.
3. A. Kohl and F. Riesenfeld, “Gas Purification”, Gulf Publishing Company, 1985.
4. Sanjay Kumar, “Gas Production Engineering”, Gulf Publishing Company, 1987.

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Drilling & Well Engineering

Subject Code: BCIE2-861

**L T P C
3 0 0 3**

Duration: 36 Hrs.

UNIT I

Drilling Geology, Oil and Gas Migration: Rock Strengths and Stresses, Hydrostatic Pressure Forced by a Fluid, Rock Properties, Primary Migration, Reservoir Rock, Seal Rock and Secondary Migration. Reservoir Drives.

Planning And Drilling of Well: Well Proposal, Gathering Data, Designing the Well, Drilling and Testing the Well. Planning of Well, Hole and Casing Sizes, Selecting a suitable Drilling Rig, Classification of Drilling Rig, Rig Systems and Equipments.

UNIT II

Drill Bits and Drilling Fluids: Roller Cone Bits, Fixed Cutter Bits and Cone Bits, Optimizing Drilling Parameters- Grading the Dull Bit and Bit Selection, Functions of Drilling Fluid, Basic Mud Classification Designing the Drilling Fluid.

UNIT III

Directional Drilling, Casing, Cementing & Evaluation: Controlling the Well Path of a Deviated Well, Horizontal Wells and Multi Lateral Well. Importance of Casing in a Well, Designing the Casing String, Role of the Cement Outside the Casing, Mud Removal, Cement Design, Running and Cement Casing and other Cement Jobs, Evaluation Techniques, Physical Sampling at Surface and Down hole, Electrical Logging and Production testing.

UNIT IV

Drilling Operations, Safety & Environmental Issues: Personnel involved in drilling Operation, Decision Making at the Well site and in the Office, Estimating the Well Cost, Safety Meetings, New Comers on the Rig, Training and Certification, Permit to Work Systems, Safety Alerts, Safety Equipments, Minimizing Spills and Environmental Impact Studies.

Books Recommended:

1. Devereux, S., "Drilling Technology", Penn Well Publishing Company, 2006.
2. Azar, J.J. and G. Rabello Samuel, "Drilling Engineering", Penn Well Corporation, 2001.
3. Devereux, S., "Practical Well Planning and Drilling", Penn Well Corporation, 1998.

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Petroleum Economics

Subject Code: BCIE2-862

**L T P C
3 0 0 3**

Duration: 36 Hrs.

UNIT I

Production Forecast and Reserves Estimation: Decline Curve Analysis, Types and utility in production forecast, Reserves to Production Ratio, Statistical analysis, Hubert curves. Reserves auditing, standard practices for reporting of reserves, SEC/ SPE/WPC norms.

Risk and Uncertainty: Definition, Exploration and Production Probabilistic Analysis, Risk Analysis, Management and Economic Assessment, Decision Analysis, Preference Theory, Real Option Theory, Stochastic Modeling.

UNIT II

Oil and Gas Prices: International Market and Geopolitics, Crude oil characteristics, marketing and trading of crude oil, Crude oil pricing mechanism and oil price elasticity, Inflation and effects on oil pricing. Factors control ling oil and gas pricing.

Cash Flow Analysis and Economic Parameters: Time value of money, types of costs, Economic Yardsticks: Return on Investment, Payout Period, Net Present Value, Discounted Cash flow, DCFROR, Incremental Analysis, Replacement Analysis, Sensitivity analysis, Optimization.

UNIT III

Asset Management and Accounting: Asset definition, performance evaluation, Analysis of ongoing costs, analysis of field development investments, purchase / sale of producing property, sources of funds, Project management techniques. Petroleum Industry Accounting and types, Petroleum Auditing, Tax Analysis, Cost, Expenditure and revenues under different heads and their proportion in Asset, Depreciation, Depletion, Amortization Methods and their use in tax calculations.

UNIT IV

Petroleum Fiscal System: E and P Business in world and India, Historical development, Role of OPEC and non OPEC countries, Reasons for development of a fiscal system for petroleum industry, Classification of Petroleum Fiscal Systems, Current distribution of exploration and production contract types, and their comparison with possible equivalence. National Oil Companies and International Oil Companies: comparative assessment Petroleum industry in India, Product ion fiscal system in India and abroad, NELP and bidding process in India.

Books Recommended:

1. Abdel A. A., Bakr A. B, and Al Sahlawi M. A., "Petroleum Economics and Engineering", Decker Publications, 1992.
2. Johnston, D, "International Exploration Economics, Risk, and Contract Analysis", Penwell Books, 2003.
3. IFP, Oil and Gas Exploration and Production, Reserves, Costs and Contracts, Technip Publication, 2007.
4. Mian M A, Project Economics and Decision Analysis, Penwell publications, Volume I and II.
5. Seba R. D., "Economics of Worldwide Petroleum Production", OGCL Publications, USA.

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Oil & Gas Processing System Design

Subject Code: BCIE2-863

**L T P C
3 0 0 3**

Duration: 36 Hrs.

UNIT I

Oil desalting: Operation, variables, Heater theater design.

Natural Gas Dehydration: Glycol Process: operation, effect of variables, dew point depression, stage calculation, NTU - graphical and analytical methods, Absorber sizing. Lean oil absorption. Solid-bed process: design & operation, effect of process variables, Regeneration and cooling calculations, Hydrocarbon recovery. Hydrate formation & inhibition.

UNIT II

Natural Gas Sweetening: Acid gases, Toxicity, Pipeline specification. Solid-bed Process : Design, operation & effect of variables, Adsorbent selection, Multistage Separation, Hengstebach's Flash calculation, stabilizer design, Amine and other absorptive process details.

UNIT III

Crude Oil & Condensate Stabilization: LTX Stabilization.

Oil & Gas Treatment: Oil desalter, emulsion treatment theory and practice, Emulsifiers & Demulsifiers, Gravity Separation, coalescence, coalescing media, electrostatic coalescers.

UNIT IV

Treating Equipment: Vertical, horizontal, Electrostatic, Process heat duty, Sensible heat of natural gas, Water, Heat transfer from fire-tube, Heat exchangers- types, fluid placement, sizing, number of tubes.

Books Recommended:

1. Essentials of Oil & Gas Utilities, Alireza Bahadori, Gulf Professional Publishing.
2. Handbook of Natural Gas Transmission & Processing, James G. Speight, William A. Poe, Saeid Mokhatab

**B. TECH. PETROCHEMICAL & PETROLEUM REFINERY ENGINEERING
SYLLABUS 2016 BATCH ONWARDS (UPDATED ON 24.05.2019)**

Major Project

Subject Code: BCIE2-843

**L T P C
0 0 4 2**

The project may be considered as the ultimate exercise presented to the final year semester student before graduation to measure accumulated engineering knowledge and experience, At the same time, the project it-self should provide the students with some new skills, innovation and information, and strengthen the acquired ones.

The project program consists of different assignments, allotted time, submission of report under internal faculty guidance and evaluation by external member along with internal faculty. The activities performed during a project may cover one or more of the following: **Data Collection, Critical literature review, Laboratory experience and tests, Mathematical modeling, Software application, Industrial visits, Design and assembly, Process analysis, etc.** The project topic allotted may be of theoretical, experimental or industrial projects to be carried out under the supervision of internal guide and external guide.

On completion of the project work, each student has to prepare a project report and submit the same to the department.

MRS PUNE