Course Handbook (B.Tech-2nd yr.)
(W.e.f.2016-2017)

Department of Petroleum Engineering
School of Technology
The Glocal University

Saharanpur

Department of Petroleum Engineering

Vision

To become a center of excellence for the development of the country and mankind by providing highly competitive professionals, cutting edge technologies and effective services to the academia and petroleum/hydrocarbon industry.

Mission

- To provide education and training to the students for serving at national and global levels.
- To develop a strong R&D infrastructure for solving the technological needs of the global economy and human society.
- To develop vibrant and creative learning environment to produce technically sound, ethically strong and morally elevated human resource.

Program Educational Objectives (PEOs)

1. To train engineering graduates for serving the petroleum, hydrocarbon, chemical & petrochemical industry as well as to cope with the recent challenges of energy harnessing, utilization and management with clear emphasis on sustainable environment.
2. To create the professionals for cutting-edge research work.
3. To prepare the highly moral and ethical professional graduates to serve the society.

Program Outcomes (POs)

The program outcomes include to develop:-

a. An ability to understand the application of basic sciences such as mathematics, science and engineering principles in petroleum engineering problems.
b. An ability to identify, analyze and solve engineering problems.
c. An ability to design a system or a process to meet desired needs within realistic constraints such as techno-economic, environmental and safety.
d. An ability to design and conduct experiments, analyze & interpret data.
e. An ability to use the techniques, skills, and modern tools necessary for engineering practice.
f. An ability to recognize the impact of engineering solutions in a global, economic, environmental and societal context.
g. An ability to understand the recent challenges for sustainable development.
h. An understanding of professional and ethical responsibility.

The overall credits structure
Total Credits = 165

BD Core (BC)		BD Elective (BE)	
Category	**Credits**	**Category**	**Credits**
DC	81	DE	16
BS	20	OE	16
BES	20		
HU	12		
Total	133	Total	32

Basic Science (BS) Core			
MA-101	Engg Mathematics-I	3-1-0	4
PH-101	Applied Physics	3-0-2	4
MA-102	Engg Mathematics-II	3-1-0	4
CH-101	Applied Chemistry	3-0-2	4
MA-201	Engg Mathematics-III	3-1-0	4
	Total BS Core	**15-3-4**	**20**

Basic Engineering & Sciences (BES) Core			
CS-101	Computer Concepts & C	2-1-2	4
CE-101	Environment and Ecology	2-1-0	3
ME-102	Engg. Graphics	1-0-2	2
EC-101	Basic Electrical & Electronics Engg.	2-1-0	3
ME-104	Engineering Mechanics	3-1-0	4
ME-105	Engineering Workshop	0-0-2	1
PE-302	Chemical Thermodynamics	2-1-0	3
	Total BES Core	**12-5-6**	**20**

Humanities and Social Sciences (HU)			
HU-101	Professional Communication-I	2-0-2	3
HU-102	Professional Communication-II	2-0-2	3
HU-201	Human Values and Professional Ethics	3-0-0	3
HU-202	Cyber Security	3-0-0	3
	Total HU	**10-0-4**	**12**

Discipline Core (DC)			
PE-101	Minor Project-1	0-0-2	1
PE-102	Minor Project-2	0-0-2	1
PE-201	Applied Geology	3-1-2	5
PE-202	Fundamentals of Heat transfer	3-1-2	5
PE-203	Introduction to Petroleum Operation	3-1-0	4
PE-204	Minor Project-3	0-0-2	1
PE-205	Geophysics	3-1-2	5
PE-206	Numerical Methods for Petroleum Engineers	3-1-0	4
PE-207	Mass Transfer	2-1-0	3
PE-208	Drilling Engineering & Well Completion	3-1-2	5
PE-209	Petroleum Formation Evaluation & Well Logging	3-1-2	5
PE-210	Minor Project-4	0-0-2	1
PE-301	Petroleum Production Engineering	3-1-0	4
PE-303	Petroleum Chemistry	2-1-2	4
PE-304	Directional Drilling	3-1-0	4
PE-305	Fluid flow through porous media	3-1-0	4
PE-306	Minor Project-5	0-0-4	2
PE-307	Well Testing	2-1-0	3
PE-308	Reservoir Engineering-1	3-1-2	5
PE-309	Minor Project-6	0-0-4	2
PE-3xx	Discipline Elective-1	3-1-0	4
PE-3xx	Discipline Elective-2	3-1-0	4
PE-3xx	Discipline Elective-3	3-1-0	4
XX-3xx	Open Elective-1	3-1-0	4
PE-4xx	Discipline Elective-4	3-1-0	4
XX-4xx	Open Elective-2	3-1-0	4
PE-401	Comprehensive Viva	1-0-0	1
PE-402	Summer Internship	0-0-2	1
PE-403	Major Project – 1	0-0-6	3
XX-4xx	Open Elective-3	3-1-0	4
XX-4xx	Open Elective-4	3-1-0	4

i. An ability to work in multi-disciplinary and multi-cultural teams, both as a member and leader.
j. An ability to communicate effectively through reports, presentations & discussions.
k. An ability to understand and apply engineering and management principles.
l. An ability to engage in life-long learning.

PE-404	Enhanced Oil Recovery	2-1-0	3
PE-405	Major Project– 2	0-0-10	5
	Total DC Core	**41-15-48**	**81**

Discipline Electives (DE)			
PE-310	Latest Trends in Petroleum Engineering	3-1-0	4
PE-311	Petroleum law	3-1-0	4
PE-312	Reservoir simulation	3-1-0	4
PE-313	Petroleum Refining & Petrochemicals	3-1-0	4
PE-314	Horizontal drilling	3-1-0	4
PE-315	Unconventional Resources of hydrocarbon	3-1-0	4
PE-316	Natural Gas Engineering	3-1-0	4
PE-317	Well testing and analysis	3-1-0	4
PE-318	Petroleum Economics	3-1-0	4
PE-319	Reaction Engineering	3-1-0	4
PE-406	Reservoir Engineering -2	3-1-0	4
PE-407	Optimization Techniques	3-1-0	4
PE-408	Computational Fluid Dynamics	3-1-0	4
PE-409	Process Control	3-1-0	4
PE-410	Transport Phenomena	3-1-0	4
PE-411	Pipe Line Transportation of Oil and Gas	3-1-0	4
PE-412	QHSE	3-1-0	4
PE-413	Industrial Pollution Control	3-1-0	4
PE-414	Solid waste management	3-1-0	4
PE-415	Polymer Industries	3-1-0	4
PE-416	Coal Gasification	3-1-0	4
PE-417	Energy Technology and Management	3-1-0	4
PE-418	Fuel Technology	3-1-0	4
PE-419	Non-Conventional Energy Resources	3-1-0	4
PE-420	Total Quality Management	3-1-0	4

Department of Petroleum Engg. *The Glocal University*								
Time table for 3rd Semester								
Day	**A3-210**	**A3-210**	**A3-210**	**A3-210**		**A3-210**		
	9:00 - 10:00	**10:00 - 11:00**	**11:00-12:00**	**12:00-1:00**	**1:00-2:00**	**2:00-3:00**	**3:00 -**	**4:00 - 5:00**

Second Year: 3rd Semester

Subject Code	Subject Name	Scheme of Teaching				
		L	T	P	Hours	Credit
PE-201	Applied Geology	3	1	2	6	5
PE-202	Fundamentals of Heat transfer	3	1	2	6	5
PE-203	Introduction to Petroleum Operation	3	1	0	4	4
MA-201	Engg Mathematics-III	3	1	0	4	4
HU 201	Human values & professional ethics	3	0	0	3	3
PE 204	Minor project-3	0	0	2	2	1
	Total	**15**	**4**	**6**	**25**	**22**

Second year: 4th Semester

Subject Code	Subject Name	Scheme of Teaching				
		L	T	P	Hours	Credit
PE-205	Geo-physics	3	1	2	6	5
PE-206	Numerical Methods for Petroleum Engineers	3	1	0	4	4
PE-207	Mass Transfer	2	1	0	3	3
PE-208	Drilling Engineering & Well Completion	3	1	2	6	5
PE-209	Petroleum Formation Evaluation & Well Logging	3	1	2	6	5
PE-210	Minor Project-4	0	0	2	2	1
	Total	**14**	**5**	**8**	**27**	**23**

							4:00	
Mon	Geo-Physics (UK)	Introduction to Petroleum Operation(MY)	HU-201 HVP (HF)	Applied Geology (New faculty-2)	Lunch	Fundamentals of Heat transfer (MI)	PDP	Minor Project -1
Tue	Geo-Physics (UK)	HU-201 HVP (HF)	Introduction to Petroleum Operation(MY)	M3-L (MA)		Fundamentals of Heat transfer (MI)		
Wed	Geo-Physics (UK)	Introduction to Petroleum Operation(MY)		M3-L (MA)		Applied Geology (New faculty-2)	PDP	Minor Project -1
Thu	Applied Geology (New faculty-2)	Applied Geology Lab -1(Rock and Minerals lab)(UK/New Faculty-2)		M3-L (MA)		Fundamentals of Heat transfer(MI)	Geo-Physics Lab(UK)	
Fri	Geo-Physics(UK)	HU-201 HVP (HF)	Applied Geology (New faculty-2)	M3-L (MA)		Fundamentals of Heat transfer(MI)	PDP	
Sat	Seminar/Project Presentations		Heat transfer Lab(MI/UK)			Student Activity		

SEMESTER: 3rdSemester

Course Title: Applied Geology
Course Code: PE 201
Course Duration: One semester
Marks (University Exam): 100 marks (total)
Progressive Assessment: 50 marks

Practical: Yes
Time of examination: 2 hours and 30 mins
Note for Examiner: The course schedule includes 2 lectures, 1tutorial and 1 practical.
Objective: To impart sound knowledge on nature and properties of rocks and minerals, their sedimentation pattern, sedimentary basins and geological methods in search of hydrocarbons and well site geological methods.

SN	Topic	No. of Lectures
PTE 301	UNIT I: Introduction: Age and origin of earth, interior of earth, plate tectonics, and geologic times. Sedimentary geology, Basins and Margins. Origin, accumulation and migration of petroleum. Properties of subsurface fluids. Petroleum Chemistry UNIT II: Rocks: Type of rocks and their formation, texture, minerals and properties, clay minerals, Sedimentary rocks – classification of rocks, types of sedimentary rocks, properties, sedimentation process, sedimentary environments. . UNIT III: Geomorphology: Geomorphology – concepts, processes, stratigraphy – principles, order of superposition, palaeontology and index fossils structural geology – principles, folds, faults, joints and unconformities; Geology of India. UNIT IV: Origin and distribution of petroleum -Sedimentary basins – types, origin and classifications petroleum system – Generation, Migration, Accumulations of hydrocarbons. Description of some Indian petroliferous basin. UNIT V: Testing and Analysis :Well site geological methods – sample collection & description, fluorescence, cores & core analysis, correlation and introduction to various geological maps	48

Outcome:

- Students able to understand how geologists conduct the search for petroleum resources through the value chain or the life cycle of a petroleum resource.
- Have basic understanding of broad array of tools used in the search for and production of hydrocarbon reserves

- Learn the principles of mapping a subsurface reservoir and estimating the volumetric.

Books

- F. J. Pettijohn, Sedimentary Rocks, CBS publishers, INR 338
- Jain, S. Fundamentals of Physical Geology, Springer, 2013, INR 7,696
- Winter J D. Principles of Igneous and Metamorphic Petrology, PHI publisher. INR510
- Boggs, S. 2006. Principles of Sedimentology & Stratigraphy. Pearson Prentice Hall, INR 720
- Cox, P.A., “The Elements on Earth”, Oxford University Press, Oxford 1995.

SEMESTER: 3rdSemester

Course Title: Fundamentals of heat transfer
Course Code: PTE 302
Course Duration: One semester
Marks (University Exam): 100 marks (total)
Progressive Assessment: 50 marks
Practical: Yes
Time of examination: 2 hours and 30 mins
Note for Examiner: The course schedule includes 2 lectures, 1 tutorial and 1 practical.
Objective: Analyze problems involving steady state and transient heat transfer in simple and composite geometries. Obtain numerical solutions for these heat transfer problems.

SN	Topic	No. of Lectures
PTE 302	Fundamentals of heat transfer Unit I Modes of heat transfer: Conduction, convection, radiation; Fourier's law of heat conduction, One dimensional steady state heat conduction equation for flat plate and hollow cylinder; Heat conduction through a series of resistances; Thermal conductivity – effect of temperature on thermal conductivity. Unit II Concepts of heat transfer by convection - Natural and forced convection, Dimensional analysis in heat transfer, Reynold's analogy, Prandtl and Coulburn analogy; Heat transfer coefficient for flow through pipe; Nusselt equation for vertical and horizontal tubes; Condensation – film wise and drop wise. Unit III. Theory of evaporation – single effect and multiple effect evaporation, Design calculation for single and multiple effect evaporation; Radiation heat transfer – black body radiation, Emissivity, Stefan – Boltzman law. Unit IV Types of Heat exchangers – single and multi-pass heat exchangers, Log mean temperature difference, Effectiveness of heat exchangers, Number of transfer units, fouling factors.	48

Outcome:

- Students gain knowledge in various heat transfer methodology in process engineering and to design heat transfer equipment's such as furnace, boilers and heat exchangers.
- To impart knowledge on how certain substances undergo go the change in composition, change in phases and exhibit the properties according to the changed environment.

Books

- Process Heat Transfer- Kern, McGraw Hill & Kogakusha Company.
- Unit Operations of Chemical Engineering - W L McCabe, J C Smith and P Harriott, McGrawhill.
- Chemical Engineering vol 1, 6th Ed – J M Coulson and J F Richardson with J r Backhurst and J H Harker, Elsevier.

SEMESTER: 3rd Semester

Course Title: Introduction to Petroleum Operations
Course Code: PTE 303
Course Duration: One semester
Marks (University Exam): 100 marks (total)
Progressive Assessment: 50 marks
Practical: - No
Time of examination: 2 hours and 30 mins.
Note for Examiner: The course schedule includes 3 lectures, 1 tutorial.
Objective: The course will provide deep knowledge on different Petroleum engineering basics and Operation techniques carried out in industry.

SN	Topic	No. of Lectures
PTE 303	Introduction To Petroleum Operations Search and Prospecting Pool: Geological and Geophysical Methods Chemistry of petroleum - Structure of petroleum compounds, Types – alkanes, Napthenes, paraffin, aromatics. Physical and chemical properties of oil, gas and formation water. Drilling and Petroleum: Drilling Rig, Power System, Drilling Fluid and Circulation System, Bits, Drill Pipe, Directional Drilling Well Logging, DST Casing and Cementation Perforation and Well Activation Production Tubing and Well Head Assembly Self-Flow and Artificial Methods of Production of Oil/Gas Separation and Storage Transportation, Field Processing and Refining Marketing and Distribution	**48**

Outcome: To impart basic knowledge about the various facts of Petroleum Engineering, Structure of petroleum compounds, Drilling, Formation Evaluation, Well Testing and Well site operations - Also to understand the basic Principles of Petroleum Engineering**.**

Books:

- J.CH Garry, Hardward G.E and M.J.Kaiser, Petroleum Refining: Technology and economics, CRC Press ,V Edition, 2007
- A.G.Lucas Hurley ,Modern Petroleum Technology Upstream, Edition 2002.
- A.LucasHurley, Modern Petroleum Technology Downstream, Vol II, VI Edition, 2002.

SEMESTER: 4thSemester

Course Title: Geo-Physics
Course Code: PTE 401
Course Duration: One semester
Marks (University Exam): 100 marks (total)
Progressive Assessment: 50 marks
Practical: Yes
Time of examination: 2 hours and 30 mins
Note for Examiner: The course schedule includes 2 lectures, 1 tutorial and 1 practical.
Objective: Understand and apply geological and geophysical methods for the evaluation of subsurface formations.

SN	Topic	No. of Lectures
PTE 401	Geo-Physics **Unit-1: Introduction to Geophysical Methods-Bridging the Knoledge gap-Basics of M/P/G** Properties of Matter and Energy, formulae, Measurable physical quantities, definitions, units, formulae, applications, Basic concepts of Physics, Mathematics, Geology and their relationship, Properties and applications of different types of rocks and minerals, structures, tectonics Principles Exploration Geophysics, Meaning of Geophysical anomalies. **Unit-2: Gravity Method:** Understanding the phenomena of Gravity and acceleration due to Gravity, Principle of Gravity method, variation, anomaly, Principle of Gravity meter, measurement of 'g', Gravity survey planning, Gravity data acquisition, Gravity data processing ,Gravity data interpretation	48

	Unit-3: Magnetic Method Rock magnetism, Geomagnetism, variations, Principle of magnetic method, magnetic anomaly, Principle of Magnetometers, Magnetic survey planning, data acquisition, Magnetic data processing, Magnetic data interpretation **Unit-4: Magnetotelluric Method:** Telluric currents, sources, magnetic and electric fields ,Principle of MT method, equipment, Acquisition of MT data, layouts, processing Interpretation of MT data, section preparation **Unit-5: Seismic Methods-Fundamental** Seismology, classification, application, Elastic properties, seismic waves, properties, Types of seismic waves, propagation, Fermat's and Huygens Principles, Laws of reflection- verification, Law of refraction- verification, Acoustic impedance, reflection-refraction coefficients, partition of Seismic energy, Reflection meaning, solid-fluid phases **Unit-6: Seismic Infrastructure-Procedures:** Seismic Energy sources, classification, properties, Receivers-types, working principles and ranges, Arrays, spreads, Layouts **Unit-7: Seismic Surveys- Data Acquisition:** seismic surveys, 2D, 3D,4D, 3C, 4C, 9C, MC, On-shore and Off-shore surveys, Acquisition parameters, Data recording, formats, multiplexing, 2D seismic data acquisition design **Unit-8: Seismic Data Interpretation:** Three major steps in seismic data interpretation, Seismic sequence stratigraphy interpretation, Structure and tectonic interpretation Lithological interpretation, Seismic Work-station, issues, Pit-falls in seismic data interpretation	

Outcome:

- Students develop a sound knowledge on Seismology, Seismic survey techniques for oil and gas exploration.
- Student would be able to understand: Main geophysical methods; Wave propagation – P and S waves, alteration at interfaces (reflection/refraction); Seismic method (data gathering and interpretation); Use and limits of seismic in reservoir description.

Books:

- Allen P A and J R Allen, 2005, Basin Analysis: Principles and Applications, Second edition, Wiley Blackwell
- Enwenode Onajite, 2014, Seismic Data Analysis Techniques in Hydrocarbon Exploration, Elsevier, 232 pp
- Guidelines for Application of the Petroleum Resources Management System, 2011, Joint publication of SPE, AAPG, WPC, SPEE and SEG
- Luca Cossentino, 2001, Integrated Reservoir Studies, Technip, 328 pp.
- McQuillin R., Bacon M., and Barclay W., "An Introduction to Seismic Interpretation", Gulf Publishing, 1948.
- Petroleum Society of Canada, 1994, Determination of Oil and Gas Reserves, 394 pp.
- Rao Ramchandra M. B.,1987, "Outline of Geophysical Prospecting", EBD Publishing,

SEMESTER: 4th Semester

Course Title: Numerical methods for Petroleum Engineers
Course Code: PTE 402
Course Duration: One semester
Marks (University Exam): 100 marks (total)
Progressive Assessment: 50 marks
Practical: No
Time of examination: 2 hours and 30 mins
Note for Examiner: The course schedule includes 3 lectures, 1 tutorial.
Objective: The course will provide applied knowledge of different numerical methods and simulation techniques employed in petroleum industries.

SN	Topic	No. of Lectures
PTE 402	Numerical methods for Petroleum Engineers Unit I Root finding - General iteration methods, Newton Raphson method, bisection method, Solution of system of linear equation by Gauss elimination method and Gauss Siedel method, Curve fitting. Unit I Interpolation- Newton's forward Interpolation formula, Newton's backward Interpolation formula, Newton's Interpolation formula for unequal interval, Lagrange's	48

	Interpolation formula for unequal interval. Unit III Numerical Differentiation- Newton's divided difference formula; Numerical integration-Trapezoidal rule, Simpson's rule, Weedle's rule. Numerical Solution of differential equation-Solution with Taylor's series, Euler's method, modified Euler method, Runge-Kutta method, Boundary value problems. Unit IV Graphical and analytical methods of optimization, Numerical search methods, linear programming, and Evolutionary methods of optimization.	

Outcome:

- To know about various types of Errors, Calculate the error correction and get actual root of the equation, Understand different methods of solution of the equations and compare them.
- Students will be made aware of different numerical and statistical methods which are used in engineering field, with emphasis on how to prepare program for different methods.

BOOKS:

- Sastry, S.S., "Introductory Methods of Numerical Analysis", Prentice Hall of India Pvt. Ltd., 2004.
- Edgar, Himmelblau and Lasdon, "Optimization of Chemical Processes", 2nd Ed.
- S. K. Gupta,Numerical Methods for Engineers. Wiley Eastern, New Delhi, 1995.

SEMESTER: 4th Semester

Course Title: Mass Transfer
Course Code: PTE 403
Course Duration: One semester
Marks (University Exam): 100 marks (total)
Progressive Assessment: 50 marks
Practical: - No
Time of examination: 2 hours and 30 mins
Objective: The course will provide information on different Mass Transfer Techniques employed in petroleum industries and recent advancement in the technology.it will

SN	Topic	No. of Lectures
PTE 403	Unit I **Diffusion and Interface Mass Transfer:** Molecular diffusion, steady state molecular diffusion in fluids at rest, molecular diffusion in gases-steady state diffusion: of A through non diffusing B, equimolal counter diffusion. Effect of temperature and pressure on diffusivity. Mass transfer coefficients, film theory, penetration theory, surface-renewal theories. Mass, Heat, and momentum-transfer analogies, interphase mass transfer: equilibrium, diffusion between phases, local two-phase mass transfer, local overall mass-transfer coefficients. Unit II **Distillation:** Distillation-Stage wise contact operation. Methods of distillation: batch, continuous, flash, steam, vacuum, molecular distillations. McCabe-Thiele and Ponchon-Savarit methods. Design of distillation towers. Azeotropic and extractive distillation. Elements of multi component distillation. Unit III **Absorption :** Introduction, types of tower packing's, contact between liquid and gas, pressure drop and limiting flow rates, material balances, limiting gas-liquid ratio, rate of absorption, calculation of tower height, number of transfer units, alternate forms of transfer coefficients, absorption in plate columns. Unit IV **Humidification and Drying :** Definitions, adiabatic saturator, Humidity chart, use of humidity chart, wet-bulb temperature, theory of wet-bulb temperature, psychometric line and Lewis relation, equations for gas-liquid contacts, air-water system, adiabatic humidification, application of HTU method. Overview of Extraction and adsorption. Introduction to drying.	**48**

facilitate to develop methodologies for solving a wide variety of practical engineering problems, and to provide useful information concerning the performance and design of particular systems and processes.

Outcome: On completion of this course, the students would learn to design absorber and stripper, Distillation column, extraction and leaching equipment's and adsorber

BOOKS:

- R.E. Treybal, Mass Transfer Operations, McGraw-Hill Book, 3rd Edition 1980.
- B. K. Dutta, Principles of Mass Transfer and Separation Processes, PHI, 2007.
- Wankat, P., "Equilibrium Stage Separations", Prentice Hall, 1993.
- Treybal, R.E., "Mass Transfer Operations ", 3rd Edn., McGraw-Hill, 1981.
- Geankoplis, C.J., "Transport Processes and Unit Operations", 4th Edition, Prentice Hall Inc.New Jersey, 2003.

- Seader, J.D. and E.J. Henley, “Separation Process Principles”, 2nd Ed., John Wiley, 2006.
- McCabe, W.L., Smith, J.C., and Harriot, P., “Unit Operations in Chemical Engineering”, 7th Edn. McGraw-Hill, 2005.
- King, C. J., “Separation Processes “, 2nd Edn. Tata McGraw-Hill 1980.

SEMESTER: 4th Semester

Course Title: Drilling Engineering & Well Completion
Course Code: PTE 404
Course Duration: One semester
Marks (University Exam): 100 marks (total)
Progressive Assessment: 50 marks
Practical: - No
Time of examination: 2 hours and 30 mins
Objective: To learn design aspects of drilling equipment, techniques, operational procedures for vertical, directional drilling and construction of well bore.

SN	Topic	No. of Lectures
PTE 404	**Drilling Engineering & Well Completion** Unit I Drilling and Cable Tool Drilling, Rotary Drilling Rig Components Wire Rope: Construction, Service Life, Handling Drill String, Casing Pipe, Production Tubing: Characteristics and Design Considerations Unit II Drilling Bit: Type, Feature and Coring Bit Drilling Fluid: Properties, Additives Circulation System: Pump Characteristics. Pressure Loss Calculation Drilling Practices: Straight Hole. Directional. Horizontal.; Tools and Techniques Coring: Core Barrel. Core Recovery and Handling Unit III Well Casing. Tools and Procedures Measurements While Drilling: Tools, Data Acquisition and Interpretation Drilling Complications: Blow Out; Blow out Preventers, Pipe Sticking, Causes and Remedy, Fishing Tools and Operations. Cement and Cementing: Oil Well Cement Types, Slurry Design. Primary, Stage and Squeeze Cementing Unit IV Drill stem testing Well head assembly. Testing Casing Perforation: Tools and Practices. Well Activation. Well Control System: Christmas Tree and Valves Environmental Impact. Oil Mine Safety Regulations Drilling Economics	**48**

Outcome:

- Understand basic components of drilling engineering for well planning and design
- Design the well using different parameters
- Understand well control methods and signatures of well in stability
- Know and apply codes for well design
- Understand rig hydraulics
- Apply rheological concepts for cement jobs

Books:

- Adams N.1985; Drilling Engineering: A Well Planning Approach, Penwell Publishing Company. 489 pp.
- Bourgoyne A. T, Jr. Adam T. Millheim, Martin E. Chenevert, Jr. F. S. Young.1986; Applied Drilling Engineering, SPE Text Book Series.508 pp.
- Grace, Robert D, Cudd, Garden Shurjen, 1994; Advanced Blowout and Well Control, Gulf Publishing Company. 414 pp.
- Rabia H.1995; Well Engineering and Construction. 640 pp.

SEMESTER: 4th Semester

Course Title: Petroleum Formation Evaluation & Well Logging
Course Code: PTE 405
Course Duration: One semester
Marks (University Exam): 100 marks (total)
Progressive Assessment: 50 marks
Practical: - No
Time of examination: 2 hours and 30 mins
Objective: To understand purpose, principles and applications of different logging tools and apply quick look methods of log interpretation to obtain properties of rocks and fluids.

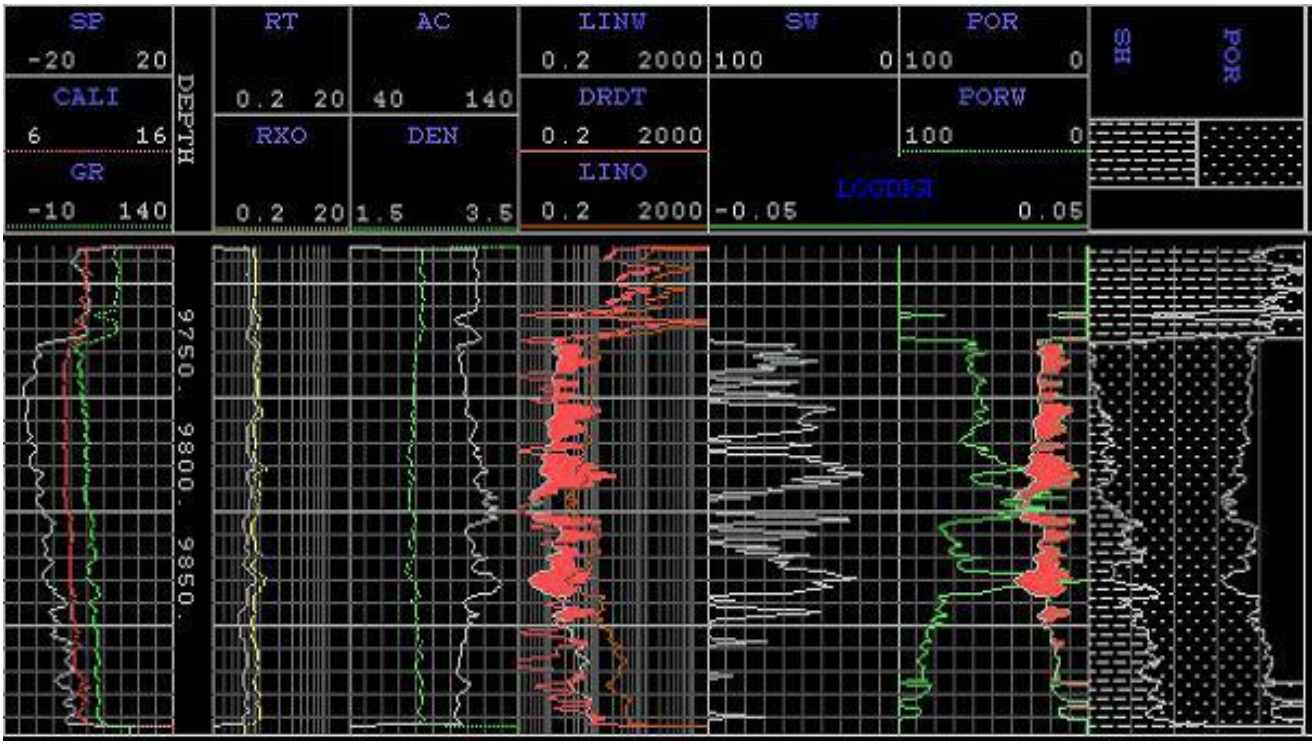
SN	Topic	No. of Lectures
PTE 405	Unit I: The Basis of well logging, Major components of logging units, Bore hole environments, Petro physical and reservoir parameters, Formation factor, Water saturation; Unit II: Open-hole logging: Self potential log-computation of formation water resistivity; Resistivity logs Focused and non-focused logs; Radioactive logs - Gamma ray, Neutron and density logs Caliper and Dip meter logs, Unit III: Principles and porosity determination; porosity logs, sonic logs, responses of resistivity and porosity logs, Pressure measurement; Cased-hole logging: Cement bond tool and its application, Qualitative and quantitative interpretations for lithology, minerals and reservoir properties. Unit IV: Use of well logs in stratigraphic correlation. New developments in well logging techniques and tools; Computer applications in log interpretation.	**48**

Outcomes:
After completing this course the student will be able to

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

Books

- Asquith George & Krygowski Daniel, 2004, Basic Well Log Analysis. USA. AAPG,
- Stefan M. Luthi, 2001, Geological Well Logs: Their Use in Reservoir Modelling, Springer, 381 pp.
- Log Interpretation, Vol. I to IV and Document VIII; Schlumberger, 1979.



GEOLOGY LABORATORY

Objective:

To demonstrate various methods involved in the preparation of structural maps and interpretation and calculation the thickness of the beds, studying depositional environment using grain size analysis and find out sediment types using Sand – Silt – Clay ratio.

List of Experiments:

- Calculation of True and Apparent Dip.
- Estimation of Thickness, Distance and Depth of the ore body.
- Estimation of Throw and Nature of the fault.

- Interpretation of surface Geology using contour maps.
- Sand – Silt – Clay ratio estimation.
- Grain – Size analysis.
- Identification of important sedimentary rocks in hand specimen.
- Identification of important sedimentary rocks in microscopic level

Outcome:
Students will be able to understand the preparation of Geological maps and identify the rock specimens by Megascopic and Microscopic, Identify the Depositional environment and Sediment types.

List of Equipment's:

- Sieve Shakers
- Sieves set.
- Petrological Microscopes
- 1000 ml and 50 ml beakers

DRILLING FLUIDS LABORATORY

Objectives:
To demonstrate the processes involved in drilling operations, introduce laboratory techniques which are used to select and optimize drilling fluids and to develop interest in experimentation.

List of experiments:

- To prepare the mud sample with given bentonite and fresh water.
- To determine the Marsh Funnel Viscosity of given mud sample.
- To determine the pH of a given mud sample
- To determine the gel strength of a mud sample.
- To determine the sand content of drilling fluid.
- To determine the Filtration Loss & Cake Thickness of given mud sample.
- To determine the Mud Density of given mud.
- To determine the Apparent Viscosity, Plastic Viscosity, Yield Point & True Yield Point of given mud

Outcome:
Students able to understand the drilling fluid equipment, Principles and operation and oil well properties.

List of Equipment's:

- Mud Mixer
- Marsh funnel
- Filter press, low pressure – Low temperature and high temperature filters
- PH meter
- Sand content kit
- Hydrometer
- Mud resistivity meter
- 1000 ml and 50 ml beakers
- Weight Machine.

GEOPHYSICS LABORATORY

Objectives:
To demonstrate the processes involved in geophysical operations, introduce laboratory techniques which are used to select and optimize geological interpretation and to develop interest in experimentation.

List of experiments:

- Study of simple seismic section
- Study of resistivity meter, gravimeter, and magnetometer.
- Preparation of different subsurface maps
- Geological data analysis.
- Exercises based on subsurface geological and geophysical data.
- Determination of total porosity and interconnected porosity and permeability.

Outcome:

- Students able to understand the geophysical equipment, Principles and operation and rock properties by analyzing geological data's.

List of Equipment's:

- Different Seismic section
- Geological data (gravity, magnetic data etc.)

Career Opportunities

Petroleum Engineering offers an opportunity to join in attractive and highly paid jobs of Oil and Gas Sector. By nature of profession, Petroleum Engineers roam all over the world. Petroleum Engineering provides a chance to peer through the Continents and Oceans. Candidate who wish a bright future and to be dynamic in life can apt for Petroleum Engineering Program. A petroleum engineer is involved in nearly all of the stages of oil and gas field evaluation, development and production. Their aim is to maximize hydrocarbon recovery at minimum cost, while maintaining a strong emphasis on reducing environmental impact.

Types of petroleum engineer

Petroleum Engineers are divided into FIVE groups: Petroleum Geologists, Reservoir Engineers, Production Engineers, Drilling Engineers and Refining Engineers.

- **Petroleum geologists**: who find hydrocarbons by analysing subsurface structures with geological and geophysical methods.
- **Reservoir engineers**: who work to optimise production of oil and gas via proper well placement, production levels and enhanced oil recovery techniques. They use computer simulations to assist in the identification of risks and to make forecasts on reservoir potential.
- **Production engineers**: who manage the interface between the reservoir and the well through such tasks as perforations, sand control, artificial lift, downhole flow control and downhole monitoring equipment. They also select surface equipment that separates the produced fluids (oil, natural gas and water).
- **Drilling engineers**: who manage the technical aspects of drilling both production and injection wells. They work in multidisciplinary teams alongside other engineers, scientists, drilling teams and contractors.
- **Plant/Refining Engineers:** Assessment of products, machinery and processes involved in plant or refinery.

Responsibilities:

The responsibilities of Petroleum Engineer are too many and hence opportunities for getting job and career improvement are plenty. Petroleum Engineers are known as King Engineers because Petroleum Engineers throughout the world are highest paid engineers. Upon experience and dynamic nature to take up challenging responsibilities, one can demand and aspire high and higher. With experience they can also work freelance engineers. In Digital Oil Fields, one can monitor several networks of stations from one's own sitting place. Petroleum Engineers have to develop a mindset of working in flexible/shift work. Off-shore assignments require pattern of shift work continuous for a period and then entitled to work-off of similar length of period.

The actual tasks carried out vary depending on the specific role but may include:

- liaising with geoscientists, production and reservoir engineers and commercial managers to interpret well-logging results and predict production potential;
- compiling detailed development plans of reservoir performance using mathematical models;
- selecting optimal tubing size and suitable equipment in the well for different functions;
- designing the completion - the part of the well that communicates with the reservoir rock and fluids;
- designing systems that help the well to flow, for example using submersible pumps;
- managing problems of fluid behavior and production chemistry;
- evaluating and recommending flow rate enhancement by using, for example, hydraulic fracturing (to force fluid into a well and fracture the rock) and acid treatment (to erode the rock and improve flow path);
- managing and controlling wells with branches at the bottom (horizontal and multilateral wells);
- using well and reservoir remote sensing technology and surveillance data to manage the value of the reservoir and decide on appropriate engineering interventions;
- understanding and managing how a set of wells interact;
- managing contractor relationships in relation to health, safety and environmental performance;
- supervising well-site operations personnel and managing staff at all levels, including the training and supervision of crew members, to ensure that everyone works as a team in order to meet deadlines to clients' satisfaction;
- liaising with separate departments to ensure correct progress with projects;
- taking responsibility for the maintenance of equipment;
- Liaising with clients to keep them informed of progress.

The job and employment outlook for petroleum engineers is quite good in both the streams i.e. upstream and downstream. Petroleum engineers have an option to obtain further education and training. Doing so will allow them to land higher-paying jobs. There are master's and doctoral degrees available on "*The Glocal University"* campus. Many companies send their employees for more training or formal education. The job opportunities doesn't end in India but also petroleum engineers are required worldwide. Few opportunities are mentioned below in different fields along with industries hiring in India and worldwide.

STREAMS	FIELD	INDIAN INDUSTRIES	FOREIGN INDUSTRIES
Upstream	Reservoir Engineering Geology and Geophysics Surveying and Exploration Production Enhanced Oil Recovery	ONGC, GAIL, HOEC, IGL, ESSAR, GGCL, PETRONET LNG Ltd, MRPL, GE Oil and Gas, Cairn, OIL, Focus Energy, , etc.	Saudi Aramco, Gazprom, NIOC, Petrochina, BP, Shell, Schlumberger,Shiv-vani,sterling, , Pemex, Chevron etc.
Downstream	Drilling Engineering Crude Refining Crude Processing and Purifying Petrochemicals Fertilizers Polymers Paints and Rubber	IOCL, HPCL, BPCL, CPCL, NRL, HMEL, RIL, Bina Refinery, Petrofac, IFFCO, NFL, quipo, John Energy, Petrotel, qmax etc.	Paraguana Refinery, Ruwais Refinery, ExxonMobil, Baytown Refinery, Abadon Refinery, Samref, MB Petroleum, Dalma Energy, Abraj, NDC etc.
Higher Studies	PhD M.Tech MBA MS	ISM Dhandbad, IITs,UPES, Glocal University, PDPU, RGPT, IIMs etc. Govt. & Corporate Institutes,……..	METU, ITMO, Texas University, Colarado school of mines, UNSW, University of Manchaster, Curtin University etc.
IT-ES	IT companies of Corporate and MNC Status	TCS, WIPPRO, TECH MAHINDRA, ,….	ACCENTURE,

"Find a trap - then drill it"