

**Course Structure of Ph. D – Petroleum Engineering  
Applicable from 2022 and Onwards**

**DIT UNIVERSITY  
Dehradun**



**Detailed Course Structure  
of**

**Ph. D – Petroleum Engineering**

## Course Structure of Ph. D – Petroleum Engineering Applicable from 2022 and Onwards

Course Category	Course Code	Course Title	L	T	P	Credit
UC	MB901	Research Methodology	4	0	0	4
UC	CPE-RPE	Research and Publication Ethics	2	0	0	2
DC	PE912	Seminar	0	0	4	2
DE	PE *	DE 1	3	0	2	4
DE	PE *	DE 2	4	0	0	4
		<b>Total</b>				16

### List of Electives

DE 1	PE 941	Drilling Engineering Hydraulics	3	0	2	4
	PE 942	Advanced Petroleum Reservoir Engineering	3	0	2	4
DE 2	PE 943	Enhanced Oil Recovery Techniques	4	0	0	4
	PE 944	Oil and Gas Economics and Risk Management	4	0	0	4

*Note: Apart from above listed Elective courses, Research Scholar may choose any course across departments being offered at PG level, if it is required/suggested by the Research Committee.*

# Course Structure of Ph. D – Petroleum Engineering Applicable from 2022 and Onwards

<b>Subject Code</b>	MB901	<b>Subject Title</b>	<b>RESEARCH METHODOLOGY</b>						
<b>LTP</b>	4 0 0	<b>Credit</b>	4	<b>Subject Category</b>	UC	<b>Year</b>	1 <sup>st</sup>	<b>Semester</b>	I / II

## Detailed Syllabus

### UNIT – I

**8L**

**Fundamentals of Research:** Defining research, Objectives of research, types, research process, deductive and inductive reasoning; Identifying and formulating a research problem, Literature review: Search for existing literature (World Wide Web, Online data bases), Review the literature selected (Case studies, review articles and Meta-analysis), Develop a theoretical and conceptual framework, Writing up the review.

Definition of variables: Concepts, indicators and variables, Types of variables, Types of measurement scales, Constructing the Hypothesis- Null(Research) and alternative, one-tailed and two-tailed testing, errors in testing. Ethical and Moral Issues in Research, Plagiarism, tools to avoid plagiarism – Intellectual Property Rights – Copy right laws – Patent rights.

### UNIT – II

**6L**

**Research Design:** Design of Experiments: Research Designs -Exploratory, Descriptive and Experimental, Experimental designs- Types of Experimental Designs.

### UNIT – III

**8L**

**Sampling, Sampling distribution, and Data Collection:** Sampling distribution, Normal and binomial distribution, Reasons for sampling, sampling technique, sampling errors. Sources of Data-Primary Data, Secondary Data, Data Collection methods

### UNIT – IV

**10L**

**Statistical Data Analysis:** Descriptive and inferential statistical analysis. Testing of hypothesis with Z-test, T-test and its variants, Chi-square test, ANOVA, Correlation, Regression Analysis, Introduction to data analysis data using SPSS20.0

### UNIT – V

**8L**

**Research Report:** Writing a research report- Developing an outline, Formats of Report writing, Key elements- Objective, Introduction, Design or Rationale of work, Experimental Methods, Procedures, Measurements, Results, Discussion, Conclusion, Referencing and various formats for reference writing of books and research papers, Writing a Research Proposal

### Text book [TB]:

1. Ganesan R, Research Methodology for Engineers , MJP Publishers, Chennai. 2011
2. C.R.Kothari, “Research Methodology”, 5th edition, New Age Publication,
3. Cooper, “Business Research Methods”, 9th edition, Tata McGraw hills publication
4. Walpole R.A., Myers R.H., Myers S.L. and Ye, King: Probability & Statistics for Engineers and Scientists, Pearson Prentice Hall, Pearson Education, Inc. 2007.

### Reference books [RB]:

1. Anderson B.H., Dursaton, and Poole M.: Thesis and assignment writing, Wiley Eastern 1997.
2. Bordens K.S. and Abbott, B.b.: Research Design and Methods, McGraw Hill, 2008.
3. Morris R Cohen: An Introduction to logic and Scientific Method Allied Publishers.

# Course Structure of Ph. D – Petroleum Engineering Applicable from 2022 and Onwards

<b>Subject Code</b>	PE941	<b>Subject Title</b>	<b>DRILLING ENGINEERING HYDRAULICS</b>						
<b>LTP</b>	3 0 2	<b>Credit</b>	4	<b>Subject Category</b>	DE	<b>Year</b>	1 <sup>st</sup>	<b>Semester</b>	I / II

## Detailed Syllabus

### UNIT 1 6L

Types of drilling fluid, components of drilling fluid system: bentonite types and hydration characteristics

### UNIT 2 5L

Fluid-loss characteristics and characteristics of Filter cake

### UNIT 3 6L

Oil-base and Saline mud system. Additives used to control drilling fluid system

### UNIT 4 7L

Oil-well cements; composition, cement slurry components

### UNIT 5 6L

Cement-slurry preparation and down hole displacement processes and system

### Text book [TB]:

1. Neal J Adams, Drilling Engineering-A complete well planning approach, Pennwell book publishing company
2. Drilling Engineering workbook by Baker Hughes
3. Larry W Wake, "Handbook of petroleum Engineering Volume-II Drilling Engineering", ISBN:978-1-55563-126-0, Society of Petroleum Engineers

### Reference books [RB]:

1. Gatlin C.; Petroleum Engineering, Drilling and Well Completions, Prentice Hall.
2. Azar, J. J., G. Robello Samuel; Drilling Engineering, Penn Well.
3. Drilling Mud and Cement Slurry Rheology Manual; Gulf Publishing Company.
4. Smith.P.K'Cementing' SPE Pulications 2nd Edition 1976

# Course Structure of Ph. D – Petroleum Engineering

## Applicable from 2022 and Onwards

<b>Subject Code</b>	PE942	<b>Subject Title</b>	<b>ADVANCED PETROLEUM RESERVOIR ENGINEERING</b>						
<b>LTP</b>	3 0 2	<b>Credit</b>	4.0	<b>Subject Category</b>	DE	<b>Year</b>	1 <sup>st</sup>	<b>Semester</b>	I / II

### Detailed Syllabus

#### UNIT 1

**6L**

Reservoir rock properties: Measurement of Porosity and packing arrangement, Permeability and combination of permeability in parallel & series beds, Porosity permeability relationship, Klinkenberg effect, Capillary pressure, Capillary hysteresis, Interfacial tension measurement: evaluation. Fluid saturation, Effective and relative permeability, Wettability, Evaluations and significance, WOC, GOC and Transition zone.

#### UNIT 2

**6L**

Reservoir Fluid System: Volumetric and phase behavior of multi-component oil/ gas system, Formation volume factor for oil and gas and evaluation & significance, Viscosity of oil & gas, Reservoir fluid sampling methods, PVT properties: measurement, estimation and application, Gas compressibility factor, Standing & Katz Chart.

#### UNIT 3

**6L**

Fluid flow through Porous media: Darcy's law, Single and multi-phase system, Linear, Radial and Spherical flow, Oil and gas field development: Water flood performance, Injection-Production wells distribution patterns and characteristics

#### UNIT 4

**6L**

Reservoir drives: Depletion drive, water drive, gas cap drive, combination drive, and recovery factor, Reserve estimation: Resource and reserve, SPE classification of reserve, Volumetric reserve estimation and MBE. Havlena and Odeh method, Rock and fluid compressibility factor; Recovery factor estimation.

#### UNIT 5

**8L**

Immiscible displacement process: Fractional flow and fractional displacement process in linear reservoir, Buckley and Leverett treatment Reservoir, Decline curve analysis. Gas, gas-condensate and oil reserves: Identification from fluid composition, Performance of volumetric reservoir, Production characteristics.

#### Text book [TB]:

1. Fundamentals of Reservoir Engineering, L.P. Dake, Elsevier Science, 1978 (17th Impression 1998).
2. B. C. Craft – M. Hawkins Applied Petroleum Reservoir Engineering, Third Edition, Revised by Ronald E. Terry & J. Brandon Rogers Prentice Hall, New York, 2014.

#### Reference books [RB]:

1. Reservoir Engineering Handbook, Tarek Ahmed, 3 rd Edition, Gulf Professional Publishing, 2006.
2. Petroleum Reservoir Engineering, James W Amyx, Daniel M. Bass Jr., Robert L. Whiting, McGraw Hill, 1960.
3. Petroleum Engineering: Principles and Practice, J.S Archer & C.G. Wall, Graham & Trotman Inc. 1986.
4. Oil & Gas Field Development, Dr. Santkumar.
5. Petroleum Reservoir Engineering, James.W. Amyx

# Course Structure of Ph. D – Petroleum Engineering Applicable from 2022 and Onwards

<b>Subject Code</b>	PE943	<b>Subject Title</b>	<b>ENHANCED OIL RECOVERY TECHNIQUES</b>						
<b>LTP</b>	4 0 0	<b>Credit</b>	4	<b>Subject Category</b>	DE	<b>Year</b>	1 <sup>st</sup>	<b>Semester</b>	I / II

## Detailed Syllabus

### UNIT 1

**8L**

Principles and Mechanism. Screening criteria, Macroscopic displacement of fluids: Areal sweep efficiency. Vertical sweep efficiency Displacement efficiency, mobility ratio, well spacing.

### UNIT 2

**8L**

Water flooding in reservoir: Equation of motion. Continuity, solution methods, Pattern flooding, recovery etc., permeability heterogeneity.

### UNIT 3

**7L**

Chemical flooding: Polymer flood; mobility control in-situ permeability modification, foam flooding; WAG process. Surfactant flooding, miscellar/polymer flooding, micro emulsion phase behavior, wettability modification, Alkaline flooding.

### UNIT 4

**9L**

Miscible displacement processes – miscibility condition, high pressure gas injection, enriched gas injection, LPG flooding, carbon dioxide flooding, alcohol flooding.

### UNIT 5

**8L**

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

### Text book [TB]:

1. Bradley H B, Petroleum Engineering Handbook, third edition, SPE.
2. Enhanced Oil Recovery; Teknica; Teknica Petroleum Services Ltd.; Calagry, Alberta.

### Reference books [RB]:

1. Lake L., “Enhanced Oil Recovery”.
2. Green D W and Willhite G P, “Enhanced Oil Recovery”, SPE, 2003, 556 pp.

# Course Structure of Ph. D – Petroleum Engineering Applicable from 2022 and Onwards

<b>Subject Code</b>	PE 944	<b>Subject Title</b>	<b>OIL AND GAS ECONOMICS AND RISK MANAGEMENT</b>						
<b>LTP</b>	4 0 0	<b>Credit</b>	4	<b>Subject Category</b>	DE	<b>Year</b>	1 <sup>st</sup>	<b>Semester</b>	I / II

## Detailed Syllabus

### UNIT 1

**8L**

Introduction: The development of Oil & Gas Industry, Structure of Oil & Gas Industry, India Hydrocarbon vision 2025; Petroleum Resource classification, Analysis of resource management.

### UNIT 2

**8L**

Natural Gas: Introduction, Natural Gas Measurements; Demand, Supply & Storage of natural gas: Gas production, Source of demand in India, The supply system, Gas Sales Pattern in India, Gas Pipeline Regulations in India, Gas Trading, Gas Pricing.

### UNIT 3

**8L**

International & National Institutions of Oil & Gas: API,OPEC, OECD, OADB, DGH, PNGRB, CHT, PII, PPAC, PCRA.

### UNIT 4

**8L**

Petroleum Contracts: NELP - Role & Background , Types of Contracts and fiscal components, Production sharing contracts in India, Crude Oil trading and pricing, CBM Contracts.

### UNIT 5

**8L**

Trade Practices & Taxation: Norms on various trade practices, Elements of Petroleum Development Policy, Financial and taxation issues; Risk Management: source of risk, managing risks by risk reduction, diversification, and uncertainty and decision analysis by decision tree.

### Text book [TB]:

1. Petroleum Resource Management System.
2. Model Production Sharing Contract.

### Reference books [RB]:

1. K. A. Alal and Mohamed A - Petroleum and Gas Field development.
2. Satter Abdus; Integrated Petroleum Reservoir Management.