Semester V

Pipe Hydraulics and Hydraulic Machinery

1.1 Course Number- ME301
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. Abhimanyu Kar, Dr. Sanat Kumar Singha, Dr Naveen Mani Tripathi, Dr. Karthik Babu NB

2. Objective:

i) This course offers basic knowledge on fluid statics, dynamics and hydraulic machines.
ii) To enable the student to understand laws of fluid mechanics and evaluate pressure, velocity and acceleration fields for various fluid flows and performance parameters for hydraulic machinery.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Flow through Channel**	Open Channel Flow - Uniform Flow Introduction, Classification of flows, Types of channels; Chezy, Manning's, Bazin, Kutter's Equations; Hydraulically efficient channel sections - Rectangular, Trapezoidal and Circular channels; Velocity distribution; Energy and momentum correction factors; Pressure distribution.	8
2	**Turbines**	Momentum Principles Action of jets on stationery and moving flat plates and curved vanes; Angular momentum principle; Torque in roto dynamic machines. Hydraulic Turbines Classification; Impulse; Reaction; Radial, Axial, mixed and tangential flow turbines; Pelton, Francis turbines; Runner profiles; Velocity triangles; Head and efficiency; Draft tube theory; Selection of Turbines; Operational characteristics.	10
3	**Centrifugal Pumps**	Manometric head; Losses and efficiencies; Work done; Working Principle; Priming; Velocity triangles; Performance and characteristic curves; Cavitation effects; Dimensionless numbers: Reynold's, Froude, Euler, Mach and Weber numbers.	8
4	**Pipe Hydraulics**	Flow through pipes, Various losses when liquid flows through pipes, Laws of fluid friction, The equations for loss of head in pipes due to friction- Darcy's & Chezy's formula (without proof), The function of Siphon, study of pressure head variations at its different sections, minimum pressure at apex and its influence in causing separation (Numerical problems omitted).	8
Total			**34**

4. Readings

4.1 Textbooks:

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by P. N. Modi and S. M. Seth; Standard Book house, New Delhi,2009.

2. Fluid Mechanics and Hydraulic Machines by R. K. Bansal,9th Edition, Laxmi Publications, 2011.

4.2 Reference Books:

1. Fluid Mechanics by A. K. Jain; Khanna Publishers, Delhi, 2008.
2. Flow in Open channels by K. Subramanya, 3rd Edition, Tata McGraw-Hill,2008.
3. Hydraulics & Hydraulic Machinery ByYeaple
4. Hydraulics and Pneumatics ByReya and Rao.

Web References:
www.nptel.iitm.ac.in
www.springerlink.com for e-journals

5. Outcome of the Course:

1) Identify importance of various fluid properties at rest and in transit.
2) Derive and apply general governing equations for various fluid flows
3) Understand the concept of boundary layer theory and flow separation.
4) Plot velocity and pressure profiles for any given fluid flow.
5) Evaluate the performance characteristics of hydraulic turbines and pumps.

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: Prose Narratives (short stories & novels) Poetry, Drama and Essays (Suitable texts are to be chosen by the instructors), Use of a Learner Dictionary.	7

3	**Introduction to Philosophy**	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. 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. Cognition: Current approaches to the understanding of mind and mental processes: empiricist, rationalist, behaviourist and cognitivist. Ethics: Impact of science and technology on man and society: elements of environmental and professional ethics	7
Total			**23**

4. Readings.

4.1 Textbooks/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, 980.
(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”, Lowa 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.

Applied Mechanics Laboratory

1.1 Course Number- ME306L
1.2 Contact Hours- 0-0-3 Credits: 3
1.3 Semester Offered- 3rd Year Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee members- Dr. Abhimanyu Kar, Dr. Sanat Kumar Singha, Dr Naveen Mani Tripathi, Dr. Karthik Babu NB

2. Objective:

i) To learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. Detailed study of engineering properties of materials. Understanding of the fundamental concepts of applying equilibrium, compatibility, and force deformation relationships to structural elements with basic analysis and design skills.
ii) Apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force deformation, and stress-strain relationships to basic engineering structures.
iii) Develop a solid knowledge about deformation of axial members by physical insight into distribution of stresses and strains in structural members by determining stress, strain, and deformation of bars, trusses, and beams, and performing stress and strain transformations.
iv) Basic understanding of the method of superposition, flexibility method, and stiffness method as applied to statically determinate and indeterminate axial and torsional members, thin-walled tubes, bending of beams and buckling of columns.

3. Course Content:

Unit-wise distribution of content and number of Lab Sessions

Unit	Topics	Description	Lab Sessions
1	**Universal Tensile Testing Machine**	Determination of Ductility, Ultimate tensile strength, Elongation at Break, Type of Fracture	2
2	**Hardness Test**	Brinnel hardness test, Rockwell hardness test, Vicker's hardness test	2
3	**Impact Test (Chirpy and Izod)**	Determination of toughness and strength	2
4	**Experimental Mechanics**	Beams, support and reaction of a simply supported beam, Angle of Repose, Moment of Intertia of Flywheel	2
5	**Theory of Machines**	Cam and Governor, Balancing	2
Total			**10**

4.Outcome of the Course:

1) Evaluate the values of yield stress, breaking stress and ultimate stress of the given specimen under tension test.
2) Conduct the torsion test to determine the modulus of rigidity of given specimen.
3) Justify the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.
4) Examine the stiffness of the open coil and closed coil spring and grade them.
5) Analyze the microstructure and characteristics of specimen.

Advanced Workshop Technology Laboratory

1.1 Course Number- ME307L
1.2 Contact Hours- 0-0-3 Credits: 3
1.3 Semester Offered- 3rd Year Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee members- Dr. Abhimanyu Kar, Dr. Sanat Kumar Singha, Dr Naveen Mani Tripathi, Dr. Karthik Babu NB

2. Objective:

i) To acquire practical skills in using a CNC machine.
ii) To understand the basics of smith forging and sand-casting processes.

3. Course Content:

Unit-wise distribution of content and number of Lab Sessions

Unit	Topics	Sub-Topic	Lab Sessions
1	**CNC Lathe**	Practice of different machining operations in all geared precision Lathe machine.	2
		Introduction and practice of CNC Lathe machining operation along with its coding & job preparation.	2
2	**CNC Milling**	Practice of different machining operations in all geared Universal Milling machine.	2
		Introduction and practice of CNC milling machining operation along with its coding & job preparation.	2
3	**Smithy and foundry shop**	Getting acquainted with various forging tools by practicing various forging operations such as drawing out, upsetting, bending and forge-welding	2
		Preparing a sand casting mould and casting and fettling using metal	2
Total			**12**

4. Readings

4.1 Textbooks:

1) P.N. Rao, Manufacturing Technology (Vol. - I & II), Tata McGraw Hill Pub. Company, New Delhi

2) P.C. Sharma, A Text Book of Production Technology (Manufacturing Processes & Technology), S. Chand and Company Ltd., New Delhi.

4.2 Reference Books:

1) Serope Kalpakjian & Schmid, Manufacturing Engineering and Technology, Pearson Education, Delhi.
2) Kibbe Richard R – PHI, Machine Tool Practices, New Delhi.

5.Outcome of the Course:

1) To be able to write a simple CNC programme for a CNC milling machine or lathe to produce simple items
2) To be able to produce an everyday object by blacksmith's tools
3) To be able to produce a small metal casting using sand moulding.

Departmental Elective/Open Elective

Power Plant Engineering

1.1 Course Number- ME302
1.2 Contact Hours- 3-0-0 Credits: 9
1.3 Semester Offered- 3rd Year Odd
1.4 Prerequisite: NA
1.4 Syllabus Committee members- Dr. Abhimanyu Kar, Dr. Sanat Kumar Singha, Dr Naveen Mani Tripathi, Dr. Karthik Babu NB

2. Objective:

i) To understand the various conventional energy conversion methods
ii) To be able to identity the various component of a conventional power plant
iii) To be able to understand the mechanism of control the power production as per demand

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	General Sources of power, Importance of Central Power Stations, Types of power stations – steam, Nuclear, Diesel and hydro – Elements of modern power stations (Steams only) brief layout and arrangement of elements and complements, Sitting of different power stations, Foundation, Elements of Electric power systems primary and secondary distribution substations (in brief).	4
2	**Steam Power Plant and Steam Generators**	Steam power plants selection of working medium, Heat Balance in steam cycles, Heat rates, Comparison of efficiencies gas loop, Fuels and fuel handling System and Ash handling System, Air pre-heater, Feed water pre-heaters, Steam re-heaters, Dearators, Feed water treatment, Pumping and regulation water walls, Modern developments in steam boilers, Important instrumentation and piping of gas and water loop. Factors to be controlled from maximum efficiency and variable output.	12
3	**Steam Turbine**	Working Principle, Types, Velocity Diagrams, Compounding, Speed Control	10
4	**Hydro Electric Power Station**	Potential power with reference to rainfall and catchments area, Water storage, Equipment used in hydro electric power stations, Characteristics of hydraulic turbines, Comparison of the factors governing the cost of hydro steam and diesel power stations.	4
5	**Nuclear Power Station**	Evolution of nuclear energy from atoms by fission and fusion, Chain reactions, Fission materials, Types of	4

		reactors, gas cooled, Boiling water liquid, Metal cooled and fast reactor, Arrangements of various elements in a nuclear power station, Steam cycles and boilers coolant heat exchangers, Reactor control, Reactor shielding and safety methods.	
6	**Power Plant Economics**	Idealized and realized load curves, Effect of variable load on plant design and operation variable load operation and load dispatch. Source of income, Cost of plant and production, Elements of cost depreciation and replacement theory of rates.	5
Total			**39**

Readings

4.1 Textbooks:

1. P.K. Nag,Power Plant Engineering, 2nd Edn., Tata McGraw-Hill Pub.Com.
2. F.T. Morse Affiliated East ,Power Plant Engineering, West Press Pvt .Ltd

4.2 Reference Books:

1. M.M. E1 – Wakil ,Power Plant Technology , McGraw Hill, International Edition
2. R.Yadav, Fundamental of Power Plant Engineeering, Central Publishing House Allahabad.

5. Outcome of the Course:

1) To be able to calculate the capacity of power production from various system parameters of a power plant.
2) To be able to calculate the cost of power production as from various parameters.

Quality Control and Metrology

1.1 Course Number- ME303
1.2 Contact Hours- 3-0-0 Credits: 9
1.3 Semester Offered- 3rd Year Odd
1.4 Prerequisite: Diploma level Mathematics
1.5 Syllabus Committee members- Dr. Abhimanyu Kar, Dr. Sanat Kumar Singha, Dr Naveen Mani Tripathi, Dr. Karthik Babu NB

2. Objective:

i) To understand statistical process control and improvement.
ii) To study measurement systems and Gage R&R.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	1.1 Quality Improvement in the Modern Business Environment: The Meaning of Quality and Quality Improvement, Statistical Methods, Management Aspects. 1.2 The DMAIC Process: Overview and Examples of DMAIC Process, Concept of Six-Sigma Process Quality.	6
2	**Modeling Process Quality**	2.1 Describing Variation: The Stem-and-Leaf Plot, The Histogram, Numerical Summary of Data, The Box Plot, Probability Distributions. 2.2 Important Distributions: Discrete and Continuous Probability Distribution Functions (PDFs). 2.3 Probability Plots: Normal and Other Probability Plots.	6
3	**Statistical Process Control (SPC)**	3.1 Methods and Philosophy: Chance and Assignable Causes of Quality Variation, Statistical Basis of the Control Chart, The Rest of the Magnificent Seven, Implementing SPC in a Quality Improvement Program. 3.2 Control Charts for Variables: Control Charts for $\bar{x}$ and R, The Shewhart Control Chart for Individual Measurements, Applications of Variables Control Charts. 3.3 Control Charts for Attributes: The Control Chart for Fraction Nonconforming, Control Charts for Nonconformities (Defects), Choice Between Attributes and Variables Control Charts, Guidelines for Implementing Control Charts.	12

4	**Process Capability Analysis**	4.1 Process Capability Analysis: Using the Histogram, Probability Plotting. 4.2 Process Capability Ratios: Centered and Off-Centered Processes, Normality and Process Centering. 4.3 Process Capability Analysis: Using Control Charts and Attribute Data.	6
5	**Engineering Metrology**	1.1 Introduction: Bias and Variance, Accuracy and Precision, General Measurement Concepts, Calibration of Measuring Instruments, Difference between Systematic and Random Errors. 1.2 Measurement Systems: Definition of Hysteresis, Linearity, Resolution, Threshold and Drift; Gauge Repeatability and Reproducibility (Gage R&R). 1.3 Linear and Angular Measurements: Difference between Line and End Measurements.	9
Total			**39**

4. Readings

4.1 Reference Books:

1. Montgomery, Douglas C. Statistical quality control. Vol. 7. New York: Wiley, 2009.
2. L. Krishnamurthy. Engineering metrology and measurements. Oxford University Press, 2013.

5. Outcome of the Course:

1) Understand the meaning of quality and quality improvement.
2) Knowledge of six-sigma process quality.
3) Describe variation in data and various PDFs.
4) Understand control charts for variable and attributes.
5) Define process capability ratios for centered and off-centered processes.
6) Differentiate between bias and variance & accuracy and precision.
7) Study techniques used in linear and angular measurements.

Offshore and Cross-Country Pipeline

1.1 Course Number- ME304
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. Abhimanyu Kar, Dr. Sanat Kumar Singha, Dr Naveen Mani Tripathi, Dr. Karthik Babu NB

2. Objective:

i) To develop skills to understand the basic fundamental of Pipeline Engineering principles.
ii) To enable the students to understand the various defects that are observed in maintenance of pipelines & corrective actions required to correct the deficiencies and subsequently identifying pipeline risk, its estimation & evaluation.
iii) To enable students to relate the reasons for various types of external & internal corrosion occurring in cross country pipelines and requirement of surface protection.
iv) Setting up the requirement for intelligent pigging to evaluate the corrosion occurring in pipelines.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Overview of offshore structures**	Introduction- Deepwater challenges- Functions of offshore structures- Offshore structure configurations- Bottom-Supported fixed structures- Compliant structures- Floating structures- Classification societies and industry standard groups.	5
2	**Novel and small field offshore structures**	Introduction- Overview of oil and gas field developments- Technical basis for developing novel offshore structures- Other considerations for developing novel offshore structures- Novel field development systems- Future field development options.	7
3	**Ocean environment**	Introduction, Ocean water properties- Airy's Wave theory, Wave kinematics along the depth of water.	6
4	**Elements of pipeline design**	Fluid properties, Environment - Effects of pressure and temperature - Supply/Demand scenario - Route selection - Codes and standards - Environmental and hydrological considerations – Economics - Materials/Construction – Operation - Pipeline protection - Pipeline integrity monitoring	8

5	**Receiving Terminals**	Receiving terminals in India – Main components and description of marine facilities – Storage capacity – Process descriptions.	5
6	**Petroleum or Oil & Gas Policies and Regulations**	Petroleum and Oil & Gas rules and regulations in India, The Oil fields regulations and development Act, New Exploration Licensing Policy (NELP), Functions of directorate general of hydrocarbons, Petroleum and Natural Gas Regulatory Board.	8
	Total		**39**

4. Readings

4.1 Textbooks:

1. Handbook of offshore engineering, S. K. Chakrabarti, Volume 1 & 2, Elsevier, 2005.
2. Hydrodynamics of offshore structures, S. K. Chakrabarthi, WIT Press. 3. Matrix methods of structural analysis, P. N. Godbole, R. S. Sonparote, S. U. Dhote, PHI Learning Private Limited, 2014.

4.2 Reference Books:

1. Structural Analysis: A Matrix Approach, G.S. Pandit and S.P. Gupta, 2nd Edition, Tata McGraw-Hill Education, 2001.
2. Ship Stability for Masters and Mates, Barrass, C. B. and D. R. Derret, 7th Edition, Butterworth-Heinemann, 2012.
3. Construction of Marine and Offshore Structure, Gerwick, Jr., C., 3rd Edition, CRC Press, 2007.

5. Outcome of the Course:

1) Should be able understand various construction steps of pipeline Construction, Project Management with knowledge of welding techniques.
2) Should be able to identify pipeline repair & rehabilitation methods for various leaks, Codes for repair, Maintenance procedures. PMP act.
3) Should have clear knowledge of metering, Storage and Calibration of products storage, line fill calculation and reconciliation, storage facilities,
4) Categorize various systems of SCADA for pipeline operation and Pipeline operation & scheduling.
5) Should be able to address various types of prime movers used in pipeline industry in stations for liquid LPG and Gas transportation CO
6) Should be able to address requirement of various Electrical Systems in pipelines and safety of installation.

Industrial Engineering and Management

1.1 Course Number- ME305
1.2 Contact Hours- 3-0-0 Credits: 9
1.3 Semester Offered- 3rd Year Odd
1.4 Prerequisite: Diploma level Mathematics
1.5 Syllabus Committee members- Dr. Abhimanyu Kar, Dr. Sanat Kumar Singha, Dr Naveen Mani Tripathi, Dr. Karthik Babu NB

2. Objective:

i) To understand work system design associated with industrial engineering.
ii) To study production, planning and control (PPC) corresponding to industrial management.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction, Plant Location and Layout**	1.1 Introduction: Definition of Industrial engineering, History & development, Objective of Industrial Engineering, Contribution of Industrial Engineering, Function of Industrial engineer, Place of Industrial engineering in an organization. 1.2 Plant Location: Need for a suitable location, Urban, Suburban, Systems approach, Factors affecting location, Quantitative method for evaluation of plant location. 1.3 Plant Layout: Objectives & Principles of plant layout, Types of layout and their suitability, Software packages for layout analysis.	6
2	**Work, Method and Time Studies**	2.1 Work Study: Productivity and work study, Introduction and definition of Work-study, Prerequisites of conducting a work study. 2.2 Method Study: Introduction, definition, procedure, Recording techniques, Flow Process Charts, Critical examination by questioning technique, man-machine chart, Motion economy principles, Micro motion study – Therbligs. 2.3 Time Study: Definition, Objectives, Techniques of Work measurement, Selection & timing the job, Rating, Allowances, Normal and standard time determination, Work sampling.	9
3	**Value Analysis and Project Scheduling**	3.1 Value Analysis: Definition, Objectives and use of value analysis, Application & techniques. 3.2 Project Scheduling: Network analysis, Critical path	9

		method (CPM), Program evaluation and review techniques (PERT), Comparison between CPM and PERT.	
4	**Maintenance Management and Inventory Control**	4.1 Maintenance Management: Objectives and need for maintenance, Types of maintenance, Maintenance costs, Failure analysis, Overall equipment effectiveness (OEE), Total productive maintenance (TPM). 4.2 Inventory control: Deterministic models, safety stock inventory control systems.	9
5	**Ergonomics and New Industrial Engineering**	5.1 Ergonomics: Introduction to ergonomics and its application. 5.2 Information Technology (IT): Role of IT in Industry, increasing value of Information Technology, IT as a New Business tool, IT as Business Enabler, IT as business driver, Internet worked enterprise, Internet, Intranet and Extranet, Globalization and IT, Competitive advantage with IT. 5.3 Business Process Re-Engineering (BPR): Definition, Need & characteristics, Industrial Engineering & BPR, Framework for Re-engineering, Process of Re-engineering, Information Technology leverage in BPR, advantages of Re-engineering.	6
Total			**39**

4. Readings

4.1 Reference Books:

i) Martand Telsang, Industrial Engineering and Production Management, S Chand & Company.
ii) Philip E Hicks, Industrial Engineering & Management –A new perspective, McGraw Hill.

5. Outcome of the Course:

1) Understand need for suitable plant location and layout.
2) Understand work, method and time studies.
3) Apply value analysis and engineering.
4) Differentiate between CPM and PERT.
5) Knowledge of predictive and corrective maintenance schemes.
6) Define OEE and TPM.
7) Knowledge of inventory control methods.
8) Apply knowledge of ergonomics.
9) Role of IT on industrial engineering and management.
10) Define and characterize BPR.