

Semester V

Workover and Well Stimulation

1.1 Course Number: PE301

1.2 Contact Hours: 3-1-0 Credits:11

1.3 Semester-offered: 3rd Year –Odd

1.4 Prerequisite: NA

1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

The objective of this subject is to introduce students to the services division of the oil and gas industry in terms of work-over jobs and well stimulation. It will briefly discuss reservoir associated problems and well completion problems. It will deal with well servicing operations like removal of hydrates, wax, scales, fishing operations. It shall also explain cementing failures and the remedial operations. The subject will also explain stimulation methods of acid treatment and hydraulic fracturing jobs.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	Well problems	Introduction, Source of well problems, Reservoir associated problems, Mechanical failures in a wellbore and well completion associated problems, coning, introduction to workover and stimulation	8
2	Hydrate, wax and scales	Hydrate: conditions for hydrate formation, hydrate inhibition; Wax/paraffin: causes of wax deposition, remedial measures, preventive measures; Scales: deposition, causes, scale removal methods, scale prevention	8
3	Remedial cementing	Cementing failures, squeeze cement injection and cement action, squeeze cementing techniques: bradenhead method, packer squeeze method, hesitation squeeze, Cement plugs, plug operations: balanced plug and dump bailer method	8
4	Fishing operations	Introduction, types of fish; junk; fishing tools: catching/grabbing tools and breaking tools; junk shots; scrappers and drilling jars; planning and preparation for fishing operations, fishing challenges	8
5	Well Stimulation: Acidization treatment	Introduction to well stimulation, reasons for performing stimulation, methods of well stimulation, acidization, matrix acidization: working, types of acids for carbonate and sandstone reservoirs, placement technique of acid job, purpose, fracture acidizing process, fracture pressure	8

6	Well Stimulation: Hydraulic formation fracturing	Introduction, reasons and purpose, components required in a hydraulic fracturing site, fracturing fluid and its components, Types of fracture fluids, proppants, hydraulic well fracturing process	8
Total			48

4. Readings

4.1 Suggested Books:

1. Introduction to Petroleum Production, Vol I, D.R. Skinner, Gulf Publishing Company
2. Petroleum production engineering; BoyunGuo, William C.Lyons, Ali Ghalambor; Gulf Professional Publishing
3. Petroleum Engineering Handbook, Volume IV: Production Operation Engineering, Joe Dunn Clegg, SPE books
4. Petroleum Production Systems, Michael J. Economides, A. Daniel Hill, Christine Ehlig-Economides, Ding Zhu; Prentice Hall Production Technology I, Heriott-Watt University

5. Outcome of the Course:

The students will be:

- 1) Gaining knowledge about different well services.
- 2) Understanding the importance of maintenance and remedial operations to keep the well in good production condition.
- 3) Knowing about simulation services of acidization and hydraulic fracturing.

Petroleum Formation Evaluation

1.1 Course Number: PE302

1.2 Contact Hours: 3-1-0 Credits:11

1.3 Semester-offered: 3rd Year –Odd

1.4 Prerequisite: NA

1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

The objective of this course is to help participants attain a comprehensive knowledge of the fundamental principles involved in evaluation of subsurface formation to identify its characteristics, the various technologies utilized to measure subsurface properties. This will help in evaluating the usability and values of subsurface rock formations for crude oil and gas accumulation and its production.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	Introduction	Introduction to formation evaluation, logging objectives, log run-log chart, classification: non-wireline logs and wireline logs, procedure of logging, , wireline logging, and production logging techniques	7
2	Non-Wireline logs	Mud log, tools utilized in mud logging; Core sample, types of coring: conventional and sidewall coring, core analysis, drilling operation logs: measurement while drilling, logging while drilling	8
3	Resistivity Log & SP Log	Resistivity Log: Introduction, resistivity logs, micro-resistivity logs, induction log, log presentation, Archie's laws; SP Log: Introduction, electrochemical potential, electro-kinetic potential, total potential, SP tool, log presentation	8
5	Gamma Ray Log	Natural Radioactivity, gamma ray, gamma ray detector, Log presentation, shale content, well log trend patterns	6
5	Density & Neutron Logs & Acoustic Log	Density & Neutron Logs: Density Logging tool & technique, bulk density and porosity measurement, log presentation; Neutron interaction, neutron tool, log interpretation, gas anomaly, uses; Acoustic (Sonic) Log: Introduction, sonic logging tools, Wyllie equation, log presentation, uses	7

6	Caliper & Temperature Logs	Caliper Logs: introduction, caliper tool, log presentation, interpretation, uses of caliper log; Temperature Logs: introduction, geothermal gradient, borehole temperature measurement, temperature logs with increased time, gas anomaly and fracture detection, uses.	5
7	Cement quality and Production Logging	Cement bond, Cementing technique efficiency, quality of cement, bond index, applications; introduction to production Logging, purpose, production logging tools, drill stem test, uses of production logging	6
Total			48

4. Readings

4.1 Suggested Books:

1. Fundamentals of Well-Log Interpretation 1. The Acquisition of logging data, O.Serra, Elsevier Science Publishers B.V.
2. Formation Evaluation, Heriot Watt University
3. Open-Hole Log Analysis and Formation Evaluation, Richard M. Bateman, Springer Netherlands
4. The Geological Interpretation of Well Logs, Malcom Rider, Whittles Publishing Services

5. Outcome of the Course:

The students will be able to:

- 1) Understand the need for evaluation of petroleum formation
- 2) Know non-wireline as well as wireline method
- 3) Gain the basics of well logging techniques used in the oil & gas Sector.

Offshore Oil and Gas Operations

1.1 Course Number: PE303

1.2 Contact Hours: 3-0-0 Credits:9

1.3 Semester-offered: 3rd Year - Odd

1.4 Prerequisite: NA

1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

The objective of this course is to help participants attain a basic knowledge of the offshore operations of the oil & gas industry. The course will discuss offshore drilling and production operations. It will discuss different infrastructures applied in offshore locations for activities such as offshore drilling rigs, offshore production platforms, sub-sea wells systems as well as support infrastructure.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	Meteorology & oceanography	Introduction, weather and climate, elements of weather, wind circulation, storms, ocean environment, branches, origin of ocean, oceanic ridge, ocean physiography	4
2	Offshore Drilling Rigs	Introduction, types of offshore rigs: bottom supported rigs- submersible drilling pontoons, self-elevating Jack up rigs. Floating rigs: Degree of freedom in rig motion, Semi-submersible rigs, drill ships, mooring and dynamic positioning, drilling: preliminary drilling operations, subsea BOP, marine riser	7
3	Offshore Production Systems	Introductions, common elements, types- Fixed: Compliant towers, Gravity platforms; Floating: Tension Leg Platforms (TLP), Floating production storage and offloading (FPSO) system, Spar, system for handling oil	6
4	Subsea System	Introduction, Subsea components: wells, subsea trees, manifolds & sleds, flowlines & jumpers, umbilical & flying lead, control systems, heat retention in flowlines.	5
5	Topsides	Introduction, different topside facilities, categories of topsides, metering and custody transfer, personnel transportation & their accommodation, safety systems, auxiliary systems.	4
6	Offshore pipeline laying & risers	Offshore operations flow path, S lay, J-lay, reel lay, coating & corrosion protection, bottom conditions & burial; Risers: attached risers, pull tubes, steel catenary risers, top tensioned risers, riser tower, flexible risers.	6

7	Offshore support vessels	Introduction, platform supply vessels, anchor handling vessels, crew boats, heavy lift vessels, specialty vessels, remotely operated vessels (ROVs)	4
Total			36

4. Readings

4.1 Textbooks:

1. Deepwater Petroleum: Exploration & Production – a nontechnical guide, William L. Leffler, Richard Pattarozi, Gordon Sterling; PennWell
2. Offshore Petroleum Drilling and Production, Sukumar Laik, CRC Press, Taylor and Francis
3. Handbook of Offshore Oil and Gas Operations, James G. Spaight, Gulf Professional Publishing
4. Handbook of Offshore Engineering, Vol I, V Subrata K. Chakrabarti, Elsevier, The Netherlands
5. Handbook of Offshore Engineering, Vol II, V Subrata K. Chakrabarti, Elsevier, The Netherlands

5. Outcome of the Course:

The students will be able to:

- 1) Understand the necessity of the offshore oil and gas industry.
- 2) Get an idea of the various infrastructure, operations & supports involved in offshore activities.
- 3) Compare the offshore with onshore technology.

Humanities

- 1.1 Course Number: HU301
 1.2 Contact Hours: 2-0-0 Credits:6
 1.3 Semester-offered: 3rd Year –Odd
 1.4 Prerequisite: Diploma level English
 1.5 Syllabus Committee Members: DUGC

2. Objective:

- i) Foster intellectual curiosity, global knowledge, critical thinking, personal responsibility, and ethical and cultural awareness.
- ii) Prepare students to use language effectively.
- iii) Establish a framework for students to develop an aesthetic appreciation for fine arts.
- iv) Prepare students to be responsible citizens, lifelong learners, and world-ready leaders in their chosen fields.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	Introduction to Sociology	Definition of sociology, some sociological concepts: social structure, status, role, norms, values etc. Socialization, and culture and change. Social stratification - various approaches and concept of social mobility. Population and society - Trends of demographic change in India and the world, Human Ecology, Trends of Urbanization in the developing countries and the world. Major social institutions - Family and marriage, caste and tribe and organizations: (i) formal organization (bureaucracy) (ii) informal organization. Processes of social change - Modernization (including Sanskritization), industrialization, environmental/ecological changes and development. Social movements - protest movements, reformist movement and radical movements in India.	9
2	Introduction to Literature	Nature of Literature: Literature as a Humanistic Experience. Definitions: (i) Humanities: concern with culture, values, ideologies; (ii) Literature: concepts of imitation, expression, intuition & imagination. Major Themes of Literature: Nature, Science, Selfhood, Love, Rebellion. The Language of Literature: Modes of literary and non-literary expression. The concepts of Figurative language, imagery, symbolism, style. The Forms of Literature:	7

		Prose Narratives (short stories & novels) Poetry, Drama and Essays (Suitable texts are to be chosen by the instructors), Use of a Learner Dictionary.	
3	Introduction to Philosophy	<p>Philosophy and History of Science: Growth of scientific knowledge: factors leading to the emergence of modern science. Conceptual evolution: internal and external history. Methodology of science: induction, falsifications, confirmation and probability. Nature of scientific laws and theories: realism, instrumentalism, and under-determination. Relationship between scientific observation, experiment and scientific theory. Nature of scientific explanation: teleological explanations and the covering law model. Selected case studies on scientific theories.</p> <p>Logic and the nature of mathematical reasoning: Inductive and deductive forms of reasoning. Nature of axioms: formal axiomatic systems. Concept of consistency, independence, and completeness. Nature of rules of inference and proof. Selected examples of axiomatic systems and proof procedures.</p> <p>Cognition: Current approaches to the understanding of mind and mental processes: empiricist, rationalist, behaviorist and cognitivist.</p> <p>Ethics: Impact of science and technology on man and society: elements of environmental and professional ethics</p>	7
Total			23

4. Readings

4.1 Textbook/Reference Books:

(A) Introduction to Sociology:

- (a) L. Broom, P. Selznick and D. Dorrock, Sociology, 11th Edn. 1990 (Harper International).
- (b) M. Haralambos, Sociology: Themes and Perspectives, Oxford University Press, 1980.
- (c) M.S.A. Rao (ed) Social movements in India, vols. 1-2, 1984, Manohar.
- (d) David Mandelbaum, Society in India, 1990, Popular.
- (e) M.N. Srinivas, Social change in modern India, 1991, Orient Longman.
- (f) Guy Rocher, A. General Introduction to Sociology, MacMillan, 1982.

(B) Introduction to Literature:

- (a) David Murdoch (ed.). The Siren's Song: An Anthology of British and American Verse, Orient Longman, 1988.
- (b) S. Alter & W. Dissanayake (eds.) The Penguin Book of Modern Indian Short Stories. Penguin Books (India), 1989.
- (c) Bertrand Russell, Impact of Science on Society. Allen & Unwin, 1952.
- (d) Henrik Ibsen, A Doll's House, Macmillan India, 1982.
- (e) George Orwell, Animal Farm, Penguin, 1951.
- (f) J. Bronowski. The Ascent of Man, BBC, 1973.

(C) Introduction to Philosophy:

- (a) A.C. Grayling (ed.) *Philosophy: A Guide through the Courses/Subjects*, Oxford Univ. Press, London, 1995.
- (b) Marx W. Wartofsky, *Conceptual Foundations of Scientific Thought: An Introduction to the Philosophy of Science*, Macmillan, London, 1968.
- (c) I.B. Cohen, *The Birth of a New Physics*, Vakils, Feffer and Simons Pvt. Ltd., Bombay, 1968.
- (d) H. Eves and C.V. Newsom, *Foundations and Fundamental Concepts of Mathematics*, Boston, PWS-Kart Pub. Co., 1990.
- (e) K.E. Goodpaster and K.M. Sayre (eds.) *Ethics and Problems of 21st Century*, Univ. of Notre Dame Press, London, 1979.
- (f) S.D. Agashe, A. Gupta & K. Valicha (eds.) *Scientific Method, Science, Technology and Society: A Book of Readings*, Univ. of Bombay Press, 1963.

5.Outcome of the Course:

Students will demonstrate:

Knowledge of the conventions and methods of at least one of the humanities in addition to those encompassed by other knowledge areas required by the General Education program.

Engineering Economics

- 1.1 Course Number: MT301
 1.2 Contact Hours: 2-1-0 Credits:8
 1.3 Semester-offered: 3rd Year –Odd
 1.4 Prerequisite: Diploma level Mathematics
 1.5 Syllabus Committee Members: DUGC

2. Objective:

- i) To make fundamentally strong base for decision making skills by applying the concepts of economics.
- ii) Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.
- iii) Prepare engineering students to analyze profit/revenue data and carry out make economic analysis in the decision-making process to justify or reject alternatives/projects.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	Introduction to Economics	Introduction to economics – Flow in an economy – Law of supply and demand – Concept of engineering economics – Engineering efficiency – Economic efficiency – Scope of engineering economics – Element of costs – Marginal cost – Marginal revenue – Sunk cost – Opportunity cost – Break-even analysis – V ratio – Elementary economic analysis – Material selection for product design selection for a product – Process planning.	10
2	Value Engineering	Make or buy decision – Value engineering – Function – Aims – Value engineering procedure – Interest formulae and their applications – Time value of money – Single payment compound amount factor – Single payment present worth factor – Equal payment series sinking fund factor – Equal payment series payment Present worth factor – Equal payment series capital recovery factor – Uniform gradient series annual equivalent factor – Effective interest rate – Examples all methods.	8
3	Cash Flow	Methods of comparison of alternatives – Present worth method (Revenue dominated cash flow diagram) – Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Rate of return method – Examples all methods.	8
Total			26

4. Readings

4.1 Textbooks:

1. Panneer Selvam, R., "Engineering Economics", Prentice Hall of India Ltd, 2001.
2. Smith, G.W., "Engineering Economy", Iowa State Press, 1973.

4.2 Reference books:

1. Park, C.S., "Contemporary Engineering Economics", Prentice Hall of India, 2002.
2. Newman, D.G. and Lavelle, J.P., "Engineering Economics and Analysis", Engineering Press, 2002.
3. Degarmo, E.P., Sullivan, W.G. and Canada, J.R., "Engineering Economy", Macmillan, 1984.
4. Grant, E.L., Ireson, W.G. and Leavenworth, R.S., "Principles of Engineering Economy", Ronald Press, 1976.

5. Outcome of the Course:

Upon completing the course, students will be able to:

- 1) Understand major principles of economic analysis for decision making among alternative courses of action in engineering.
- 2) Apply economic principles to prices and quantities in competitive supply and demand for goods and for money.
- 3) Solve economic problems involving comparison and selection of alternatives by using analytical techniques including benefit-cost ratio and breakeven analysis.

Petroleum Product Testing Laboratory

1.1 Course Number: PE307L

1.2 Contact Hours: 0-0-2 Credits:2

1.3 Semester-offered: 3rd Year–Odd

1.4 Prerequisite: Fundamentals of Petroleum Refinery Operations

1.5 Syllabus Committee Members: Dr. Satyajit Chowdhury, Dr. Chinmoy Jit Sarma, Dr. Sekhar Gogoi
& Dr. Srawanti Medhi

List of Experiments:

1. To determine the Cloud Point and Pour Point of Crude Oil.
2. To determine the Smoke Point of Crude Oil.
3. To determine the Fire & Flash Point of Crude Oil.
4. To determine the density and viscosity of crude oil.
5. To determine TAN of crude oil.
6. To conduct distillation of crude oil sample using ASTM distillation Apparatus and plot ASTM, TBP and EFV curves.
7. To determine the Softening Point of the given sample.
8. To determine the calorific value of a given sample.

Departmental Elective/ Open Elective

City Gas Distribution

1.1 Course Number: PE304

1.2 Contact Hours: 3-0-0 Credits:9

1.3 Semester-offered: 3rd Year - Odd

1.4 Prerequisite: NA

1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

- i) To provide a fundamental understanding of the technical and business aspect of the City Gas Distribution network.
- ii) To provide a fundamental understanding of the technical and business aspect of the City Gas distribution network.
- iii) To make students confident to implement the knowledge of City Gas Distribution in industry

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	Introduction	Natural gas: definition, composition, uses, liquefied natural gas (LNG) compressed natural gas (CNG) and piped natural gas (PNG), Path of flow of natural gas, application in domestic, commercial, and industrial sector, Storage of CNG, Advantages, limitations.	7
2	Liquefied Natural Gas	LNG, history, LNG characteristics, LNG properties, need of LNG, LNG chain, liquefaction technology, LNG transportation, LNG terminal, LNG storage, Uses.	6
3	Distribution	CGD concept, infrastructure-distribution network, various stations involved: city gas station (CGS), pressure reduction station (PRS), district regulation station (DRS), setting up the network, network pressures, challenges.	7
4	City gas pipelines and metering	Market Demand, Type of pipelines used- carbon steel, MDPE and GI and Copper; procedure of carbon steel and MDPE pipe laying, city gas metering- gas meters, gas chromatograph, pressure and temperature transmitter.	7
5	Operation and maintenance	Hazards, built-in design, operation preparedness, emergency preparedness- emergency response and disaster management plan, customer related operations, liaisoning.	5

6	Safety at CGD	Statutory rules and safety codes, behavioral safety, infrastructure safety, Process safety, Environmental safety, overall safety areas, Safety compliance, Safety kits and equipment, PPE.	6
Total			38

4. Readings

4.1 Textbooks:

1. Natural Gas- A Basic Handbook, James Speight, Gulf Professional Publishing
2. Handbook of Liquefied Natural Gas; S. Mokhatab, J. Mak, J Valappil, David A.Wood; Gulf Professional Publishing
3. Handbook of Natural Gas Transmission and Processing, S. Mokhatab, W. Poe, J. Speight; Gulf Professional Publishing

5. Outcome of the Course:

- 1) Summarize City Gas Distribution value chain and Natural Gas system.
- 2) Acquaint and adapt the roles, functions and objectives of PNGRB
- 3) Explain Piped Natural Gas (PNG) distribution system.
- 4) Classify the types of Compressed Natural Gas (CNG) Stations and explain the CNG infrastructure.
- 5) Practice the HSE measures for safety of CGD sector.
- 6) Assess the steps to be taken in financing the CGD measures.

Unconventional Oil and Gas Resources

1.1 Course Number:PE305

1.2 Contact Hours: 3-0-0 Credits:9

1.3 Semester-offered: 3rd Year - Odd

1.4 Prerequisite: NA

1.5 Syllabus Committee Members: Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

The objective of the course is to introduce the students to the domain of oil and gas resources which are termed as unconventional because of their complexity during drilling and production. It will introduce some unconventional oil and unconventional gas resources. The focus will be on shale gas, coal bed methane, heavy oil, gas hydrates and tight gas reservoirs. The course will also discuss the availability and potential of unconventional resources in the context of India.

3. Couse Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	Introduction	Unconventional resources, occurrence, evaluation of unconventional resource, unconventional oil, unconventional gas, unconventional resource triangle, drilling and production of unconventional oil and gas resources, hydraulic fracturing, Environmental concerns water quality, water utilization, noise control, GHG emissions control and air pollution from hydraulic fracturing.	6
2	Shale Gas	Introduction to shale gas, characteristics of a shale gas play: maturity, type of gas, TOC, permeability; exploration and production of shale gas well, hydraulic fracturing steps, dealing flowback water and abandonment, challenges to shale gas production and hydraulic fracturing, shale gas resource in India.	7
3	Coal Bed Methane	Introduction, coal formation and composition, coal porosity, coal cleat, methane storage, CBM well, gas production, methane migration, production curve for CBM well, CBM potential in India.	6
4	Heavy Oil	Introduction and origin of heavy oil, occurrence, heavy oil and extra heavy oil, heavy oil recovery: cold method and hot method, primary cold production, cold heavy oil production with sand (CHOPS), thermal methods, heavy oil transportation: viscosity reduction, drag reduction, in-situ upgrading	6

5	Gas Hydrates	Introduction, conditions promoting gas hydrates formation, worldwide locations, gas hydrate resource pyramid, marine gas hydrate and permafrost associated gas hydrate, producing methane from hydrates: water circulation, depressurization, carbon dioxide injection, hydrates in India	6
6	Tight Gas reservoirs	Introduction, geological control of tight gas sandstone reservoirs: gas accumulation in low-permeability tight sandstones of a conventional trap and basin centered gas accumulations, general properties: source rock, abnormal pressure, stacking patterns, reservoir quality; drilling and completion scenarios, producing gas from tight reservoirs, tight gas potential in India	5
Total			36

4. Readings

4.1 Textbooks:

- 1) Advanced Reservoir Engineering, Tarek Ahmed and Paul D. McKinney, Gulf Professional Publishing
2. Unconventional Oil and Gas Resources Handbook, Y Ma and Stephen Holditch, Gulf Professional Publishing
3. Shale Oil and Gas Handbook, Sohrab Zendehboudi and Alireza Bahadori, Gulf Professional Publishing
4. Unconventional Oil and Gas Resources- Exploitation and Development, Usman Ahmed and D. Nathan Meehan, CRC Press
5. Coal Bed Methane-Theory and Application; Pramod Thakur, Steven J. Schatzel, Kashy Aminian, Gary Rodvelt, Morgan H. Mosser and Joseph S.D'Amico, Elsevier

5. Outcome of the Course:

The course will equip students with

- 1) Knowledge and importance of unconventional oil and gas resources which are emerging topics in today's oil and gas industry
- 2) Production methods to harness oil and gas from these unconventional resources.
- 3) The potential of such resources in India and encourage to think of alternatives to conventional oil and gas resources helping reduce dependence on foreign exports in coming decades.

Pipeline Transportation of Oil and Gas

1.1 Course Number- PE306

1.2 Contact Hours- 3-0-0 Credits: 9

1.3 Semester Offered- 3rd Year – Odd

1.4 Prerequisite: NA

1.5 Syllabus Committee members- Dr. Chinmoy Jit Sarma, Dr. Satyajit Chowdhury,
Dr. Sekhar Gogoi & Dr. Srawanti Medhi

2. Objective:

- i) Help students to understand pressure distribution system in Natural Gas Pipelines i.e. low-pressure medium pressure and high-pressure system
- ii) Enable students to design of City Gas Distribution Network
- iii) To give students knowledge methods of Pipeline Network Analysis i.e. Hardy Cross Methods, Newton Loop Method
- iv) Assist students to analyze graph theory applicable for Network Analysis
- v) Help students to examine steady state & unsteady state analysis for gas pipelines.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	Introduction	Mode of transportation, scope, advantages of pipeline transportation, planning and evaluation, technical, financial and economics and cost structure, Lease Automatic Custody Transfer.	4
2	Design of Pipeline	Overview, Types of onshore/offshore(subsea) pipeline and gathering systems, factors influencing design: physical properties of fluid, physical properties of pipelines, Climatic conditions, Hydraulic Shock/surge and water hammering, Road, railroad and water body(river) crossings, Piping codes and specifications.	6
3	Flow of Fluids	Basic planning and initial planning, Types of pipeline system, Laminar and turbulent flow, Compressible and incompressible fluids, Newtonian and non-Newtonian fluids and time dependent and independent fluids, Flow Regimes: bubble, slug, churn, mist, annular.	8
4	Construction of Pipelines	Pipeline project construction specifications, Material and equipment, Types of line pipe- seamless line pipe, flexible pipe, composites; Types of valves- gate, plug, ball, check, butterfly and Pressure Relief Devices: safety valve and relief valve, pipe coating.	8

5	Pipeline Pigging	Introduction of Pigs, Types of Pigs, pig launchers, Smart pigs/Intelligent pig, Plugs.	5
6	Corrosion protection	Causes, Types, Protection: coating, cathodic protection, Internal corrosion, Corrosion Monitoring and control.	5
Total			36

4. Readings

4.1 Textbooks:

1. Pipeline Rules of thumb Handbook, E.W. McAllister, Gulf Professional Publishing
2. Pipeline & risers : Young Boi ,Elsevier Ocean Engineering Book series 2001 Volume
3. Piping Handbook, MohinderL.Nayyar, McGraw Hill
- 4.NACE Corrosion Engineer's Reference Book, Robert Baboian, NACE International

5. Outcome of the Course:

- 1) Identify pressure distribution system in Natural Gas Pipelines i.e.low-pressure medium pressure and high-pressure system.
- 2) Design of City Gas Distribution Network i.e.Primary Network, Secondary Network and Distribution Network
- 3) Evaluate methods of Pipeline Network Analysis i.e.Hardy Cross Methods, Newton Loop Method.
- 4) Analyze graph theory applicable for Network Analysis
- 5) Examine steady state & unsteady state analysis for gas pipelines