

**SYLLABUS
OF
Ph.D.
PRE-REGISTRATION COURSEWORK
PROGRAMME
2023-24**



**DEPARTMENT OF PETROLEUM TECHNOLOGY
FACULTY OF EARTH SCIENCES AND ENERGY
DIBRUGARH UNIVERSITY**

Annexure II

COURSE STRUCTURE & EXAMINATION PATTERN OF THE Ph.D. PROGRAMMES

1. There shall be four Courses in One-Semester Course work for the Ph.D. programmes conducted in Dibrugarh University comprising with the following components:

- Course I : Research Methodology (Core)
- Course II : Optional (Intra/ Inter-Departmental)
- Course III : Optional (to be offered by the prospective Supervisor concerned)
- Course IV : Assignment (under guidance of the prospective Supervisor concerned)

Provided that, the total credit of the Ph.D. Pre-Registration Course Work should be within the range of 16-20 Credit.

2. The syllabi for the Ph.D. Course Work shall be prepared by the DRC and through the School Board concerned and shall come into effect after approval of the Post Graduate Board, Dibrugarh University.

3. The distribution of marks of the course work shall be as below:

Courses	Internal Assessment	End Semester examination	Total Weightage
Course I	40%	60%	100%
Course II	40%	60%	100%
Course III	40%	60%	100%
Course IV	80% (assignment writing)	20% (viva on the assignment)	100%
Total Credit (16-20)			

4. Candidates shall have to secure a minimum of 45% marks in aggregate to pass a paper individually.
5. The mode of Internal Assessment (IA) shall be decided and implemented by the Department/Centre concerned. The mode of IA shall have to be communicated to the Controller of Examinations, Dibrugarh University at the time of submission of IA marks.
6. Examination & Declaration of Results:
- (a) The IA of a student shall be conducted by the course teacher of the student concerned. The marks of the IA shall be submitted to the Controller of Examinations, Dibrugarh University by the Head of the Department/ Director of the Centre concerned.
 - (b) The End Semester examinations shall be conducted by the Controller of Examinations, Dibrugarh University in consultation with the Head of the Department/ Director of the Centre concerned.
 - (c) The result shall be declared by the Controller of Examinations.
 - (d) The examinations shall be conducted as per the existing examination ordinance of the University.

7. The result of the candidates appeared in the examination for Ph.D. Course Work shall be awarded in the following Grade system:

Letter Grade with meaning		Grade Point
O	Outstanding	10 (Marks securing above 95%)
A ⁺	Excellent	9 (Marks securing 90%-95%)
A	Very Good	8 (Marks securing 80%-90%)
B ⁺	Good	7 (Marks securing 70%-80%)
B	Above Average	6 (Marks securing 60%-70%)
C	Average	5 (Marks securing 50%- 60%)
P	Pass	4 (Marks securing 45%- 50%)
F	Fail	0 (Marks securing below45%)
Ab	Absent	0

A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

8. Every candidate shall be given a maximum of two consecutive chances (including the first regular chance) for passing the examination. Not appearing in an examination after becoming eligible to appear in the same amounts to losing a chance.
9. The candidates who have failed the examination in the first chance shall have to clear the same in the second and last chance, which shall be held within three months from the date of declaration of results.

A candidate shall have to appear in the second chance only in the failed paper(s) to pass the examination.

10. The candidates passed in the Ph.D. Pre-registration Course Work with not below the Latter Grade B shall be eligible to go for Ph.D. registration.
11. Matters not covered by the above Regulations shall be decided as per the other statutory provisions of the University.

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Course Structure of Ph.D. Pre-Registration Coursework:

Course I: Research Methodology (Core)

**Course II: Optional (Intra/Inter-Departmental)
(Anyone)**

- **Petroleum Geology**
- **Production Engineering**
- **Reservoir Engineering-I**
- **Drilling Technology**
- **Production Technology-I**

**Course III: Optional (to be offered by the prospective Supervisor concerned)
(Anyone)**

- **Petroleum Sedimentology**
- **Reservoir Engineering-II**
- **Clean Energy**
- **Drilling Fluids Technology**
- **Production Technology-II**

Course IV: Assignment (under guidance of the prospective Supervisor concerned)

DEPARTMENT OF PETROLEUM TECHNOLOGY

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Ph.D. Course-work

Course I

Title of the Course: RESEARCH METHODOLOGY (CORE)

Marks: 60 (End) + 40 (In) = 100

Unit I: Research Methodology- an introduction (Dr. P. Borgohain & Dr. D.J. Neog)

Meaning and Objectives of Research, Motivation in Research, Types of Research, Significance of Research, Research Methods versus Methodology, Criteria of Good Research, Problems Encountered by Researchers in India, Research Problem, Features of Good Research Design.

Unit II: Methods of Data Collection (Dr. R. Phukan & Dr. B.M. Das)

Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection. Review of previous work and literature

Unit III: Interpretation and Report Writing (Dr. S.B. Gogoi & Dr. P. Talukdar)

Meaning and Technique of Interpretation, Precaution in Interpretation, Different Steps in Writing Report, Types of Reports, Oral Presentation, Precautions for Writing Research Reports. References & Bibliography, Citation index of Publication

Unit IV: Role of computer in Research (Dr. N. Medhi)

Computer application, Software application

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Ph.D. Course-work

Course II (Optional)

Title of the Course: PETROLEUM GEOLOGY

Name of Course Teacher : Dr. Pradip Borgohain

Marks: 60 (End) + 40 (In) = 100

- Unit I:** Origin, types and composition of Petroleum. Unconventional hydrocarbons.
- Unit II:** Depositional environment and its impact on reservoir characteristics.
- Unit III:** Measurement of statistical grain size parameters and their influence on textures of reservoir rocks
- Unit IV:** Provenance study and their role in characterisation of reservoir rock. Heavy minerals.
- Unit V:** Distribution of Oil & gas fields in N-E India. Future exploration targets in NE India
- Unit VI:** Collection of data before, during and after drilling a well. Geological mapping-measurement of dip & strike and thickness of beds.

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Ph.D. Course-work

Course II (Optional)

Title of the Course: PRODUCTION ENGINEERING

**Name of Course Teacher: Dr. (Mrs.) Subrata Borgohain Gogoi &
Dr. Prasenjit Talukdar**

Marks: 60 (End) + 40 (In) = 100

- UNIT I:** Displacement mechanism in homogeneous and heterogeneous reservoirs, Injection well location including central and peripheral flooding, pattern flooding, areal sweep efficiency for pattern flood, unit mobility ratio, non-unit mobility ratio.
- UNIT II:** Enhanced Oil Recovery by miscible displacement, thermal recovery, Chemical recovery and other methods
- UNIT III:** Modelling & Simulation of 2D and 3D displacement using different software's.
- UNIT IV:** Development of images of velocity vectors and pressure contours in ANSYS FLUENT and designing flow parameters in Design Expert, Grapher and CalcPlot3D

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Course II (Optional)

Title of the Course: RESERVOIR ENGINEERING-I

Name of Course Teacher: Dr. Ranjan Phukan & Dr. Nayan Medhi

Marks: 60 (End) + 40 (In) = 100

UNIT I: Fluid flow in reservoirs:

Darcy's law; Classification of reservoir flow systems; Steady-state flow equations for the flow of incompressible, compressible, and slightly compressible fluids.

UNIT II: Solutions to the radial diffusivity equation:

Unsteady-state flow and derivation of radial diffusivity equation CTR solutions to diffusivity equations; Pseudo steady-state flow equations; Principle of superposition, Transient well testing.

UNIT III: Reservoir Drive Mechanisms:

Primary recovery mechanisms and their effects on the performances of oil reservoirs.

UNIT IV: Principles of Waterflooding - conventional and hybrid methods.

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Course II (Optional)

Title of the Course: DRILLING TECHNOLOGY

Name of Course Teacher: Dr. Borkha Mech

Marks: 60 (End) + 40 (In) = 100

- UNIT I:** Introduction to oil well drilling, drilling process, directional wells, oil well drilling rigs, onshore/offshore, rig components and arrangement, subsurface conditions, pressure relations within formation and well bore, geo-mechanics, and fracture pressure, well control fundamentals.
- UNIT II:** Drill string, components, design factors, drill bit, types/classification & selection.
- UNIT III:** Casing, types and functions, components and accessories, casing policy, casing load analysis and design.
- UNIT IV:** Cementing, types of cement, cement slurry, additives, equipment, cementing operation, design of cement job.
- UNIT V:** Drilling Optimization

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Course II (Optional)

Title of the Course: PRODUCTION TECHNOLOGY-I

Name of Course Teacher: Dr. Dhruvajyoti Neog

Marks: 60 (End) + 40 (In) = 100

UNIT I: Self flowing & Artificial lift methods:

Self-flowing mechanisms, artificial lift-types, Gas lift, SRP, ESP, Jet Pump

UNIT II: Improved Oil Recovery:

Secondary recovery-water flooding & gas injection, Enhanced Oil Recovery-types & selection mechanisms

UNIT III: Flow assurance:

Sick wells, problem well types and solutions (water and gas cut, scale formation, high viscosity oil), different issues behind limited production rate.

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Course III (Optional)

Title of the Course: PETROLEUM SEDIMENTOLOGY

Name of Course Teacher: Dr. Pradip Borgohain

Marks: 60 (End) + 40 (In) = 100

- UNIT I:** Classification of sedimentary rocks. Sandstone diagenesis and its impact on reservoir characteristics
- UNIT II:** Types of organic matters in sediments, Role of time and temperature in maturation of sediments (TTI)
- UNIT III:** Hydrocarbon Source Rock analysis: TOC, whole rock analysis and kerogen analysis
- UNIT IV:** Well logging and their application in reservoir studies.
- UNIT V:** Structure contour map, isopach map, iso-facies map and its application. Application of Scanning Electron Microscope (SEM) in reservoir studies

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Course III (Optional)

Title of the Course: RESERVOIR ENGINEERING-II

Name of Course Teacher: Dr. Ranjan Phukan

Marks: 60 (End) + 40 (In) = 100

UNIT I: Reservoir Rock and Fluid Properties

Phase behaviour and phase diagrams; Fluid composition and fluid types classification; Natural gas properties; Crude oil properties; Formation water properties; Porosity; Permeability; Fluid saturations; Wettability; Surface forces and Capillary pressure; Rock Compressibility.

UNIT II: Routine and special core analysis:

Core preparation; Routine core analysis for the determination of porosity and permeability of reservoir cores; Special core analysis like IOR/EOR studies, wettability determination, and reservoir condition core floods.

UNIT III: Laboratory analysis of reservoir fluids.

UNIT IV: Reservoir engineering aspects of enhanced oil recovery methods

Fractional flow equation; Buckley-Leverett frontal advance equation; Oil recovery mechanisms; Concepts of enhanced oil recovery methods.

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Ph.D. Course-work

Course III (Optional)

Title of the Course: CLEAN ENERGY

Name of Course Teacher: Dr. (Mrs.) Subrata Borgohain Gogoi

Marks: 60 (End) + 40 (In) = 100

UNIT I: Types of clean energies

UNIT II: Importance of Unconventional Gas Reservoirs including Gas Hydrates: Phase stability, Kinetics, Prevention for flow assurance, Storage and Transportation, Roles and Applications. Shale Gas: Properties, Exploration Technique, Fracking, Roles and Applications.

UNIT II: Natural Gas as an Alternative Fuel w.r.t. Methanol, ethanol, dimethyl ether production and compatibility with fossil fuel.

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Ph.D. Course-work

Course III (Optional)

Title of the Course: DRILLING FLUIDS TECHNOLOGY

Name of Course Teacher: Dr. Borkha Mech

Marks: 60 (End) + 40 (In) = 100

UNIT I: Introduction to Drilling fluids:

Functions, types, composition, and properties, drilling fluid additives and treatment, drilling fluid calculations.

UNIT II: Clay mineralogy and chemistry of drilling fluids, rheology, and filtration property of drilling fluids.

UNIT II: Rig Hydraulics

Pressure losses, Surface connection losses, pipe and annular pressure losses, pressure drop across bit, optimization of bit hydraulics.

UNIT III: Drilling complications

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Course III

Title of the Course: PRODUCTION TECHNOLOGY-II

Name of Course Teacher: Dr. Dhruvajyoti Neog

Marks: 60 (End) + 40 (In) = 100

- UNIT I:** Oil Recovery Methods:
Self-flowing & Artificial lift methods, Secondary recovery-water flooding & gas injection, Enhanced Oil Recovery-types & selection mechanisms
- UNIT II:** Well completion & performance evaluation:
Well completion, completions-Gas Lift, SRP, ESP, Jet Pump, Multi-zone completion, well activation, Drawdown and Productivity Index (PI), Specific Productivity Index (SPI), Inflow performance relationship (IPR), vertical lift performance-flow regime in vertical two-phase flow, stable and unstable flowing conditions, choke performance, Nodal analysis.
- UNIT III:** Sick well analysis:
Sick wells, issues behind limited production rates, water production problems in oil wells, mechanical failures, and problem well analysis checklist.
