

COURSE STRUCTURE and SYLLABUS

For

4 Year B.Tech and B.Tech (Hons)

Degree in Petroleum Engineering

(Approved by 90th Academic Council On 05.05.2015)

TO BE IMPLEMENTED FROM SESSION

(2015 – 2016)



**DEPARTMENT OF PETROLEUM ENGINEERING
INDIAN SCHOOL OF MINES
DHANBAD 826004**

**COURSE STRUCTURE OF III SEMESTER B. Tech PETROLEUM ENGG
(Effective from 2015– 16 session)**

Sl.No.	Course No.	Name of the course	L	T	P	Credit Hrs.
1	MMR 13101	Mechanical Engineering – I	3	1	0	7
2.	AMR 13101	Methods of Applied Mathematics – I	3	1	0	7
3.	GLC 13152	Geology for Petroleum Engineers	3	0	0	6
4	PEC 13101	Drilling Fluids & Cements	3	1	0	7
5.	PEC 13102	Drilling Technology	3	1	0	7
6.	PEC 13201	Petroleum Engineering Practical- I (Drilling Fluids Lab)	0	0	2	2
7.	GLC 13252	Geology for Petroleum Engineers Practical	0	0	2	2
8.	PEC13801	Project and Term Paper	0	0	0	(2)
9.	HSE	Humanities and Social Sciences Optional papers: (Sessional Theory Paper) Any one of the following	3	0	0	6
i.	HSE 13301	History of Science and Technology				
ii.	HSE 13302	Philosophy of Science.				
iii.	HSE 13303	Gandhian Studies				
iv.	HSE 13304	Oral Communication Skills				
v.	HSE 13305	Oral Presentation Skills				
vi.	HSE 13306	Literary Communication				
vii.	HSE 13307	Present History of India				
		Total Contact Hours = 26	18	4	4	44 + (2) = 46

**COURSE STRUCTURE OF IV SEMESTER B. Tech PETROLEUM ENGG.
(Effective from 2015 – 16 session)**

Sl. No.	Course No.	Name of the course	L	T	P	Credit Hrs.
1.	MMR 14101	Mechanical Engineering – II	3	1	0	7
2.	AMR 14101	Numerical and Statistical Methods	3	1	0	7
3.	PEC14101	Petroleum Production Operations-I	3	1	0	7
4.	PEC14102	Elements of Reservoir Engineering	3	1	0	7
5.	MSR 14151	Managerial Economics	3	0	0	6
6.	MER 14103	Surveying (Sessional Theory Paper)	3	0	0	6
7.	HSC 14306	English for Professional Communication (Sessional Theory Paper)	3	0	0	6
8.	PEC14201	Petroleum Engineering Practical-II (Reservoir Engineering Lab)	0	0	2	2
9.	MER 14203	Surveying Practical	0	0	2/2	1
10.	PEC 14601	Educational Excursion	0	0	0	(2)
11.	PEC14801	Project and Term Paper	0	0	0	(2)
12.	PEC14501	Composite Viva-Voce	0	0	0	(4)
13.	SWC 14701	Co-curricular Activities	0	0	0	(3)
		Total Contact Hours = 28	21	4	3	49+(11) = 60

**COURSE STRUCTURE OF V SEMESTER B. Tech PETROLEUM ENGG.
(Effective from 2015 – 16 session)**

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC 15101	Applied Petroleum Reservoir Engineering and Management	3	1	0	7
2.	PEC 15102	Petroleum Production Operations-II	3	1	0	7
3.	GLC 15153	Sedimentary and Petroleum Geology	3	0	0	6
4.	AMR 15101	Methods of Applied Mathematics – II	3	1	0	7
5.	PEC 15201	Petroleum Engineering Practical – III (Production & Product Testing Lab)	0	0	2	2
6.	GLC 15253	Sedimentary and Petroleum Geology Practical	0	0	2/2	1
7.	PEC15801	Project and Term Paper	0	0	0	(4)
		Total Contact Hours = 18	12	3	3	30 + (4) = 34

**COURSE STRUCTURE OF V SEMESTER B. Tech (Hons) PETROLEUM ENGG.
(Effective from 2015 – 16 session)**

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC 15101	Applied Petroleum Reservoir Engineering and Management	3	1	0	7
2.	PEC 15102	Petroleum Production Operations-II	3	1	0	7
3.	GLC 15153	Sedimentary and Petroleum Geology	3	0	0	6
4.	AMR 15101	Methods of Applied Mathematics – II	3	1	0	7
5.	PEH 15103	Reservoir Fluid Thermodynamics	3	1	0	7
6.	ACH 15303	Physical Chemistry (Sessional Theory Paper)	2	0	0	4
7.	PEC 15201	Petroleum Engineering Practical – III (Production & Product Testing Lab)	0	0	2	2
8.	GLC 15253	Sedimentary and Petroleum Geology Practical	0	0	2/2	1
9.	PEC15801	Project and Term Paper	0	0	0	(4)
		Total Contact Hours = 24	17	4	3	41 + (4) = 45

COURSE STRUCTURE OF VI SEMESTER B.Tech PETROLEUM ENGG.
(Effective from 2015 – 16 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC16101	Directional Drilling	3	1	0	7
2.	PEC16102	Petroleum Formation Evaluation	3	1	0	7
3.	AMR 16101	Advanced Numerical Methods	3	1	0	7
4.	EER 16101	Applied Electrical Engineering	3	0	0	6
5.	PEC16201	Petroleum Engineering Practical – IV Process Lab Practical/ Simulation and Modeling Lab	0	0	3	3
6.	PEC16501	Composite Viva Voce	0	0	0	(4)
7.	PEC16801	Project & Term Paper	0	0	0	(4)
		Total Contact Hours = 18	12	3	3	30+(8)=38

COURSE STRUCTURE OF VI SEMESTER B.Tech (Hons) PETROLEUM ENGINEERING
(Effective from 2015 – 16 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC16101	Directional Drilling	3	1	0	7
2.	PEC16102	Petroleum Formation Evaluation	3	1	0	7
3.	PEH16103	Natural Gas Engineering	3	1	0	7
4.	AMC 16101	Advanced Numerical Methods	3	1	0	7
5.	EER 16101	Applied Electrical Engineering	3	0	0	6
6.	PEH 16301	Energy Management & Policy (Sessional Theory Paper)	1	2	0	4
7.	PEC16201	Petroleum Engineering Practical – IV Process Lab Practical/ Simulation and Modeling Lab	0	0	3	3
8.	PEC16501	Composite Viva Voce	0	0	0	(4)
9.	PEC16801	Project and Term Paper	0	0	0	(4)
		Total Contact Hours = 25	16	6	3	41+(8)=49

COURSE STRUCTURE OF VII SEMESTER B.Tech PETROLEUM ENGG.
(Effective from 2016– 17 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC17101	Oil and Gas Well Testing	3	1	0	7
2.	PEC 17102	Offshore Drilling and Petroleum Production Practices	3	1	0	7
3.	PEC 17103	Health Safety and Environment in Petroleum Industry	3	0	0	6
4.		Elective paper	3	0	0	6
5.	GPD 17163	Petroleum Exploration – Geophysical Methods (Sessional Theory Paper)	2	0	0	4
6.	GLD 17154	Petroleum Exploration – Geological Methods (Sessional Theory Paper)	2	0	0	4
7.	PEC17801	Petroleum Engineering Projects	0	0	0	(6)
8.	PEC17901	Vocational Training*	0	0	0	(5)
		ELECTIVES: ANY ONE OF FOLLOWING				
i.	PEE17101	Transportation and Marketing of Petroleum and Petroleum Products				
ii.	PEE17102	Well Performance and Intervention				
iii.	PEE17103	Drilling System Design				
		Total Contact Hours = 18	16	2	0	34+(11) = 45

* Vocational Training taken and Internship are credited in VII Semester.

COURSE STRUCTURE OF VII SEMESTER B.Tech (Hons) PETROLEUM ENGINEERING
(Effective from 2016– 17 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC17101	Oil and Gas Well Testing	3	1	0	7
2.	PEC 17102	Offshore Drilling and Petroleum Production Practices	3	1	0	7
3.	PEC 17301	Health Safety and Environment in Petroleum Industry	3	0	0	6
4.	MSH 17152	Industrial Engg. and Management	3	1	0	7
5.		Elective Paper – 1	3	0	0	6
6.	GPD 17163	Petroleum Exploration – Geophysical Methods (Sessional Theory Paper)	2	0	0	4
7.	GLD 17154	Petroleum Exploration – Geological Methods (Sessional Theory Paper)	2	0	0	4
8.	PEC 17801	Petroleum Engineering Projects	0	0	0	(6)
9.	PEC17901	Vocational Training*	0	0	0	(5)
		ELECTIVES: ANY ONE OF FOLLOWING				
i.	PEE17101	Transportation and Marketing of Petroleum and Petroleum Products				
ii.	PEE17102	Well Performance and Intervention				
iii.	PEE17103	Drilling System Design				
		Total Contact Hours = 22	19	3	0	41+(11) = 52

* Vocational Training and Internship taken are credited in VII Semester.

COURSE STRUCTURE OF VIII SEMESTER B.Tech PETROLEUM ENGG.
(Effective from 2016 – 17 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC 18101	Petroleum Engineering Design	3	1	0	7
2.	PEC18102	Enhanced Oil Recovery Techniques	3	1	0	7
3.	PEC18104	Pipeline Engineering	3	1	0	7
4.		Elective Paper	3	0	0	6
6.	PEC18801	Petroleum Engg. Projects and Seminar	0	0	0	(6)
7.	PEC18501	Composite Viva Voce	0	0	0	(4)
		ELECTIVES: ANY ONE OF FOLLOWING				
i.	PEE 18101	Oil and Gas Processing System Design				
ii.	PEE18102	Coal Bed Methane, Gas Hydrates & Shale Gas/ Oil				
iii.	PEE18103	Advanced Offshore Engineering				
iv.	PEE18104	Oil and Gas Marketing and Resource Management				
v.	PEE18105	Deep Sea Production System				
		Total Contact Hours = 15	12	3	0	27+(10) = 37

COURSE STRUCTURE OF VIII SEMESTER B.Tech (Hons) PETROLEUM ENGG.
(Effective from 2016 – 17 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC 18101	Petroleum Engineering Design	3	1	0	7
2.	PEC18102	Enhanced Oil Recovery Techniques	3	1	0	7
3.	PEH18103	Reservoir Modeling and Simulation	3	0	0	6
4.	PEC18104	Pipeline Engineering	3	1	0	7
5.		Elective Paper	3	0	0	6
6.	PEH18304	Oil and Gas Marketing and Resource Management (Sessional Theory paper)	3	0	0	6
7.	PEC18801	Petroleum Engg. Projects and Seminar	0	0	0	(6)
8.	PEC18501	Composite Viva Voce	0	0	0	(4)
		ELECTIVES: ANY ONE OF FOLLOWING				
i.	PEE 18101	Oil and Gas Processing System Design				
ii.	PEE18102	Coal Bed Methane, Gas Hydrates & Shale Gas/ Oil				
iii.	PEE18103	Advanced Offshore Engineering				
iv.	PEE18105	Deep Sea Production System				
		Total Contact Hours = 21	18	3	0	39+(10) = 49

**COURSE STRUCTURE OF III SEMESTER B. Tech PETROLEUM ENGG
(Effective from 2015– 16 session)**

Sl.No.	Course No.	Name of the course	L	T	P	Credit Hrs.
1	MMR 13101	Mechanical Engineering – I	3	1	0	7
2.	AMR 13101	Methods of Applied Mathematics – I	3	1	0	7
3.	GLC 13152	Geology for Petroleum Engineers	3	0	0	6
4	PEC 13101	Drilling Fluids & Cements	3	1	0	7
5.	PEC 13102	Drilling Technology	3	1	0	7
6.	PEC 13201	Petroleum Engineering Practical- I (Drilling Fluids Lab)	0	0	2	2
7.	GLC 13252	Geology for Petroleum Engineers Practical	0	0	2	2
8.	PEC13801	Project & Term Paper	0	0	0	(2)
9.	HSE	Humanities and Social Sciences Optional papers: (Sessional Theory Paper) Any one of the following	3	0	0	6
i.	HSE 13301	History of Science and Technology				
ii.	HSE 13302	Philosophy of Science.				
iii.	HSE 13303	Gandhian Studies				
iv.	HSE 13304	Oral Communication Skills				
v.	HSE 13305	Oral Presentation Skills				
vi.	HSE 13306	Literary Communication				
vii.	HSE 13307	Present History of India				
		Total Contact Hours = 26	18	4	4	44 + (2) = 46

COURSE SYLLABUS

COURSE NO.	COURSE NAME	L	T	P
MMR 13101	MECHANICAL ENGINEERING – I	3	1	0

COURSE CONTENT:

Introduction to Strength of Materials; Stress-strain diagram; Elastic constants and their relations, Thermal stresses and strains; Stresses in oblique planes- Principal stresses and principal planes. Theory of simple bending; Deflection of beams-integration method and moment area method. Analysis of stresses in pressure vessels - thin and thick cylinders. Torsion of solid and hollow circular shafts.

Introduction to theory of Machines; Basic concepts; degrees of freedom, kinematic constrains, linkages, mechanisms. Different types of gears, gear trains, reduction ratio and torque assessment, application of gearboxes. Basic principles and constructions of governors, flywheels, brakes, clutches and dynamometers.

Case study based on laboratory setups on the above broad areas.

COURSE NO.	COURSE NAME	L	T	P
AMR 13101	METHODS OF APPLIED MATHEMATICS – I	3	1	0

COURSE CONTENT:

Part-I:

Complex Variables:

Limit, continuity and differentiability of function of complex variables. Analytic functions. Cauchy-Riemann's equations, Cauchy's integral theorem, Morera's theorem, Cauchy's integral formula, Taylor's and Laurent's series, singularities, Residue theorem, contour integration.

Special Functions:

Solution of Bessel equation, recurrence relations and generating function for $J_n(x)$, orthogonal property and integral representation of $J_n(x)$. Solution for Legendre equation, Legendre polynomial, Rodrigue's formula, orthogonality property and generating function for $P_n(x)$.

Part-II:

Laplace Transform:

Laplace transform of simple functions, properties of Laplace transform, t-multiplication and t-division theorems, Laplace Transform of derivatives, integrals and periodic functions. Inverse Laplace transform and its properties, convolution theorem. Use of Laplace transform in evaluating complicated and improper integrals and solution of ordinary differential equations related to engineering problems.

Partial Differential Equations:

Classification of partial differential equations, solutions of one dimensional wave equation, one dimensional unsteady heat flow equation and two dimensional steady heat flow equation by variable separable method with reference to Fourier trigonometric series.

COURSE NO.	COURSE NAME	L	T	P
GLC 13152	GEOLOGY FOR PETROLEUM ENGINEERS	3	0	0

COURSE CONTENT:

Mineralogy and Petrology

1. Minerals: General properties; Classification of minerals and properties of common rock-forming minerals.
2. Petrology: Rocks; Classification and description of some common rocks.
3. **Stratigraphy**
4. Principles of stratigraphy; Concepts of palaeontology; Fossils, their mode of preservation and significance as indices of age and climate; Concept of index fossils; Broad stratigraphic subdivisions and associated rock types of important coal belts and oil fields of India.
5. **Structural Geology**
6. Interpretation of topographic (structural) maps; Attitude of planar and linear structures; Effects of topography on outcrops. Unconformities, folds, faults and joints - their nomenclature, classification and recognition. Forms of igneous intrusions - dyke, sill and batholith. Effects of folds and fractures on strata and their importance in exploration activities.

COURSE NO.	COURSE NAME	L	T	P
PEC 13101	DRILLING FLUIDS AND CEMENTS	3	1	0

COURSE CONTENT:

A. Drilling Fluids:

1. **Overview of Drilling Fluids:** Clay chemistry and its application to drilling fluids, Types of clays, hydration, flocculation, aggregation and dispersion.
2. **Classification, Types and applications of Drilling Fluids:** Water based, oil based, emulsion based, polymer based, Surfactant based, Foam based and Aerated drilling fluids. Synthetic oil based drilling fluid (SOBM). HPHT Drilling fluids.
3. **Drilling Fluid Characteristics:** Basic functions, properties, maintenance and treatments of drilling fluids.
4. Drilling fluid calculations.
5. **Rheology of drilling fluids**
6. Advancement in drilling fluid technology- New generation drilling fluids.
7. Impact of drilling fluids on well productivity
8. Drilling fluids and well complications.
9. Mud logging.

B. Cements:

1. **Cementing, Cements & cement slurry:** Objectives of cementing, oil well cements, Classification of cement, Slurry design, Slurry additives, Factors influencing cement slurry design, Cementing equipment.
2. **Cementing Methods:** Primary cementing, Stage cementing, Liner cementing, Plugging, Squeeze Cementing techniques in practice. Deep well cementing, Characteristics of good quality cementation. HPHT and Deep water Cementing.
3. Cementing calculations.

COURSE NO.	COURSE NAME	L	T	P
PEC 13102	DRILLING TECHNOLOGY	3	1	0

COURSE CONTENT:

1. **Well Planning:** Introduction to oil well drilling, Drilling planning approaches.
2. **Rotary Drilling Method:** Rig parts, selection and general layout.
3. **Drilling Operations & Practices:** Hoisting, circulation, Rotation, power plants and Power transmission, Rig wire line system handling & storage.
4. **Well tubular:** Casing String and Drill String
5. **Drill Bits:** Classification and design criteria of drag, rotary, roller, diamond and PDC bits. Bit Selection: Conventional and Log based.
6. **Coring:** Different methods of core drilling.
7. **Well Problems and Solutions:** Fatigue failure, Pipe sticking, Lost-circulation, Sloughing shale, Swabbing, surge, gas cap drilling, Blow out and kick control.
8. **Oil Well Fishing:** Fish classification, tools and techniques.

COURSE NO.	COURSE NAME	L	T	P
HSE 13301	HISTORY OF SCIENCE AND TECHNOLOGY	3	0	0

COURSE CONTENT:

1. Introduction to the History of Science- Emergence and Character of Science, Science in the Ancient world, The Dawn of History: Babylon-China-India, Classical Science.
2. Greek and Romans, Science during the Medieval Age, The Dark Age, The Arabian and the Indian Science, Birth of Modern Science: Renaissance and Scientific Revolution, Eighteen-Century Science, Application of Science, Industrial Revolution, Causes and Consequences, Present Day Science, Impact of Science on Society, Growth of Indian Mineral Industry, including Mining and Petroleum Industry.

COURSE NO.	COURSE NAME	L	T	P
HSE 13302	PHILOSOPHY OF SCIENCE	3	0	0

COURSE CONTENT:

1. Introduction: Rationale for study of Philosophy of Science prevalence of imbalances; General Approach, Nature, Scope and Relation of the subject with Historical Development.; Science and Philosophy vis-à-vis need for Intellectual and Moral Balance.
2. Scientific and Philosophical approaches to knowledge development and Knowledge application (Emphasis on Earth and Mineral Sciences)
3. Foundations of Philosophy: Nature, Concept, Scope, Methodology, Divisions and Implications.
4. Concept and Nature of Science: Origin/Aim, Methodology, Scope and Development: Nature of Scientific Methods; Movements; Scientific Thought; Divisions of Science; Scientific Laws and Scientific Explanations.
5. Convergence of Science and Philosophy: Unified Theory; Space Time Relationship; Patterns of Change; Deeper issues and broad involvements of Science; Status of Scientific Proposition and Concepts of Entities, Epistemic and Ontological aspects.
6. Philosophical Analysis and Scientific Practice: Philosophical Base of Eastern Thought and their parallel in Science; The Essential of Unity between Eastern Thought Pattern and Western Science, Need for harmony between Intuitive Thought and Rational Knowledge; Philosophers of Science with reference to Western Thought, Philosophers of Science – Western and Eastern.

- Inter-relationship of Science and Culture: Science and Aesthetics, Science and Human Values, Science in the full tradition, Science vis-à-vis Human Conduct and Social Affairs; Social Significance of Science; Implications of Philosophy of Science for a new peaceful Social Order, Synthesis of Eastern "World View" and Western "Materialism".

COURSE NO.	COURSE NAME	L	T	P
HSE 13303	GANDHIAN STUDIES	3	0	0

COURSE CONTENT:

- Introduction to Gandhi's Life and Philosophy; Fundamentals of Gandhian Economics; Gandhi's Concept of Human Nature, Perfectibility of Man; Ethical Ideas of Gandhi- Truth, Ahimsa, Brahmacharya, Non-stealing, Non-possession and Voluntary Poverty. Gandhi's Interpretation of History and Society.
- Public Welfare and Sarvadoyo Philosophy – Antyodaya; Sarvadoya Socialism and Capitalism; Nature of Sarvodaya's Economy from Gandhi to Vinobha; Concept of Production and Distribution in Sarvodaya Economy and it's Utility in our Socio- economic and Scientific/ Technical development; Non- violent Economy vis-à-vis Centralized Industrial Economy and Rural Economy.
- Study of the Current Industrial Problems and Priorities as against the Gandhian Ideology.
- Gandhian approach to Man-power Management, Prospects, Co-operative Production and Consumption, Rural Entrepreneurship, Finance, Plan changes for helping the disadvantaged sections of the society.
- Man and machine- Problems of Automation and Gandhi's View.
- Gandhi's Political Views: The State as an organ of Violence, Political Sovereignty of the People, Decentralization of Political Power, Concept of Freedom, The Idea of Political Condition- Ram Rajya.
- Satyagraha: The Importance of Truth Force, Self Suffering, Winning over the opponent by Love.
- Relevance of Gandhian Ideas in the contemporary Economic and Political situation.
- Note: Use of Video Films shall be made to support the classroom teaching.

COURSE NO.	COURSE NAME	L	T	P
HSE 13304	ORAL COMMUNICATION SKILLS	3	0	0

COURSE CONTENT:

The nature, purpose and characteristics of good conversation, Phonological forms to use in speech, Developing conversation skills with a sense of stress, intonation , and meaning, Use of question tags, Starting, maintaining and finishing conversations, Standard conversational exchange, Spoken language idioms, Effective listening and attention to others, Gestures and body language, Do's and Don'ts in conversation, Telephonic conversation, Functions of English in conversation: introductions, greetings, clarifications, explanations, interruptions, opinions, Agreement and disagreement, complaints, apologies, Participating in informal discussions and situations, Using information to make some decision, i.e., making social arrangements with friends, Reproducing information in some form (question/answer summarizing, oral reporting, etc.)

COURSE NO.	COURSE NAME	L	T	P
HSE 13305	ORAL PRESENTATION SKILLS	3	0	0

COURSE CONTENT:

Characteristics of good presentation, Assessing the audience and its needs, Planning a presentation, Different presentation styles, Using the presentation matrix, The informative presentation, The demonstrative presentation, The persuasive presentation, Presentation structure and design, Materials and logistics, Visual aids and their development and use, Rehearsing and delivering, Using performance techniques, Overcoming anxiety and stress, Opening and closing, Getting and maintaining audience attention, Using language to optimal effect, Body language and gestures, Linguistic aspects: introducing, sequencing, signaling, quoting, clarifying and summarizing, Handling questions.

COURSE NO.	COURSE NAME	L	T	P
HSE 13306	LITERARY COMMUNICATION	3	0	0

COURSE CONTENT:

1. Exposer to recent literary and creative trends in English and their relation with the values, culture and norms of behaviour; linguistic and cultural process.
2. What and how of literary communication for improvement of proficiency in the use of English language
3. Analysis and interpretation of five to six recent short stories from different parts of the world to make the sensitive and different intensification of the skills of conceiving the ideas, situations and solutions, and rendering them into appropriate expression on a higher plane of finish.

COURSE NO.	COURSE NAME	L	T	P
HSE 13307	PRESENT HISTORY OF INDIA	3	0	0

COURSE CONTENT:

1. Idea of a Nation: Defining Nation, Citizenship Duties, Profession, Society, Modern Nation-State as it emerged after 1789, The Socio-Economic context of the new 'Nation'.
2. The Modern Individual: Transition from pre-modern definition and social location of Individuals to the growth of idea of free Individual, Social Contract, The Duties of an Individual, Atomization of Individual and a critique to it.
3. Colonial Rule in India: Colonial redefinition of Nation, Individual, Society in India- a critique of Pre-colonial mode of life by the colonial theorists, The 'Progressive' colonial alternatives, the ambiguity in colonial 'Image' of India.
4. Nation and the Nationalists: The Ideological Contestation of Colonial Images by the Nationalists, Critique of Colonialism by Gandhi, Nehru, Tagore, S.C. Bose, Aurobindo Ghosh, M.N. Roy, J.P. Narayan. Problematizing Colonial Ideas, Impact of Colonialism in India, Problems with the Nationalist Critique of Colonialism. Colonialists and Nationalists on the idea of 'Science', 'Modernity' and 'Development'.
5. Re-inscribing Indian Fertility: Changing Views of Indian Fertility vis-à-vis female Sexuality.
6. Threats of Neo-Colonialism: The Challenges to the Nation, Post-Colonial Critique of Colonialism and Nationalism, Individual and Society in a Changing World Order.

COURSE NO.	COURSE NAME	L	T	P
PEC 13201	PETROLEUM ENGINEERING PRACTICAL	0	0	2

COURSE CONTENT:

1. Practical related to measurements of drilling fluids properties like mud weight, Plastic viscosity, Gel strength, Filtration loss, Sand content, Salt contents etc.
2. Practical related to the setting point and consistency of cement slurry.

COURSE NO.	COURSE NAME	L	T	P
GLC 13252	GEOLOGY FOR PETROLEUM ENGINEERS PRACTICAL	0	0	2

COURSE CONTENT:

1. Study of physical properties of minerals.
2. Study of common rocks with reference to their structures, mineral composition and uses.
3. Interpretation of Topographic Maps
4. Interpretation of geological Maps - 1 : Attitude and Cross sections
5. Outcrop completion - 1 : One point problem and V - rule
6. Outcrop completion - 2 : Three point problem
7. Interpretation of geological Maps - 2 Unconformable beds
8. Interpretation of geological Maps - 3: Folded beds
9. Interpretation of geological Maps - 4: Faults and dykes

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(Effective from 2015 – 16 session)**

Sl. No.	Course No.	Name of the course	L	T	P	Credit Hrs.
1.	MMR 14101	Mechanical Engineering – II	3	1	0	7
2.	AMR 14101	Numerical and Statistical Methods	3	1	0	7
3.	PEC14101	Petroleum Production Operations-I	3	1	0	7
4.	PEC14102	Elements of Reservoir Engineering	3	1	0	7
5.	MSR 14151	Managerial Economics	3	0	0	6
6.	MER 14103	Surveying (Sessional Theory Paper)	3	0	0	6
7.	HSC 14306	English for Professional Communication (Sessional Theory Paper)	3	0	0	6
8.	PEC14201	Petroleum Engineering Practical-II (Reservoir Engineering Lab)	0	0	2	2
9.	MER 14203	Surveying Practical	0	0	2/2	1
10.	PEC 14601	Educational Excursion	0	0	0	(2)
11.	PEC14801	Project and Term Paper	0	0	0	(2)
12.	PEC14501	Composite Viva-Voce	0	0	0	(4)
13.	SWC 14701	Co-curricular Activities	0	0	0	(3)
		Total Contact Hours = 28	21	4	3	49+(11) = 60

COURSE SYLLABUS

COURSE NO.	COURSE NAME	L	T	P
MMR 14101	MECHANICAL ENGINEERING – II	3	1	0

COURSE CONTENT:

Introduction to thermodynamics; Analysis of various thermodynamic processes, P-V and T-S diagrams . Analysis of air standard cycles – Otto, Diesel and Dual cycles. Classifications, applications and performance estimation of internal combustion engines;

Fundamentals of simple open cycle and closed cycle gas turbines and reciprocating air compressors – single and multi-stage.

Performance study and power estimation on laboratory experimental data

Introduction to Fluid Mechanics; Properties of fluid, classifications ideal fluid, Newtonian fluid and non-Newtonian fluids, Newton’s law of viscosity. Fluid pressure and its measurement- Piezometers, Manometers, Mechanical gauges. Continuity equation, types of flow. One dimensional equation of motion, Bernoulli’s equation, applications of Bernoulli’s equation, venturimeter, Flow through pipes –Darcy-Weisbach’s equations.

Classification, basic construction and applications of different types of pumps and water turbines.

Performance study and power estimation based on laboratory experimental data.

COURSE NO.	COURSE NAME	L	T	P
AMR 14101	NUMERICAL AND STATISTICAL METHODS	3	1	0

Part-I: Numerical Methods

Solution of algebraic and transcendental equation by bisection, iteration, false position and Newton-Raphson methods.

Solution of a system of linear simultaneous equations by Gauss elimination, Gauss-Jordan, Crout’s triangularisation, Jacobi and Gauss-Seidel methods.

Finite difference, Symbolic relations, Interpolation and Extrapolation, Newton-Gregory forward and backward, Gauss forward and backward, Sterling, Bessel and Lagrange’s formulae, Inverse interpolation by Lagrange and iterative methods, Numerical differentiation and integration: Trapezoidal, Simpson’s 1/3rd, Simpson’s 3/8th and Weddle quadrature formulae.

Numerical solution of first order ordinary differential equations by Taylor’s series, Picard’s, Euler’s, Modified Euler’s, Runge-Kutta and Milne’s methods. Solution of simultaneous first order

and second order ordinary differential equations with initial conditions by Runge-Kutta and Milne's methods. Numerical solution of boundary value problems by finite difference method.

Part II: Statistical Methods

Moments, skewness and kurtosis.

Probability: Various approaches of probability, two theorems (without proof), conditional probability, Bayes theorem.

Random variable: Definition, probability mass & density functions, distribution function, mathematical expectation and moment generating function.

Probability distributions: Bernoulli, binomial, Poisson and normal distributions.

Theory of least squares and curve fitting.

Correlation and Regression: Simple, multiple & partial correlation coefficients, regression lines, regression coefficients and their properties.

Test of significance: Normal test, t-test, chi square test and F test.

COURSE NO.	COURSE NAME	L	T	P
PEC 14101	PETROLEUM PRODUCTION OPERATION - I	3	1	0

COURSE CONTENT:

- Well Equipment:** Well Head Equipment, Christmas tree, valves, hangers, flow control devices, packers, tubular and flow lines.
- Well Completion Design:** Well completion Methods, Perforating Oil & Gas Wells - Conventional and Unconventional techniques viz. through tubing and tubing conveyed underbalanced perforating techniques, type size and orientation of perforation holes. Well activation, use of compressed air & liquid Nitrogen. Down-hole equipment selection, servicing, installation & testing, smart wells- intelligent completions.
- Production System Analysis & Optimization:** Self flow wells - PI & IPR of self flowing and artificial lift wells, production testing - back pressure test, flow after flow test & isochronal test, surface layout, test design & analysis of test data. Production characteristics of Horizontal and multilateral wells - coning, IPR & skin factor. Multiphase flow in tubing and flow-lines. Sizing, selection and performance of Tubing, chokes and surface pipes. Production Optimization – Nodal System analysis.
- Well Production Problems and mitigation:** Scale formation, paraffin deposition, formation damage, water production, gas production, sand deposition etc.
- Designing Gravel Pack for Sand Control:** Sand control techniques, Formation Sand Size analysis, optimum gravel - sand ratio, gravel pack thickness, gravel selection, gravel packing fluid & gravel pack techniques.
- Well Servicing & Workover:** Workover system, workover rigs and selection, rig less workover including Endless/ Coiled tubing unit, minor & major workover jobs-diagnosis & remedial measures water shut off and gas shut off- Chemical treatment and conformance control. Wire-line operations, Workover & completion fluids - types & selection, Formation damage, Workover planning & economics, asphaltene wax.
- Introduction to Artificial Lift Techniques.**
- Introduction to Shale Oil, Shale Gas and Oil Shale:** concept of exploration and production strategies.

COURSE NO.	COURSE NAME	L	T	P
PEC 14102	ELEMENTS OF RESERVOIR ENGINEERING	3	1	0

COURSE CONTENT:

- Introduction to reservoir engineering
- Characteristics of crude oil and natural gas, classification of crude and its physicochemical properties.
- Reservoir Rock Properties :** Porosity and permeability determination, combination of permeability in parallel & series beds, porosity permeability relationship, fluid saturation determination and significance, effective and relative permeability, wettability, capillary pressure characteristics, measurements and uses. Coring and Core Analysis

4. **Reservoir Fluids:** Phase behavior of hydrocarbon system, ideal & non ideal system, equilibrium ratios, reservoir fluid sampling, PVT properties determination, different correlations and laboratory measurements, data reduction, evaluation and application.
5. **Flow of Fluids through Porous Media :** Darcy's law, single and multiphase flow, linear, radial & spherical flow, steady state & unsteady state flow, GOR, WOR equations
6. **Special type of flow:** flow through fractures, Water and gas coning.
7. **Reservoir Pressure Measurements and Significance:** Techniques of pressure measurement.
8. **Reservoir Drives :** Reservoir drive mechanics and recovery factors
9. **Reserve estimation:** resource & reserve concept, Different reserve estimation techniques: Volumetric, MBE, decline curve analysis;, latest SPE/ WPC/ IS classification,

COURSE NO.	COURSE NAME	L	T	P
MSR 14151	MANAGERIAL ECONOMICS	3	0	0

COURSE CONTENT :

Fundamentals of Economics - Microeconomics and Macroeconomics; Marginal Analysis and Time Value of Money; Firm - meaning and objectives; Demand and Supply Analysis - law of demand and law of supply, price mechanism, price ceilings and floors; Utility Analysis – cardinal and ordinal utility, law of diminishing marginal utility, Indifference curves, budget constraints, consumer's equilibrium – utility maximisation; Production and Cost Analysis- short run and long run production functions, returns to scale, economies of scale and scope, different costs, producer's equilibrium – cost minimisation; Market Analysis – types of markets, short run and long run equilibrium in each market; Pricing Strategies - price discrimination; Public Goods and Externalities; Asymmetric Information – adverse selection and moral hazard; Economics of Uncertainty and Risk; Inflation: Measures, Causes and Remedies.

COURSE NO.	COURSE NAME	L	T	P
MER 14103	SURVEYING (Sessional Theory Paper)	3	0	0

COURSE CONTENT:

1. **Introduction to Surveying:** Objective of surveying and its importance, Classification, principles of surveying, Application of Surveying in various fields of Engineering.
2. **Linear measurements:** Conventional Instruments for measuring distances, ranging and chaining out of survey lines, Obstacle in chaining and errors in chaining, corrections Principles, offsets, booking field notes, problems.
3. **Linear measurements (EDMs):** Theory and characteristics of electromagnetic waves, radio waves, infra red, laser waves, principle of distance measurement with EDMs
4. **Angular measurements:** Principle and construction of prismatic compass, bearing of lines, local attraction, magnetic declination and examples.
5. **Theodolite:** The essentials of transit theodolite, definition and terms, temporary adjustments, measurement of horizontal and vertical angles, different operations and sources of error, theodolite traversing, Omitted Measurements.
6. **Total Station:** Principle, working and construction. Corrections to be applied.
7. **Leveling instruments:** Definition, different type of leveling instruments, curvatures and refraction corrections, reciprocal leveling, errors in leveling and problem solving.
8. **Plane Table Surveying:** General, Methods, Intersection, Traversing, Resection, two point problem and three points problem etc.
9. **Contouring:** General, Contour Interval, Characteristics, Methods of locating contours, Interpolation etc.
10. **Global Positioning System (GPS):** Theory, principles and applications
11. **GIS:** Introduction to GIS, Its application in mapping.

COURSE NO.	COURSE NAME	L	T	P
HSC 14306	ENGLISH FOR PROFESSIONAL COMMUNICATION	3	0	0

COURSE CONTENT:

Part I -- Professional Oral Communication

Course Introduction: Professional Communication: Need, principle, channels, forms and barriers; Speaking for professional Purposes: Nature of Oral Communication, Oral Communication Process, and characteristics of Oral Communication

Group Discussion: Group Discussion(GD): nature, uses and importance; Leadership function in GD; developing leadership qualities and positive group behaviour; Starting discussions: opening the discussion, stating objectives, suggesting good group procedure (Time management, speaking procedure, etc); Giving opinions, asking for opinions and supporting opinions in GD; Making suggestions and asking for suggestions; Balancing points of view, expressing advantages, disadvantages and consequences; Some pitfalls in discussions, fallacies in argument and rebuttal, concluding and controlling discussions

Job Interview: Job Interview: The interviewing process, types of interviews and interview formats; Pre-interview preparation techniques, self-analysis, skills assessment, company analysis, job analysis, practice, developing interview file; Projecting success: The beginning, the middle and the end of the interview; Interview Strategies; Upholding the personality and overcoming interviewing hazards

Part II --Professional Writing

Report Writing: Report Writing: Characteristics of business reports, reports and other forms of communication, features of good reports; Types of reports (Formal/informal); Structure of formal reports: Front matter, main body and back matter; Style of reports: Readability of reports, choice of words and phrases, construction and length of sentences and paragraphs

Business Correspondence: Official communication: nature and principles of business correspondence; Structure of business letters; Business letter formats; Letter giving instructions; Letters of requests and inquiries; Letters of complaints; Employment letters and applications; CV and resume writing; Business memos: Forms and structure; Writing an effective memo.

COURSE NO.	COURSE NAME	L	T	P
PEC 14201	Petroleum Engineering Practical – II (Reservoir Engineering Lab)	0	0	2

COURSE CONTENT:

Practical related to porosity, permeability, Saturation properties of cores, Practical related to TPD, BHP chart analysis.

COURSE NO.	COURSE NAME	L	T	P
AMR 14201	NUMERICAL AND STATISTICAL METHODS PRACTICAL	0	0	3

COURSE CONTENT:

A. Numerical Methods:

1. Numerical solution of non-linear algebraic and transcendental equation by bisection, iteration, false position, secant and Newton Raphson methods.
2. Numerical solution of system of linear simultaneous equations by Gauss elimination and Gauss's Seidel methods
3. Interpolation by Lagrange's interpolation formula.
4. Numerical evaluation of definite integral by Trapezoidal, Simpson's 1/3rd, Simpson's 3/8th, Weddle and Gaussian quadrature formulae.
5. Numerical solution of first order ordinary differential equation by Euler's, Modified Euler's, second and fourth order Runge-Kutta, Adams-Moulton and Milne's methods.

B. Scope of practice sessions:

Computation of raw moments, central moments, coefficient of variation, coefficients of skewness and kurtosis; Fitting of straight line, second degree polynomial (parabola), power curve and exponential curve; Computation of product moment correlation, multiple and partial

correlation coefficients; Regression coefficients and regression lines, plane and regression. Application tests of significance based on numerical data.

COURSE NO.	COURSE NAME	L	T	P
MER 14203	SURVEYING PRACTICAL	0	0	2/2

COURSE CONTENT:

Study of linear measuring instruments and chain surveying, Study of Theodolite and traversing with theodolite, study of levels and ordinary leveling with tilting level, Profile leveling, study of total station and measurement with total station. Study of Global Positioning System (GPS) and measurement with GPS. Profile leveling.

**COURSE STRUCTURE OF V SEMESTER B. Tech PETROLEUM ENGG.
(Effective from 2015 – 16 session)**

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC 15101	Applied Petroleum Reservoir Engineering and Management	3	1	0	7
2.	PEC 15102	Petroleum Production Operations-II	3	1	0	7
3.	GLC 15153	Sedimentary and Petroleum Geology	3	0	0	6
4.	AMR 15101	Methods of Applied Mathematics – II	3	1	0	7
5.	PEC 15201	Petroleum Engineering Practical – III (Production & Product Testing Lab)	0	0	2	2
6.	GLC 15253	Sedimentary and Petroleum Geology Practical	0	0	2/2	1
7.	PEC15801	Project and Term Paper	0	0	0	(4)
		Total Contact Hours = 18	12	3	3	30 + (4) = 34

**COURSE STRUCTURE OF V SEMESTER B. Tech (Hons) PETROLEUM ENGG.
(Effective from 2015 – 16 session)**

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC 15101	Applied Petroleum Reservoir Engineering and Management	3	1	0	7
2.	PEC 15102	Petroleum Production Operations-II	3	1	0	7
3.	GLC 15153	Sedimentary and Petroleum Geology	3	0	0	6
4.	AMR 15101	Methods of Applied Mathematics – II	3	1	0	7
5.	PEH 15103	Reservoir Fluid Thermodynamics	3	1	0	7
6.	ACH 15303	Physical Chemistry (Sessional Theory Paper)	2	0	0	4
7.	PEC 15201	Petroleum Engineering Practical – III (Production & Product Testing Lab)	0	0	2	2
8.	GLC 15253	Sedimentary and Petroleum Geology Practical	0	0	2/2	1
9.	PEC15801	Project and Term Paper	0	0	0	(4)
		Total Contact Hours = 24	17	4	3	41 + (4) = 45

COURSE SYLLABUS

COURSE NO.	COURSE NAME	L	T	P
PEC 15101	APPLIED PETROLEUM RESERVOIR ENGG. AND MANAGEMENT	3	1	0

COURSE CONTENT:

1. Overview of applied reservoir engineering and reservoir management
2. Generalized Oil & Gas MBE and its modification
3. Drive Mechanism and recovery factors; production behaviour of oil & gas reservoirs
4. Performance prediction of depletion drive, gas cap drive, water drive and combination drive
5. Water influx : steady and unsteady state models
6. Reservoir pressure maintenance techniques, their advantages and limitations
7. Immiscible Displacement processes: Theory & practices- Buckley Leverette treatment of fractional flow and frontal advance equations, water flood performance
8. Reservoir Management: concepts, components and applications

9. **Introduction to oil & gas field development:** Rational development plan, Rate and order of drilling well, well spacing & pattern, selection of development scheme, economic aspect of development of oil and gas fields.

COURSE NO.	COURSE NAME	L	T	P
PEC 15102	PETROLEUM PRODUCTION OPERATION - II	3	1	0

COURSE CONTENT:

- Gathering and collection of oil and gas:** GGS, CTF and GCS - layout, sequential treatment, and safety features.
- Field Processing of Oil & Gas:** Flash and stage separation of oil & gas, oil & gas. Design of Oil & Gas separators. Demulsification, dehydration, stabilisation and desalting of crude oil. Dehydration and desalting of gas. Special problems in oil and gas separation. Removal of suspended solid & water from oil & gas. Scrubbers and wash tank. Safety features in oil and gas separation system.
- Storage of Petroleum and Petroleum Products:** Types of storage system, Design of storage tanks as per API and ASTM codes, Specification, maintenance and operation of tank batteries, Vapour control and gravity conservation measures. Vapour recovery system. LPG, NGL & LNG storage.
- Metering and Measurements:** Metering of oil & gas, Orifice and other metering devices and systems. Multiphase flowmeter. Tank gauging. Sampling and Testing of crude oil. Water and sediment determination.
- Well Stimulation Techniques** - Type & description of stimulation techniques, Design of matrix acidization and acid fracturing. Design of hydraulic fracturing, Multistage Fracturing. Wave technology & microbial stimulation
- Introduction to cash flow analysis related to petroleum economics, concepts of Payout, NPV, IRR etc.
- Digital oil field.

COURSE NO.	COURSE NAME	L	T	P
GLC 15153	SEDIMENTARY AND PETROLEUM GEOLOGY	3	0	0

COURSE CONTENT :

SECTION – A (Sedimentary Geology)

Introduction: Sedimentary processes, Textural properties, Pore morphology and its significance, Sedimentary structures, Important rock groups with special reference to sandstones and carbonates, Reconstruction of sedimentary environment, Tectonics, sedimentation and sequence stratigraphy, Role of sedimentology in petroleum exploration. Elements of basin modeling.

SECTION – B (Petroleum Geology)

- Physical and chemical characteristics of crude oil, Origin of oil, source rock and maturation.
- Migration of oil:** mechanism, pattern and barriers.
- Reservoir rocks and cap rocks
- Entrapment of oil:** types and mechanism.
- Geology of prospective basins of India.

COURSE NO.	COURSE NAME	L	T	P
AMR 15101	METHODS OF APPLIED MATHEMATICS - II	3	1	0

COURSE CONTENT:

PART I:

Special Functions

Solution of Associated Legendre equations, Associated Legendre Functions, Recurrence relations for Associated Legendre Functions, Bessel Function of 1st and 2nd kinds, Hankel function, Equations reducible to Bessel's equation, Modified Bessel functions,

Finite Element Method

Variational principles, Functionals, Euler's equations, Approximation by piecewise polynomial, Rayleigh-Ritz method, Galerkin methods, Element properties, Natural coordinate system, Two dimensional triangular elements, Three dimensional tetrahedral element, Shape functions, Element stiffness matrix, One dimensional heat transfer element, Finite element solution of two dimensional fluid-flow problems. Concept of finite volume.

PART II:

Integral Transform

Fourier integrals, Fourier Sine and Cosine integrals, complex form of Fourier integrals, Fourier transforms, Fourier Sine and cosine transforms, properties. Inversion and convolution with problems, Parseval's identity for Fourier transforms, Fourier transforms of derivatives of a function, multidimensional Fourier transform with problems, Introduction to Hankel transform.

Partial Differential Equations

Solution of Laplace equation in three dimensions (Cartesian and Polar), Spherical Harmonics, Solution of Poisson Equation in two dimensions, Solution of heat conduction and wave equations using variable separable methods and integral transforms, namely, Laplace and Fourier transforms techniques.

COURSE NO.	COURSE NAME	L	T	P
PEH 15103	RESERVOIR FLUID THERMODYNAMICS (Theory paper for V B.Tech PE Honors)	3	1	0

COURSE CONTENT:

- 1. Work Calculations:** Work calculation for compression/ expansion of ideal and non ideal gases, compression cycles and horse power calculations - single, double and multistage with and without clearance.
- 2. Thermodynamics of Gases and Liquid Hydrocarbons:** Free energy & work function, Mollier diagrams, perfect & imperfect gaseous mixtures, Equation of state, Law of corresponding states, Joule Thompson effect, Arrhenius equation and activation energy. Fugacity and fugacity coefficient of gases and gaseous mixtures, Lewis fugacity rules and Third law of thermodynamics.
- 3. Solution Thermodynamics:** Vapour liquid equilibria, equilibrium constant, partial molar properties, chemical potential, Raoult's law and Henry's law, ideal and non ideal solutions, Activity and activity coefficients, Gibb's Duhem equation, Gibb's adsorption equation.
- 4. Phase Rule:** Phase rule of single, two, three, multi component and multi phase systems, phase behaviour in different conditions, Thermodynamic aspects of phase equilibria. Calculation of phase equilibria. Ternary and pseudo ternary phase diagrams
- 5. Fluid Flow Thermodynamics:** Single phase flow & multiphase flow through vertical, incline and horizontal conduits. Pressure traverse curves and their applications. Venturi flow, nozzle flow, pipe internal flow, annular flow and nozzle flow thermodynamics of multiphase & multicomponent system.

COURSE NO.	COURSE NAME	L	T	P
ACH 15303	PHYSICAL CHEMISTRY (Sessional Theory Paper for V B.Tech PE Honors)	2	0	0

COURSE CONTENT:

- 1. CORROSION AND CORROSION CONTROL:** Principles of corrosion, methods of corrosion control, cathodic and anodic protection, corrosion inhibitors. Surface coatings, Corrosion Monitoring. Case Studies of Corrosion in Petroleum industry including metals and alloys used in Petroleum Industry.
- 2. ADVANCED SURFACE CHEMISTRY:** Interfacial phenomena; Wetting; Surface tension measurements; Electrokinetic phenomena; Zeta potential and its measurement. Adsorption: Types of adsorption isotherm, Gibb's adsorption equation, BET equation, surface area of adsorbents, Application of Adsorption on the surface of solids, adsorption of high molecular compounds.

3. **ANALYTICAL TECHNIQUES:** UV-Vis Spectrophotometry, Atomic Absorption Spectrophotometer (AAS), IR Spectroscopy, Liquid and Gas Chromatography and Solvent extraction methods.

COURSE NO.	COURSE NAME	L	T	P
PEC 15201	Petroleum Engineering Practical – III (Production & Product Testing Lab)	0	0	2

COURSE CONTENT:

Practical related to measurements of viscosity, surface tension, fire point- Flash point, Cloud point, Pour point, Diesel Index, Bromine number, RVP, Sulphur content, Carbon Residue, Water content, ASTM distillation of Petroleum and Petroleum Products.

COURSE NO.	COURSE NAME	L	T	P
GLC 15253	SEDIMENTARY AND PETROLEUM GEOLOGY PRACT.	0	0	2/2

COURSE CONTENT:

Practical related to Sedimentary and Petroleum Geology.

COURSE STRUCTURE OF VI SEMESTER B.Tech PETROLEUM ENGG.
(Effective from 2015 – 16 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC16101	Directional Drilling	3	1	0	7
2.	PEC16102	Petroleum Formation Evaluation	3	1	0	7
3.	AMR 16101	Advanced Numerical Methods	3	1	0	7
4.	EER 16101	Applied Electrical Engineering	3	0	0	6
5.	PEC16201	Petroleum Engineering Practical – IV Process Lab Practical/ Simulation and Modeling Lab	0	0	3	3
6.	PEC16501	Composite Viva Voce	0	0	0	(4)
7.	PEC16801	Project & Term Paper	0	0	0	(4)
		Total Contact Hours = 18	12	3	3	30+(8)=38

COURSE STRUCTURE OF VI SEMESTER B.Tech (Hons) PETROLEUM ENGINEERING
(Effective from 2015 – 16 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC16101	Directional Drilling	3	1	0	7
2.	PEC16102	Petroleum Formation Evaluation	3	1	0	7
3.	PEH16103	Natural Gas Engineering	3	1	0	7
4.	AMC 16101	Advanced Numerical Methods	3	1	0	7
5.	EER 16101	Applied Electrical Engineering	3	0	0	6
6.	PEH 16301	Energy Management & Policy (Sessional Theory Paper)	1	2	0	4
7.	PEC16201	Petroleum Engineering Practical – IV Process Lab Practical/ Simulation and Modeling Lab	0	0	3	3
8.	PEC16501	Composite Viva Voce	0	0	0	(4)
9.	PEC16801	Project and Term Paper	0	0	0	(4)
		Total Contact Hours = 25	16	6	3	41+(8) =49

COURSE SYLLABUS

COURSE NO.	COURSE NAME	L	T	P
PEC 16101	DIRECTIONAL DRILLING	3	1	0

COURSE CONTENT:

- Directional Drilling:** Objectives, Types of deflection tools, tool orientation, Directional well profiles.
- Well Monitoring:** Well path deflection & correction. Down the hole surveying methods, Surveying Analysis Methods and Calculations of Three Dimensional well coordinates.
- Measurements and Logging While Drilling:** Objectives of MWD/ LWD, SWD, MWD tools, Telemetry system and data interpretation.
- Down Hole Motors:** Positive displacement motors and Turbo-drills - motor description, Power calculation and applications. Auto-track and verti-track system. Rotary Steerable system, Geo-steering tools.
- Slant Hole Drilling:** Objectives and selections, Well profiles and applications.
- Horizontal Well Drilling:** Horizontal well objectives and selection, Different profiles, Drilling techniques, Mud requirements & characteristics, casing and drill string requirements and completion programs.
- Special Methods of Directional Drilling :** Extended reach drilling, Multilateral drilling, coil tubing drilling and Geo-steering.
- Directional drilling problems and their remedies.
- Hole cleaning in high angled wells.

COURSE NO.	COURSE NAME	L	T	P
PEC 16102	PETROLEUM FORMATION EVALUATION	3	1	0

COURSE CONTENT:

1. Petrophysical measurements to sub-surface engineering.
2. **Indirect Methods:** SP and resistivity logs, radioactive logs, acoustic logs (principles, types of tools, limitation and applications). Evaluation of CBL/ VDL, USIT, SFT, RFT.
3. **Production Logging:** Introduction, type of tools, principles, limitations and applications.
4. **Special Type of Logging Tools:** Casing inspection tools (principles, application and limitation), Formation micro scanner (FMS), DSI, NMR logging principles. Logging in high-angle wells.
5. **Log Interpretation and Analysis Techniques.**
 - a) Standard log interpretation methods.
 - b) Cross-plotting methods: neutron-density, sonic-density and sonic-neutron etc.
 - c) Clean sand interpretation
 - d) Concepts of invasion – RXO, Tornado charts.
 - e) Shaly sand interpretation.

COURSE NO.	COURSE NAME	L	T	P
PEH 16103	NATURAL GAS ENGINEERING. (Theory paper for VI B.Tech PE Honors)	3	1	0

COURSE CONTENT:

1. **Introduction:** Composition of Natural Gas, Utilization of Natural Gas, Natural Gas Industry, Natural Gas Reserves, Types of Natural Gas Resources, Future of the Natural Gas Industry.
2. **Properties of Natural Gas:** Physical properties of natural gas and hydrocarbon liquids associated with natural gas. Reservoir aspects of natural gas. Calorific value of gas and measurement.
3. **Gas Compression:** Types of Compressors, Selection, Thermodynamics of Compressors, Compression calculations. Heat and Mass Transfer Principles and Applications in Natural Gas Engineering, Use of Mollier Diagrams.
4. **Gas Flow Measurement:** Process control and instrumentation in natural gas processing plants.
5. **Natural Gas Processing:** Field separation and oil absorption process, Refrigeration and low temperature processing, Liquefaction Process, Dehydration of Natural Gas, Sweetening of Natural gas and sulphur recovery. Processing for LPG, CNG, system, Conversion of gas to liquid. Custody transfer- principles and measurements.
6. **Gas Gathering, Transport and Storage:** Gas Gathering System. Steady Flow in Simple Pipeline System, Steady State and non Steady State Flow in Pipelines, Solution for Transient Flow. Transmission of Natural Gas, Specifications. Underground Storage and Conservation of Natural Gas.
7. **Unconventional gas:** Coal Bed Methane, Natural Gas Hydrate, Basin Centered Gas, Tight Gas Sands, Shale Gas. Current Technology for Shale Gas and Tight Gas Exploration and Production.
8. **LNG: Production and Utilization**
9. Issue and Challenges to Enhance Supply of Natural Gas.

COURSE NO.	COURSE NAME	L	T	P
AMR 16101	ADVANCED NUMERICAL METHODS	3	1	0

COURSE CONTENT:

1. Solution of tridiagonal system, Evaluation of largest and smallest eigen values and corresponding eigen vectors by Power method.
2. Complex root of non-linear equations by Newton-Raphson method, Solution of simultaneous non-linear algebraic and transcendental equations, Numerical evaluation for double and triple integrals with constant and variable limits and its application, Solution of integral equations by numerical methods.

3. Numerical solution of simultaneous first order ordinary differential equations and higher order differential equation subject to initial condition by single step and multistep methods, Numerical solution of higher order linear and non-linear ordinary differential equations subject to different boundary conditions by finite difference method, Numerical solution of characteristic value problems.

4. Classification of Partial differential equations, Finite difference approximations of partial derivatives of functions of two and three variables, Numerical solution of elliptic partial differential equations: Solutions of Laplace and Poisson equations in two variables by five-point formula, Solution of Laplace equation in two variables by ADI method, Solution of mixed boundary value problem, Algorithm for elliptic partial differential equation in three variables.

5. Solution of Parabolic partial differential equations: Solution of heat conduction in two variables by explicit and implicit methods i.e. Schmidt, Laasonen, Crank-Nicolson and Durfort-Frankel methods, Gauss-Seidel iterative method for Crank-Nicolson scheme, Solution of parabolic partial differential equation with derivative boundary conditions, Solution of heat conduction equation in three variables by ADE and ADI methods.

6. Solution of hyperbolic partial differential equations: Solution of wave equation in two variables by explicit and implicit methods and algorithm for hyperbolic equations of three variables.

COURSE NO.	COURSE NAME	L	T	P
EER 16101	APPLIED ELECTRICAL ENGINEERING	3	0	0

COURSE CONTENT:

1. Operation and characteristics of three-phase Induction motors; Methods of starting & speed control of three phase induction motor; Ward-Leonard method of speed control of DC motor; Basic principles of Thyristor controlled variable speed AC and DC motors;
2. Principles of rate making of electricity and power factor improvement; Substation arrangement; Circuit breakers; Protective relays:- Inductions pattern over current relay, thermal overload relay, earth fault relay, Lightning Arrester, Fuses :- types and selection.
3. Power Cables: Types & selection, Types of motor enclosure, FLP enclosures for hazardous area equipment, intrinsically safe circuit.
4. Industrial application & control of electrical motors: Types of electric motors and their application in industry; Controllers for the speed control of dc & ac motors.
5. Diesel – Electrical oil rigs.
6. I.E. rules applied to mines & oil fields.
7. Introduction to Power Electronics converters (Phase Angle controlled rectifier, chopper, inverter and cyclo-converter).

COURSE NO.	COURSE NAME	L	T	P
PEH 16301	ENERGY MANAGEMENT & POLICY (Sessional Theory Paper for VI B.Tech PE Honors)	1	2	0

COURSE CONTENT:

Markets for oil, gas, coal, electricity and renewable energy, resources and alternate fuels. Legal and policy aspects of supply and trading in energy. Regulations of energy industries, Industry privatization. International context of liberalization of energy markets. Land acquisition policy, Carbon credit, Modeling techniques for supply and demand, market structure, transportation models, game theory, futures markets, environmental issues, energy policy, energy regulation, input/output models, linear and nonlinear programming models, energy conservation, and dynamic optimization. Development of appropriate models and their application to current issues in energy markets. Energy audit.

COURSE NO.	COURSE NAME	L	T	P
PEC 16201	Petroleum Engineering Practical – IV (Process and Simulation Lab)	0	0	2

Practical related to the Heat transfer, Process control, Air and water flow bench, Flame propagation, Heat conductivity etc. Practical and training regarding application of oil field Simulators.

COURSE STRUCTURE OF VII SEMESTER B.Tech PETROLEUM ENGG.
(Effective from 2016– 17 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC17101	Oil and Gas Well Testing	3	1	0	7
2.	PEC 17102	Offshore Drilling and Petroleum Production Practices	3	1	0	7
3.	PEC 17103	Health Safety and Environment in Petroleum Industry	3	0	0	6
4.		Elective paper	3	0	0	6
5.	GPD 17163	Petroleum Exploration – Geophysical Methods (Sessional Theory Paper)	2	0	0	4
6.	GLD 17154	Petroleum Exploration – Geological Methods (Sessional Theory Paper)	2	0	0	4
7.	PEC17801	Petroleum Engineering Projects	0	0	0	(6)
8.	PEC17901	Vocational Training*	0	0	0	(5)
		ELECTIVES: ANY ONE OF FOLLOWING				
i.	PEE17101	Transportation and Marketing of Petroleum and Petroleum Products				
ii.	PEE17102	Well Performance and Intervention				
iii.	PEE17103	Drilling System Design				
		Total Contact Hours = 18	16	2	0	34+(11) = 45

* Vocational Training taken at the end of VI semester is credited in VII Semester.

COURSE STRUCTURE OF VII SEMESTER B.Tech (Hons) PETROLEUM ENGINEERING
(Effective from 2016– 17 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC17101	Oil and Gas Well Testing	3	1	0	7
2.	PEC 17102	Offshore Drilling and Petroleum Production Practices	3	1	0	7
3.	PEC 17301	Health Safety and Environment in Petroleum Industry	3	0	0	6
4.	MSH 17152	Industrial Engg. and Management	3	1	0	7
5.		Elective Paper – 1	3	0	0	6
6.	GPD 17163	Petroleum Exploration – Geophysical Methods (Sessional Theory Paper)	2	0	0	4
7.	GLD 17154	Petroleum Exploration – Geological Methods (Sessional Theory Paper)	2	0	0	4
8.	PEC 17801	Petroleum Engineering Projects	0	0	0	(6)
9.	PEC17901	Vocational Training*	0	0	0	(5)
		ELECTIVES: ANY ONE OF FOLLOWING				
i.	PEE17101	Transportation and Marketing of Petroleum and Petroleum Products				
ii.	PEE17102	Well Performance and Intervention				
iii.	PEE17103	Drilling System Design				
		Total Contact Hours = 22	19	3	0	41+(11) = 52

* Vocational Training taken at the end of VI semester is credited in VII Semester.

COURSE SYLLABUS

COURSE NO.	COURSE NAME	L	T	P
PEC 17101	OIL & GAS WELL TESTING	3	1	0

COURSE CONTENT

- Principles of Fluid Flow for steady state, semi steady state & non steady state conditions.
- Diffusivity Equation Derivation & Solutions, Radius of investigation, principle of superposition, Horner's approximation.

3. **Drill Stem Testing:** Equipment, DST chart observation and preliminary interpretation. Well preparation for testing, Multiple well testing. Effect of reservoir heterogeneities & Well bore conditions, fractured reservoir application.
4. **Pressure Transient Tests:** Drawdown and buildup-test analysis, determination of permeability and skin factor, Analysis of pressure-buildup tests distorted by phase redistribution, Well-test interpretation in hydraulically fractured wells, Interpretation of well-test data in naturally fractured reservoirs, Wellbore effects, Multilayer reservoirs, Injection well testing, Multiple well testing, Wireline formation testing. Wireline while drilling formation testing. Interference testing, Pulse testing,
5. **Well-test analysis by use of type curves:** Fundamentals of type curves, Ramey's type curve, McKinley's and Gringarten et al type curves.
6. **Gas well testing:** Basic theory of gas flow in reservoir, Flow-after-flow test, Isochronal test, etc.
7. **Applications of well testing:** Well testing in horizontal wells, Extended Reach wells & multi-laterals wells, tests with and without flow measurement.
8. **Computer-aided well test analysis:** Derivative plot, diagnostic plot evaluation, data preparation, nonlinear regression, Introduction to well testing software.

COURSE NO.	COURSE NAME	L	T	P
PEC 17102	OFFSHORE DRILLING AND PETROLEUM PRODUCTION PRACTICES	3	1	0

COURSE CONTENT:

1. Introduction to offshore oil and gas operations.
2. **Sea States and Weather:** Meteorology, oceanography, ice, sea bed soil.
3. Buoyancy and stability.
4. **Offshore Fixed Platforms:** Types, description and operations.
5. **Offshore Mobile Units:** Types, description and installation. Station keeping methods like conventional mooring & dynamic positioning system.
6. **Offshore Drilling:** Difference in drilling from land, from fixed platform, jackup, ships and semi submersibles. Use of conductors and risers. Deep sea drilling.
7. **Offshore Well Completion** - Platforms and subsea completions, Deep water applications of subsea technology.
8. **Offshore Production:** Oil processing platforms, gas processing platforms, water injection platforms, storage, SPM and SBM, transportation and utilities.
9. **Deep water technology:** Introduction, definition & prospects. Deep water regions, Deep water drilling rig – selection and deployment, Deep water production system, Emerging deep water technologies – special equipment and systems, Remote operation vessels (ROV).
10. **Divers and Safety:** Principles of diving use of decompression chambers, life boats.
11. Offshore Environmental Pollution and Remedial Measures.

COURSE NO.	COURSE NAME	L	T	P
PEC 17103	HEALTH, SAFETY & ENVIRONMENT MANAGEMENT IN PETROLEUM INDUSTRY	3	0	0

COURSE CONTENT:

Health Hazards in Petroleum Production Refining and Utilization:

1. Toxicity, Physiological, Asphyxiation, respiratory and skin effect of Petroleum Hydrocarbons (including mixtures), sour gases (eg Hydrogen sulphide and carbon monoxide etc) with their thresh-hold limits.
2. Effect of corrosive atmosphere and additives during acidizing, sand control and fracturing jobs etc.

Safety System:

1. Hazards analysis, developing a safe process, failure mode analysis, safety analysis (API-14C) safety analysis function evaluation chart (synergic approach).
2. Manual & automatic shutdown system, blow down systems.
3. Gas detection system

4. Fire detection and suppression systems.
5. Personal protection systems & measures.
6. HSE Policies, standards & specifications
7. Disaster & crisis management.

Environment:

1. Environment concepts, impact on eco-system, air, water and soil.
2. The impact of drilling & production operations on environment, Environmental transport of petroleum wastes.
3. Offshore environmental studies, offshore oil spill and oil spill control.
4. Oil mines regulations and other environmental legislations.
5. Environmental impact assessment.
6. Waste treatment methods, waste disposal method, remediation of contaminated sites.
7. Air & noise pollution

COURSE NO.	COURSE NAME	L	T	P
GPD 17363	PETROLEUM EXPLORATION - GEOPHYSICAL METHODS (Sessional Theory Paper)	2	0	0

COURSE CONTENT:

1. **Magnetic Method:** The geomagnetic field, Magnetic anomalies. Magnetic survey instrument, Field method of magnetic surveys. Reduction of magnetic data, diurnal and geomagnetic correction. Interpretation of magnetic anomalies. Magnetic response of simple geometric shapes. Application of magnetic survey.
2. **Gravity Method:** Units of gravity, gravity measuring instruments, gravity survey, gravity anomalies, Gravity data reduction, Drift, Latitude, Elevation, and Free-air correction. Free-air and Bouguer anomalies. Gravity response of simple geometric shapes. Interpretation of gravity anomalies and application of gravity methods.
3. **Seismic Methods:** Geometry of refracted ray path, planar interface. Two layer case with horizontal interface. Methodology of refraction profiling. Field surveys arrangements. Recording instruments and energy source. Corrections applied to refraction data. Interpretation of refraction data. Application of seismic refraction method, Passive seismic
4. Geometry of reflected ray path, planar interface, single horizontal reflector. Importance of seismic reflection survey over seismic refraction survey technique. Common depth point (CDP) profiling and stacking. 2-D data processing and interpretation of reflection data. Introduction to 3-D data acquisition, processing and interpretation. Applications of seismic method in oil exploration, Concept of 4-D seismic and its application.

COURSE NO.	COURSE NAME	L	T	P
GLD 17354	PETROLEUM EXPLORATION - GEOLOGICAL METHODS (Sessional Theory Paper)	2	0	0

COURSE CONTENT:

Surface indications of subsurface oil and gas accumulations. Oil accumulation parameters. Regional structural plan and local structures. Time of accumulation vis-avis time of oil generation. Geochemical methods of prospecting: Soil geochemical surveys; Source rock characterization and Hydro-geochemistry as a tool for oil exploration. Development Geology. Theoretical principles of prognostication of hydrocarbon reserve. Role of plane tectonics in Hydrocarbon accumulation onshore and offshore. Sequence of geological methods of oil exploration.

COURSE NO.	COURSE NAME	L	T	P
MSH 17152	INDUSTRIAL ENGG. AND MANAGEMENT (Theory Paper for VII B.Tech PE Honors)	3	0	0

COURSE CONTENT :

1. Basic functions of Management – Planning, organizing, staffing, directing and controlling.
2. Introduction to Industrial Engineering techniques.
3. Productivity: definition, measurement.
4. Work study and its role in improving productivity of an organization.

5. Types of production systems.
6. Introduction to production planning and control.
7. Concepts of Human Resource Management – Selection, Training & Development.
8. Finance Management – Capital Budgeting Techniques. Pay-back period, ARR, NPV, IRR, PI; Sources of capital; Cost concepts and Break-even analysis.
9. Project Management – Introduction, Network construction & identification of critical activities in CPM & PERT

COURSE NO.	COURSE NAME	L	T	P
PEE 17101	TRANSPORTATION AND MARKETING OF PETROLEUM AND PETROLEUM PRODUCTS	3	0	0

COURSE CONTENT:

1. Mode of Transportation of petroleum & petroleum products.
2. Basics of pipeline construction, operation and protection.
3. Pump and compressor stations. Instrumentation and control.
4. Metering and measurements of oil and gas.
5. Traffic management, Fire and safety rules.
6. Indian and Global supply scenario of petroleum and petroleum products. Product quality control. Bulk distribution and handling-domestic, commercial and industrial.
7. Storage of petroleum products in fixed installations. Standards and regulations.
8. Role of International oil companies and OPEC pricing mechanism. Administered and market determined pricing mechanism in India. Conservation of petroleum & its products, Spot and other market control mechanism.

COURSE NO.	COURSE NAME	L	T	P
PEE 17102	WELL PERFORMANCE AND INTERVENTION	3	0	0

COURSE CONTENT:

1. Introduction: Objectives of well tests, Reservoir models, Plotting methods
2. Fundamentals of Flow in Porous Media: Material balance concepts (constant compressibility and dry gas systems), Steady-state and pseudo-steady state flow concepts, Inflow Performance Relations (IPRs) for Gas-Oil and Gas-Condensate Reservoir Systems, Development of the diffusivity equation: Liquid and gas systems.
3. Solutions/Models for Well Test Analysis: Steady-state, pseudo steady-state, and transient radial flow, Dimensionless variables — radial flow diffusivity equation, Solutions of the diffusivity equation (various cases - concept of "type curves"), Variable-rate convolution: general and single-rate drawdown cases, Wellbore Phenomena
4. Well Test Analysis: Variable-rate convolution: Single-rate pressure build-up case, Conventional analysis of pressure drawdown/buildup test data. Analysis of gas well tests, Un-fractured and fractured wells, and dual porosity reservoirs, Design of well tests, Software for the analysis of well test data
5. Analysis and Modeling of Production Data: Production analysis: Introduction, empirical analysis/forecasting, and deliverability testing, Decline type curve analysis, Software for the analysis of production data

COURSE NO.	COURSE NAME	L	T	P
PEE 17103	DRILLING SYSTEM DESIGN	3	0	0

COURSE CONTENT:

1. Drilling Rig Selection and Design: Environmental loading and stability of rig. Design of Block and Tackle System, Design of Draw works Drum, Top drive drilling.
2. **Casing Design:** Conventional and conditional Casing Design Practices, Deep well strings, Design practices for high inclined, Horizontal and Slanted wells. Liner design and setting,
3. **Casing Buckling and Well Head Loads:** Casing landing practices, Buckling criteria and Calculation of well head loads.
4. **Casing while drilling.**

5. **Drill String Design.**
6. **Drilling fluid selection method for critical exploratory wells and development drilling.**
7. **Mud Hydraulics Design:** Rheology of drilling fluids and compatibility to borehole conditions, Hydraulic horse power and Rig horse power calculations. Jet impact force, Hydraulics design in High inclines wells. Bit Hydraulics, Bottom drive hydraulics design.
8. **Rotary System Design:** Design and performance of Kelly drive, Bottom Drive and Top Drive Systems.
9. **Special Methods of Drilling:** Aerated drilling, Under-balanced drilling, Overbalanced drilling, HPHT Drilling, Variable pressure regime, Plasma drilling, Electrical Drilling, Re-entry drilling, Jet Drilling, Drilling automation. Smart wells Design, Managed Pressure Drilling
10. **Drilling Economics.**
11. **Computer Application in Drilling**

COURSE STRUCTURE OF VIII SEMESTER B.Tech PETROLEUM ENGG.
(Effective from 2016 – 17 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC 18101	Petroleum Engineering Design	3	1	0	7
2.	PEC18102	Enhanced Oil Recovery Techniques	3	1	0	7
3.	PEC18104	Pipeline Engineering	3	1	0	7
4.		Elective Paper	3	0	0	6
6.	PEC18801	Petroleum Engg. Projects and Seminar	0	0	0	(6)
7.	PEC18501	Composite Viva Voce	0	0	0	(4)
		ELECTIVES: ANY ONE OF FOLLOWING				
i.	PEE 18101	Oil and Gas Processing System Design				
ii.	PEE18102	Coal Bed Methane, Gas Hydrates & Shale Gas/ Oil				
iii.	PEE18103	Advanced Offshore Engineering				
iv.	PEE18104	Oil and Gas Marketing and Resource Management				
v.	PEE18105	Deep Sea Production System				
		Total Contact Hours = 15	12	3	0	27+(10) = 37

COURSE STRUCTURE OF VIII SEMESTER B.Tech (Hons) PETROLEUM ENGG.
(Effective from 2016 – 17 session)

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs
1.	PEC 18101	Petroleum Engineering Design	3	1	0	7
2.	PEC18102	Enhanced Oil Recovery Techniques	3	1	0	7
3.	PEH18103	Reservoir Modeling and Simulation	3	0	0	6
4.	PEC18104	Pipeline Engineering	3	1	0	7
5.		Elective Paper	3	0	0	6
6.	PEH18304	Oil and Gas Marketing and Resource Management (Sessional Theory paper)	3	0	0	6
7.	PEC18801	Petroleum Engg. Projects and Seminar	0	0	0	(6)
8.	PEC18501	Composite Viva Voce	0	0	0	(4)
		ELECTIVES: ANY ONE OF FOLLOWING				
i.	PEE 18101	Oil and Gas Processing System Design				
ii.	PEE18102	Coal Bed Methane, Gas Hydrates & Shale Gas/ Oil				
iii.	PEE18103	Advanced Offshore Engineering				
iv.	PEE18105	Deep Sea Production System				
		Total Contact Hours = 21	18	3	0	39+(10) = 49

COURSE SYLLABUS

COURSE NO.	COURSE NAME	L	T	P
PEC 18101	PETROLEUM ENGINEERING DESIGN	3	1	0

COURSE CONTENT :

1. **Development of Oil & Gas Fields:** Selection of development scheme, economic aspect of development of oil and gas fields. Production variants, performance prediction, Recovery factor, Stages of preparation of development plans. Computation of economic indices viz. Capital investment, payout period, IRR, Profile, Economic life etc. Analysis of different variants based on technical and economic considerations. Economic development of Marginal fields.
2. **Design of oil and gas separation system:** Design of two phase and three phase separators.
3. **Crude oil Treatment:** Heater treaters, Electrostatic heater treaters, Design of heater treaters
4. **Basic principles and descriptions of Artificial lift techniques:** Gas-lift - continuous and intermittent, chamber lift, plunger lift/sucker rod pumping, and hydraulic pumping - piston & jet type.
5. **Design of Continuous gas lift system (pressure operated valves)** - graphical and analytical methods.
6. **Design of Intermittent gas lift system;** single point injection standard tubing installation (Pressure operated valves) - graphical and analytical methods.
7. **Design of Sucker rod pumping system**
8. **Characteristics and Selection of electric submersible pumping/PCP systems**

COURSE NO.	COURSE NAME	L	T	P
PEC 18102	ENHANCED OIL RECOVERY TECHNIQUES	3	1	0

COURSE CONTENT:

1. Introduction: Historical background and review of primary and secondary recovery, injection rate and pressures in secondary recovery. Flood Patterns and Coverage.
2. Microscopic displacement of fluids in a reservoir: Capillary forces, viscous forces, phase trapping, mobilization of trapped phases.
3. Macroscopic displacement of fluids in a reservoir: Areal sweep efficiency, vertical sweep efficiency, displacement efficiency, mobility ratio, well spacing.
4. Flow of immiscible fluids through porous media. Continuity equation, equation of motion, solution methods Water flooding, Fractional flow equation, Frontal advance theory. Recovery efficiency, permeability heterogeneity.
5. Water flooding performance calculations: Frontal advance method, viscous fingering method, Stiles method, Dykstra-Parsons Method, Water for water flooding.
6. Chemical Flooding: Polymer flooding and mobility control processes, Micellar/ polymer flooding, phase behavior of micro-emulsions, phase behavior and IFT, wettability alterations, Alkali flooding.
7. Miscible Displacement Processes: Mechanism of miscible displacement, phase behavior related to miscibility, high pressure gas injection, enriched gas injection, LPG flooding, Carbon dioxide flooding, alcohol flooding.
8. Thermal Recovery Processes: mechanism of thermal flooding, hot water flooding, cyclic steam injection, estimation of oil recovery from steam drive, in-situ combustion, air requirement for in-situ combustion.
9. Microbial oil recovery
10. EOR Project Evaluation.

COURSE NO.	COURSE NAME	L	T	P
PEH 18103	RESERVOIR MODELING AND SIMULATION (Theory Paper for VIII B.Tech PE Honors)	3	0	0

COURSE CONTENT:

1. Introduction & Overview: Definition, Objectives and applications of reservoir simulation with brief overview of the system, steps of the reservoir simulation.
2. Modeling concepts: type of models, check list for designing a model, concept of grid blocks, initial and boundary conditions, various flow models, concept of proper grid orientation
3. Designing of model equations- black oil model and compositional model
 - a. Simplification of model equations with realistic solution:
 - b. Selection & Preparation of data: Rock data, fluid data, mechanical data, production data., Thickness and depth etc . Sensitivity of results to data accuracy
 - c. Pseudo functions :Pseudo-relative permeability & Capillary pressure functions, VE pseudo functions
4. Solution techniques for model equations: Analytical vs. numerical solutions
 - a. Conversion of complex PDE to simplified algebraic equation using finite difference method, concept of Explicit & Implicit functions
 - b. Selecting Grid & Time-step sizes: Selection of gridblock size example grids, Selection of time steps, Numerical dispersion, Grid orientation, Cost considerations
 - c. Selecting the Numerical solution method. Terminology, Formulating options, Numerical Dispersion, Choosing the formulation option, Matrix Equations, Solution methods, Selecting the Equation-solving technique.
5. History Matching: Validity of the Reservoir Model, Strategy & Plans, Adjustment of parameters, Pressures, Pressure gradients, GOR-WOR behavior Automatic History Matching.
6. Forecasting Future Performance: Planning prediction cases, Preparation of input data, Making a smooth transition from history to predictions, Review & Analysis of predicted performance, Evaluating & Monitoring predicted performance
7. Simulating Special Processes: Concept of Compositional Simulation, Miscible displacement, Chemical & polymer flooding, Steam simulation and steam drive, In-Situ combustion, Special Data requirements

COURSE NO.	COURSE NAME	L	T	P
PEC 18104	PIPELINE ENGINEERING	3	1	0

COURSE CONTENT :

1. Objective and scope of pipeline as a means of fluid transportation with special reference to crude oil/gas/refined products, Economics of Pipeline transportation.
2. **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.
3. Theory and different formulae of the 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.
4. **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.
5. Corrosion protection and control; Design of cathodic protection system, Pipeline automation.
6. **Offshore Pipeline:** Design and control of Sag and Over bend; Description of stinger; and Riser, articulated stinger, construction of offshore pipeline, Method of underwater welding.
7. **Hydrates, Wax & Scale:** Formation and prevention. Crude conditioning and use of additives to improve flow conditions.
8. City distribution network of oil/gas. Lease and custody transfer.

COURSE NO.	COURSE NAME	L	T	P
PEH18304	OIL AND GAS MARKETING AND RESOURCE MANAGEMENT (Sessional Theory Paper for VIII B.Tech Honors)	3	0	0

COURSE CONTENT:

1. Introduction: The structure and development of Oil & Gas Industry, India Hydrocarbon vision 2025.
2. Petroleum Resource classification, Analysis of resource management.
3. Natural Gas: What is Natural Gas, Measuring Natural Gas, Pipeline quality natural Gas
4. Demand, Supply & Storage of natural gas: Gas production, Source of demand in India, The supply system, Pipeline Operations & Network, Storage of Natural Gas, Liquefied Natural gas Plant & Operations, Gas Sales Pattern in India, Gas Pipeline Regulations in India, Gas Trading, Gas Pricing
5. Coal Bed Methane: Introduction, Present status of Coal Bed Methane, CBM Storage and sales, CBM Pricing in India
6. Crude Oil: Crude oil/ specification, Measuring/ Custody transfer of Crude Oil, Crude Oil Transportation, Crude Oil Production in India, Crude Oil refineries, Products from Crude Oil
7. International & National Institutions of Oil & Gas: API, OPEC, OECD, OADB, DGH, PNGRB, CHT, PII, PPAC, PCRA
8. Petroleum Contracts: NELP - Role & Background, Types of Contracts and fiscal components, Production sharing contracts in India, Crude Oil trading and pricing, CBM Contracts
9. Strategic Reserves concepts.

COURSE NO.	COURSE NAME	L	T	P
PEE 18101	OIL AND GAS PROCESSING SYSTEM DESIGN	3	0	0

COURSE CONTENT:

1. **Oil desalting:** Operation, variables, Heater treater design.
2. **Natural Gas Dehydration:** (a) Glycol Process: operation, effect of variables, dew point depression, stage calculation.
3. NTU - graphical and analytical methods, Absorber sizing. Lean oil absorption. (b) Solid-bed process: design & operation, effect of process variables, Regeneration and cooling calculations. Hydrocarbon recovery. (c) Hydrate formation & inhibition.
4. **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.
5. **Crude Oil & Condensate Stabilization:** LTX Stabilization.
6. **Oil & Gas Treatment :** Oil desalter, emulsion treatment theory and practice, Emulsifiers & Demulsifiers, Gravity Separation, coalescence, coalescing media, electrostatic coalescers.
7. **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.

COURSE NO.	COURSE NAME	L	T	P
PEE18102	COALBED METHANE, GAS HYDRATES & SHALE GAS / OIL	3	0	0

COURSE CONTENT:

A: COALBED METHANE:

1. Introduction & present status of coalbed methane- Global and Indian Scenario
2. Formation and properties of coalbed methane: Generation of coalbed methane gas & its properties, properties of coal as reservoir rock & Reserve Estimation.
3. Thermodynamics of coalbed methane: isotherm studies

4. Overview of Drilling and Production systems of coalbed methane wells.
5. Selection of Artificial lift for CBM wells
6. Hydro-fracturing of coal seams
7. Treating and disposing produced water.
8. Testing of coalbed methane wells.

B: NATURAL GAS HYDRATES:

1. Introduction & present status of gas hydrates
2. Formation, accumulation and properties of gas hydrates
3. Thermodynamics, kinetics and phase behaviour of gas hydrates
4. Drilling and production systems of gas hydrate wells
5. Prevention & control of gas hydrates
6. Gas extraction from gas hydrates. Uses and application of gas hydrates.

C: SHALE GAS/ OIL:

1. Global Scenario of shale gas/ Oil production.
2. Nature, origin and distribution of Shale Gas/ Oil.
3. Characterization of Shale for Production of Shale Gas/ Oil.
4. Extraction methods of Shale gas/ Oil: development of current practices.
5. Location and size of production areas: estimated reserves and economics.
6. Environmental issues in shale gas exploration.
7. Markets and Globus impact on energy scenario.
8. Economic factor of shale Gas/ oil production

COURSE NO.	COURSE NAME	L	T	P
PEE 18103	ADVANCED OFFSHORE ENGINEERING	3	0	0

COURSE CONTENT:

1. Introduction: Deviations from Onshore drilling, Challenges , Rig types:Jack-up, Semi-sub, Floaters
2. Deepwater Drilling: Introduction - History & Geology, Floating Drilling Rigs and chronological Advancements, Basic Floating Rig equipment, Rig Automation
3. 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.
4. Open Water Operations: Remotely operated vehicles: Wellhead components for open water operations, Guidance systems; Guideline system; Guideline less system; Mudmat, 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.
5. Riser Systems: Riser system Components, Buoyancy, Riser Tensioners & Tensioning Criteria, Basic Riser Analysis, Riser Operations, Emergency Disconnect, High Current Operations.
6. Subsea Wellheads: Overview of Wellhead Components, Tool Description, Wellhead sizing.
7. 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.
8. 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.
9. Well Abandonment ; Abandonment Guidelines & Regulations: Plug placement; balance plug calculations; inflow test, Barrier placement.
10. Review and case studies.

COURSE NO.	COURSE NAME	L	T	P
PEE 18105	DEEP SEA PRODUCTION SYSTEM	3	0	0

COURSE CONTENT:

1. Concept of deep sea development: Direct tie back and FPSO based development.
2. Hydrate, Wax, Scale and Asphaltene equilibrium curves and the effect of low temperature. Analysis of well bore and pipeline heat transfer processes.
3. Concept of cool down time and its application for the development concept.
4. Basic multiphase flow concepts, Flow patterns, hold up and pressure drop in multiphase flow lines. Slugging phenomena – Concepts of transient vs hydrodynamic slugging .Design of the receiving facility- Slug catcher vis a vis Separators.
5. Outlines of thermodynamic inhibitors (MEG and Methanol) and basic calculation methods for hydrate formation prevention.
6. Introduction to LDHIs and their chemistry for hydrate prevention.
7. Field techniques used for the dissociation of the hydrate plugs in pipelines.