

**Complete Course Grid and Syllabus**

**Diploma in Mechanical Engineering with specialization in Pipeline  
Engineering**

**From Academic Year 2020-2021**



Course Grid for Diploma in Mechanical Engineering (Specialization: Pipeline Engineering)  
Assam Energy Institute, Sivasagar  
Rajiv Gandhi Institute of Petroleum Technology, Jais, Amethi

**Course: Diploma in Mechanical Engineering(Specialization: Pipeline Engineering)**

**Total Number of Credits: 370**

<b>SEMESTER I</b>					
<b>Subject Code</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>IS101</b>	Mathematics-I	3	1	0	11
<b>IS102</b>	Physics-I	3	1	0	11
<b>IS103</b>	Chemistry-I	2	1	0	8
<b>IE101</b>	Engineering Thermodynamics	3	1	0	11
<b>EP101</b>	Engineering Drawing	0	0	3	3
<b>EP102</b>	Engineering Workshop Practices-I	0	0	3	3
<b>IE102</b>	Fundamentals of Computer Engineering	2	0	2	8
<b>IS102L</b>	Physics Lab	0	0	2	2
<b>TOTAL</b>					<b>57</b>
<b>HU101</b>	Universal Human Values	1	1	0	5
<b>LM101</b>	Communication Skills*	2	0	1	7

\*For selective students with less proficiency in English

<b>SEMESTER II</b>					
<b>Subject Code</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>p</b>	<b>Credits</b>
<b>IS 104</b>	Mathematics-II	3	1	0	11
<b>IS 105</b>	Physics-II	3	1	0	11
<b>IS 106</b>	Chemistry-II	3	0	0	9
<b>IE104</b>	Fluid Mechanics & Fluid Flow Operations	3	1	0	11
<b>IE103</b>	Fundamentals of Mechanical Engineering	2	0	0	6
<b>IE105</b>	Computer Programming	2	0	2	8
<b>IS106L</b>	Chemistry Lab	0	0	2	2
<b>TOTAL</b>					<b>58</b>
<b>HU102</b>	Community Internship	1	1	0	5

<b>SEMESTER III</b>					
<b>Subject Code</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>IE201</b>	Materials Science	3	0	0	9
<b>EP201</b>	Workshop Technology	3	0	0	9
<b>IE202</b>	Fundamentals of Electronics & Electrical Engineering	3	1	2	13
<b>IE203</b>	Heat Transfer Operations	3	0	0	9
<b>DC201</b>	Thermal Engineering	3	0	0	9
<b>DC202</b>	Engineering Mechanics	2	1	0	8
<b>DC203L</b>	<b>Unit Operations Lab-I (PROBLEM)</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>
<b>TOTAL</b>					<b>59</b>

<b>SEMESTER IV</b>					
<b>Subject Code</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>DC203</b>	Theory of Machines	2	1	0	8
<b>DC204</b>	Piping Elements, Codes & Standards	3	0	0	9
<b>DC205</b>	Strength of Materials	2	1	0	8
<b>DC206</b>	Welding Technology	3	0	0	9
<b>DC207</b>	Design of Machine Elements	2	1	0	8
<b>DC208</b>	Manufacturing Engineering	3	0	0	9
<b>DC208L</b>	Engineering Workshop Practices Lab-II	0	0	3	3
<b>DP202</b>	Project	0	0	5	5
<b>TOTAL</b>					<b>59</b>
<b>DP302</b>	<b>Industrial training</b>	0	0	5	5

<b>SEMESTER V</b>					
<b>Subject Code</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>DC 301</b>	Pipe Hydraulics & Hydraulic Machinery	3	0	0	9
<b>DC 302</b>	Advanced Manufacturing Process	3	0	0	9
<b>DC 303</b>	Health, Safety & Environment	2	0	0	6
<b>HU301</b>	Humanities	2	0	0	6
<b>LM301</b>	Engineering Economics	2	1	0	8
<b>DC304</b>	Quality Analysis & Quality Control	3	0	0	9
<b>DC 302L</b>	Engineering Workshop Practices-III	0	0	2	2
<b>DP 303</b>	<b>Project</b>	0	0	10	10
<b>TOTAL</b>					<b>59</b>

<b>SEMESTER VI</b>						
<b>Subject Code</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	
<b>DC305</b>	Pipeline transportation of Oil & Gas	2	0	0	6	
<b>DC306</b>	Mechatronics	3	0	0	9	
<b>DC307</b>	<b>Piping Drawing Basics and Development of Plot Plan</b>	3	0	0	9	
<b>DC308</b>	Corrosion & Material Selection	2	0	0	6	
<b>EP302</b>	<b>AUTOCAD</b>	0	0	2	2	
<b>DE301</b>	<b>Departmental Elective</b>	3	0	0	9	
<b>OE301</b>	<b>Open Elective</b>	3	0	0	9	
<b>DP304</b>	<b>Project</b>	0	0	10	10	
<b>TOTAL</b>						<b>60</b>

<b>DE 301</b>	Power Plant Engineering
	Pipe Support Design & Engineering
	Offshore & Cross Country Pipeline
	Industrial Engineering & Management

<b>Cat.</b>	<b>Diploma in Mechanical Engineering (Specialization: Pipeline Engineering)</b>	<b>Min</b>
HU	Humanities and Social Science	16
IS	Basic Science	65
IE	Institute Requirement Engineering	75
EP	Engineering Drawing (Manual and Computer Aided), Manufacturing Practices and Practice course of Department	20
LM	Language and Management	8
DC	Departmental Core	138
DE	Departmental Elective	9
OE	Open Elective	9
DP	Project/ Industrial visit/ Training	30
	<b>Total</b>	<b>370</b>

## **Syllabus**

## Semester I

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
IS101	Mathematics-I	3	1	0	11

### **Unit-I: Complex Numbers:**

Definition of Complex numbers; Real and imaginary parts of a Complex number; Polar and Cartesian form of a complex number and its conversion from one form to other; Conjugate of a complex number; Modulus and amplitude of a complex number; Addition, Subtraction, Multiplication and Division of complex numbers. De-Moivre's theorem and its application.

### **Unit-II: Partial fractions:**

Definition of polynomial proper fraction & improper fractions and definition of partial fractions; To resolve proper fraction into partial fraction with denominator containing non-repeated linear factors, repeated linear factors and irreducible non-repeated quadratic factors; To resolve improper fraction into partial fraction.

### **Unit-III: Permutations and Combinations:**

Fundamental principle of counting; Fundamental principle of multiplication, Fundamental principle of addition; Factorial notation; Permutations; Combinations; Practical problems on permutations and combinations.

### **Unit-IV: Binomial theorem:**

Binomial theorem (without proof) for positive integral index ; General and middle term in Binomial expansion; Binomial theorem for any rational number (without proof); Simple applications

### **Unit-V: Trigonometry:**

Concept of angle; Measurement of angle in degree, grades and radians and their conversions; Trigonometric ratios; Sum, difference formulae and their applications ( Without proof); Product formula (Transformation of Product to Sum and Differences and vice versa); Trigonometric Ratios of multiple angle, sub-multiple angles (2A,3A,A/2); Graph of  $\sin x$ ,  $\cos x$ ,  $\tan x$ ,  $\operatorname{cosec} x$ ,  $\sec x$  and  $\cot x$ .

### **Unit-VI: Differential Calculus**

Definition of function; Concept of limits; Four standard limits

$\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$ ,  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ ,  $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$  and  $\lim_{x \rightarrow 0} (1 + x)^{1/x}$ . Differentiation by definition of  $x^n$ ,  $\sin x$ ,  $\cos x$ ,  $e^x$  and  $\log_a x$ . Differentiation of sum, product and quotient of functions; Differentiation of function of a function; Differentiation of trigonometric and inverse trigonometric functions; Logarithmic differentiation; Exponential functions.

### **TEXT BOOKS:-**

1. B.S. Grewal, Higher Engineering Mathematics, Khana Publishers, New Delhi, 40<sup>th</sup> Edition, 2007.
2. Murray R. Spiegel, Robert E. Moyer, College Algebra, Tata McGraw Hill, New Delhi, 2<sup>nd</sup> Edition, 2000.

### **REFERENCE BOOKS:-**

1. G. B. Thomas, R.L. Finney, Calculus and Analytical Geometry, Addison Wesley, 9<sup>th</sup> Edition, 1995
2. Frank Ayers, Elliot Mendelson, Calculus, McGraw Hill, New York, 4<sup>th</sup> Edition.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
IS102	Physics-I	3	1	0	11

### **Unit 1: Physical world, Units and Measurements**

Physical quantities; fundamental and derived, Units and systems of units (FPS, CGS and SI units).

Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications (conversion from one system of units to other, checking of dimensional equations and derivation of simple equations), Limitations of dimensional analysis.

Measurements: Need, measuring instruments, least count, types of measurement (direct, indirect), Errors in measurements (systematic and random), absolute error, relative error, error propagation, error estimation and significant figures.

### **Unit 2: Force and Motion**

Scalar and Vector quantities – examples, representation of vector, types of vectors. Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product, Resolution of a Vector and its application to inclined plane and lawn roller.

Force, Momentum, Statement and derivation of conservation of linear momentum, its applications such as recoil of gun, rockets, Impulse and its applications.

Circular motion, definition of angular displacement, angular velocity, angular acceleration, frequency, time period, Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical), Centripetal and Centrifugal forces with live examples, Expression and applications such as banking of roads and bending of cyclist.

### **Unit 3: Work, Power and Energy**

Work: Concept and units, examples of zero work, positive work and negative work.

Friction: concept, types, laws of limiting friction, coefficient of friction, reducing friction and its engineering applications, Work done in moving an object on horizontal and inclined plane for rough and plane surfaces and related applications.

Energy and its units, kinetic energy, gravitational potential energy with examples and derivations, mechanical energy, conservation of mechanical energy for freely falling bodies, transformation of energy (examples).

Power and its units, power and work relationship, calculation of power (numerical problems).

### **Unit 4: Rotational Motion**

Translational and rotational motions with examples, Definition of torque and angular momentum and their examples, Conservation of angular momentum (quantitative) and its applications.

Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid); (Formulae only).

### **Unit 5: Properties of Matter**

Elasticity: definition of stress and strain, moduli of elasticity, Hooke's law, significance of stress-strain curve.

Pressure: definition, units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications.

Surface tension: concept, units, cohesive and adhesive forces, angle of contact, Ascent Formula (No derivation), applications of surface tension, effect of temperature and impurity on surface tension.

Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.

Hydrodynamics: Fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem (only formula and numerical) and its applications.

### **Unit 6: Heat and Thermometry**

Concept of heat and temperature, modes of heat transfer (conduction, convection and radiation with examples), specific heats, scales of temperature and their relationship, Types of Thermometer (Mercury thermometer, Bimetallic thermometer, Platinum resistance thermometer, Pyrometer) and their uses.

Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them, Co-efficient of thermal conductivity, engineering applications.

### **TEXT BOOKS:-**

1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi

### **REFERENCE BOOKS:-**

1. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
2. Concepts in Physics by HC Verma, Vol. I & II, BhartiBhawan Ltd. New Delhi
3. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
4. Engineering Physics by DK Bhattacharya&PoonamTandan; Oxford University Press, New Delhi.
5. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
6. Practical Physics by C. L. Arora, S. Chand Publication.
7. E-books/e-tools/ learning physics software/websites etc.

Subject Code	Subject Name	Credit Lecture (L-T-P)	Total Credits
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IS 103	Chemistry-I	2	1	0	8
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### **Unit – 1: States of matter**

States of matter, Gas laws, Ideal gas equation, Gas constant, Dalton's law of partial pressure, Graham's law of diffusion, Avogadro's hypothesis and its applications, Mole concept and problems, Standard solution, normal solution and molar solution, concentration terms-normality, molarity, gm/l, ppm, normality equation, acid-base titration.

### **Unit – 2: Chemical equation**

Chemical equation-definition, qualitative and quantitative significance, limitations, balancing by partial and ion-electron method, electronic concept of oxidation and reduction, Stoichiometric calculations.

### **Unit – 3: Acids, bases and salts**

Acids, bases and salts, Theories of acids and bases- Arrhenius, Bronsted-Lowry, Lewis theory, Strong acids and strong bases, conjugate acid-base pair, classification of salts, hydrolysis of salts and its effect.

### **Unit – 4: Atomic structure**

Atomic structure: Rutherford's Model, Bohr's Model, Atomic spectra, Dual nature of electron, uncertainty principle, Quantum number, Aufbau principle, Hund's rule, Pauli's exclusion principle, electronic configuration.

### **Unit – 5: Modern Periodic table**

Modern Periodic table, Periodic properties, size of atoms (atomic and ionic radii), Ionization energies, electron affinity, electro-negativity, Basic Concepts of s,p,d and f- block Elements.

### **Unit – 6: Chemical bonding**

Chemical bonding: electronic theory of valency, Ionic, covalent and co-ordinate covalent bonds, characteristics of ionic and covalent compounds, Hydrogen bonding.

### **Unit-7: Chemical equilibrium**

Chemical equilibrium: Law of mass action, equilibrium constant, factors effecting equilibrium, Le-Chatellier's principle and its applications, ionic equilibrium, pH value, dissociation of acids and bases, common ion effect, buffer solution, solubility product and its applications.

### **Unit-8: Electrolysis**

Electrolysis: Laws of electrolysis, problems, Industrial application of electrolysis (extraction and purification of metals, electroplating and galvanization).

### **Unit-9: Catalysis**

Catalysis: Definition, type of catalyst, industrial applications of catalysis in manufacture of  $\text{NH}_3$ ,  $\text{H}_2\text{SO}_4$  by contact process, cracking.

### **Unit-10: Water**

Water: Causes of hardness of water, removal of hardness by permutite process, de-ionisation of water, effect of water in boiler preparation of boiler-feed water, preparation of Municipal water with block-diagram, Estimation of hardness of water

### **SUGGESTED READINGS:**

### **TEXTBOOKS:**

1. NCERT Text book (Class XI and XII)

2. Engg. Chem, B. K. Sharma
3. A Text Book Of Engineering Chemistry, SashiChawla
4. Engineering Chemistry, Jain and Jain
5. Applied Chemistry, Dr. Raman Rani Mittal

**REFERENCE BOOKS:**

1. Physical Chemistry: Peter Atkins, Julio De. Paula
2. Concise Inorganic Chemistry: J. D. Lee

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		3	1	0	
IE101	Engineering Thermodynamics	3	1	0	11

### Unit-I: Basic concepts and definition

Scope of Thermodynamics, Macroscopic and Microscopic approaches; Definition of Fixed mass (closed systems) and Control volume(open system), Properties (extensive and Intensive), State and its representation on a property diagram, Process and its representation, Cyclic process (or cycle) and its representation, Carnot Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, Rankine Cycle, Brayton Cycle, Characteristics of properties (point and path function);Reversible and Irreversible processes; Thermal, mechanical and Chemical equilibrium, Thermodynamic equilibrium, Zeroth Law of Thermodynamics and temperature, Measurement of temperature and calibration of Thermometers, the ideal gas temperature scale, Measurement of pressure, Bourdon pressure gage and manometers, gage and absolute pressure.

### Unit-II: Ideal Gases

Ideal gases and their P-V-T relations, Gas mixtures. Work Transfer (definition and calculation), Different modes of work, Displacement Work for various process, Heat Transfer; Modes of heat transfer, Basic laws in conduction, convection and radiation, combined modes of heat transfer with examples.

### Unit-III: First Law of Thermodynamics

Formal statement (using cyclic processes), First law for processes of fixed masses(closed systems) and introduction of internal energy as a thermodynamics property, Introduction of enthalpy as a thermodynamic property; Definition of specific heats and their use in calculation of internal energy and enthalpy with emphasis on ideal gases.

Application of First Law to control volumes; Nozzle, Diffuser, Compressor, Turbine, Throttling device, Heat Exchanger.(only steady flow need be considered)

### Unit- IV: Second Law of Thermodynamics

Kelvin- Planck and Clausius statements of Second Law, Reversible and irreversible engines and their efficiency, Entropy concepts and the principle of entropy increase.

### Unit- V: Properties of Pure Substances

P-V, P-T, T-S, H-S diagram for steam, different types of steam, Introduction to steam tables with respect to specific volume, pressure, temperature, enthalpy and entropy.

### Unit-VII: Application of thermodynamics

Air compressors, steam power plant, Refrigerators and Heat pump, I.C. Engines (Brief description of different components of above mentioned systems and working principles with Schematic diagram only)

#### TEXT BOOK(S):

1. Engineering Thermodynamics by P.K.Nag, Publisher:TMH
2. Basic Engineering Thermodynamics by Rayner Joel, Pearson Education

#### REFERENCE BOOK(S):

1. Engineering Thermodynamics by Van Wylen and Sontang, John Wiley

2. Engineering Thermodynamics by M.Achuthan, Publisher:PHI
3. Applied Thermodynamics by Eastop and McConkey, Publisher:Pearson
4. Fundamental of Engineering Thermodynamics by E. Rathakrishnan, publisher.PHI
5. Engineering Thermodynamics by Russel and Adebisi, publisher,Oxford
6. Steam Tables in SI Units by Ramalingam,Scitech.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
EP101	Engineering Drawing	0	0	3	3

## 1. Introduction to Engineering Drawing

1.1 Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards.

1.2 Different types of lines in Engineering drawing as per BIS specifications

1.3 Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments.

1.4 Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degree, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ratio of 7:4

## 2. Dimensioning Technique

2.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions)

2.2 Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches

## 3. Scales

3.1 Scales –their needs and importance (theoretical instructions), type of scales, definition of R.F. and length of scale

3.2 Drawing of plain and diagonal scales

## 4. Orthographic Projections

4.1 Theory of orthographic projections (Elaborate theoretical instructions)

4.2 Projection of Points in different quadrant

4.3 Projection of Straight Line (1st and 3rd angle)

4.3.1. Line parallel to both the planes

4.3.2. Line perpendicular to any one of the reference plane

4.3.3. Line inclined to any one of the reference plane.

4.4 Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1st angle only

4.5 Three views of orthographic projection of different objects. (At least one sheet in 3rd angle)

4.6 Identification of surfaces

## 5 Projection of Solid

5.1. Definition and salient features of Solid

5.2. Types of Solid (Polyhedron and Solid of revolution)

5.3 To make projections, sources, Top view, Front view and Side view of various types of Solid.

## 6. Sections

6.1 Importance and salient features

6.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.

6.3 Conventional sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections

6.4 Orthographic sectional views of different objects.

## **7. Isometric Views**

7.1 Fundamentals of isometric projections and isometric scale.

7.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.

### **RECOMMENDED BOOKS:-**

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
5. Engineering Drawing I by DK Goel, GBD Publication.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
EP102	Engineering Workshop Practices I	0	0	3	3

### **Unit 1**

#### **Fitting Shop:**

Introduction and practice of various fitting processes: Use of hand tools in fitting, preparing a male and female joint of M.S.

### **Unit 2**

#### **Welding Shop:**

Introduction and practice of various Welding processes: Electric Arc welding Practice and Gas welding, TIG, MIG, Gas Cutting and application. Joints such as a Lap joint, a T-joint or a Butt joint are to be prepared.

### **Unit 3**

#### **Machine Shop:**

Introduction and practice of various Machining processes: Plain and Stepped cylindrical turning, grooving, knurling and Thread-cutting of a job in lathe.

#### **TEXT BOOK(S):**

1. Elements of Workshop Technology, Vol. I and II by Hajrachoudhary, Khanna Publishers

#### **REFERENCE(S):**

1. Workshop Technology by WAJ Chapman, VivaBooks
2. Workshop Manual by Kannaiah / Narayana, Scitech

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
IE102	Fundamentals of Computer Engineering	2	0	2	8

#### **UNIT 1:**

Basic Internet skills: Understanding browser, efficient use of search engines, awareness about Digital India portals (state and national portals) and college portals.

General understanding of various computer hardware components – CPU, Memory, Display, Keyboard, Mouse, HDD and other Peripheral Devices.

#### **UNIT 2:**

OS Installation (Linux and MS Windows), Unix Shell and Commands, vi editor.

#### **UNIT 3:**

HTML4, CSS, making basic personal webpage.

#### **UNIT 4:**

Office Tools: OpenOffice Writer, OpenOffice Spreadsheet (Calc), OpenOffice Impress.

#### **UNIT 5:** Information security best practices.

Class lectures will only introduce the topic or demonstrate the tool, actual learning will take place in the Lab by practicing regularly.

#### **SUGGESTED LAB WORK:**

This is a skill course. Topics/concepts taught in the class should be practiced in the Lab same week and practiced regularly during the semester till student becomes confident about it. This course is all about some theory and a lot of practice.

#### **RECOMMENDED BOOKS:-**

- 1) R.S. Salaria, Computer Fundamentals, Khanna Publishing House.
- 2) Ramesh Bangia, PC Software Made Easy – The PC Course Kit, Khanna Publishing House.
- 3) Online Resources, Linux man pages, Wikipedia.
- 4) Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and Shell programming, by MokhtarEbrahim, Andrew Mallett.



Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
IS102L	Physics Lab	0	0	2	2

### List of Practicals:

*(To be performed a minimum of 10 practicals)*

1. To measure length, radius of a given cylinder, a test tube and a beaker using a Vernier caliper and find volume of each object.
2. To determine diameter of a wire, a solid ball and thickness of cardboard using a screw gauge.
3. To determine radius of curvature of a convex and a concave mirror/surface using a spherometer.
4. To verify triangle and parallelogram law of forces.
5. To find the co-efficient of friction between wood and glass using a horizontal board.
6. To determine force constant of a spring using Hook's Law.
7. To verify law of conservation of mechanical energy (PE to KE).
8. To find the moment of inertia of a flywheel.
9. To find the viscosity of a given liquid (Glycerin) by Stoke's law.
10. To find the coefficient of linear expansion of the material of a rod.
11. To determine atmospheric pressure at a place using Fortin's barometer.
12. To measure room temperature and temperature of a hot bath using mercury thermometer and convert it into different scales.

### TEXT / REFERENCE BOOKS:-

1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi.
2. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P)Ltd.
3. Practical Physics by C. L. Arora, S. Chand Publication.
4. E-books/e-tools/ learning physics software/YouTube videos/websites etc.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		1	1	0	
HU 101	Universal Human Values	1	1	0	5

### **Unit I: Motivation and Objectives of Human Values Course**

Introduction to the objectives of the course. Content and process of the course including mode of conduct. Daily life as lab for the course. Activities in the course.

### **Unit II: Purpose of Education**

How human being has a need for Knowledge, what should be the content of knowledge, how the content should be discussed in education. Complimentarily of skills and values, how the current education system falls short.

### **Unit III: Peers Pressure, Social Pressure**

In various dimensions of life, how do these things work. What is the way out? In the context of education, peer pressure etc.

### **Unit IV: Concept of Competition and Excellence**

How competition leads to degradation of self and relationships. How excellence is the basic need of a human being. What is excellence?

### **Unit V: Time Management**

How does one deal with myriads of activities in college? Focus of the mind.

### **Unit VI: Concept of Preconditioning**

How preconditioning affects our thinking, behavior, work, relationships, society and nature. How do we develop pre-conditioning? What are the various sources of preconditioning? How do we evaluate our Preconditioning? How do we come out of it?

### **Unit VII: Concept of Natural Acceptance in Human Being**

What is natural acceptance? How can the concept of natural acceptance be used to evaluate our preconditioning. Universal nature of natural acceptance. Are anger, jealousy, hatred natural? How do we feel when we experience them? Which feelings are natural for a human being and which are not?

### **Unit VIII: Understanding Relationships**

Are relationships important? What is the role of relationships in our life? If relationships are important then why they are important? If they are important then why it is the case that we are not discussing them? What are the notions/conditions and factors which stop us to explore more into relationships. Relationships in family and extended family. Dealing with anger, Basic expectations in relationships. Seven types of relations, Gratitude as a universal value in relationships, Nine universal values in human relationships, Trust as the founding value, Concept of acceptance, Unconditional acceptance in relationships, Our preconditioning affecting our relationships, Our relationships with subordinate staff, with people of opposite gender, caste, class, race, How relationships have the power to force a person to change his preconditioning.

### **Unit IX: Concept of prosperity Material goods**

What role others have played in making material goods available to me: Identifying from one's own life.

### **Unit X: Idea of Society**

What is a society? What constitutes a society? What systems are needed for a society to work? What is the purpose of society and various systems which are working in it? How understanding of Human Nature is important in order to understand the purpose of Society and various social systems? And what happens when this understanding is lacking?

## **Unit XI: Balance in nature**

Balance which already exists in nature, How human beings are disturbing the balance. Resource depletion and pollution, our own role in wastage of electricity, water and in use of plastics, Waste management, Issues like global warming, animal extinction

### **SUGGESTED READINGS:**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3. On Education - J Krishnamurthy
4. Siddhartha - Hermann Hesse
5. Old Path White Clouds -ThichNhatHanh
6. Diaries of Anne Frank - Anne Frank
7. Life and Philosophy of Swami Vivekananda
8. Swami Vivekananda on Himself
9. Small is Beautiful - E. F Schumacher
10. Slow is Beautiful - Cecile Andrews
11. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi
12. Rediscovering India - by Dharampal
13. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
14. India Wins Freedom -Maulana Abdul Kalam Azad
15. Autobiography of a Yogi – by ParamhansaYogananda
16. Gandhi and Question of Science – Sahasrabudhe

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		2	0	1	
LM 101	Communication Skills	2	0	1	7

### **Chapter 1: Parts of Speech**

Recognition and review of Nouns, Pronouns, Verbs, Adverbs, Adjectives, Prepositions, Conjunctions, Interjections, Knowledge of Subject, Object and Compliment of the Verb, Verbals –Infinitival, Gerund and Preposition

### **Chapter 2: Prepositions of time and place**

Contextual teaching of prepositions of time - on, in, at, since, for, ago, before, to, past, to, from, till/until, by  
Prepositions of place: in, at, on, by, next to, beside, near, between, behind, in front of, under, below, over, above, across, through, to, into, towards, onto, from

### **Chapter 3: Clause, phrases and Relative Clauses**

Basic definitions of clauses and phrases, Focus on Relative Pronouns and their use in sentences as relative clauses

### **Chapter 4: Subject Verb Agreement**

Rules that guide the agreement of the subject to its verb

### **Chapter 5: Sentence types and Transformation of sentences**

Assertive sentences, Exclamatory sentences, Interrogative sentences, Negative sentences, Compound sentences, complex sentences, simple sentences, Degrees of Comparison

### **Chapter 6: Voice**

Change from Active Voice to Passive Voice and vice versa

### **Chapter 7: Punctuation**

Use of the comma, semi-colon, colon, apostrophe, exclamation mark, question mark and quotation marks

### **Chapter 8: Word formation**

Change of one part of speech to the other: from Verbs to Nouns, Nouns to Verbs, Adjectives to Nouns, Nouns to Adjectives, Verbs to adverbs, and Adverbs to Verbs

### **Chapter 9: Affixation**

Prefixes and Suffixes and new word formations

### **Chapter 10: Nominal Compounds**

Common nominal compound

### **Chapter 11: Paragraph Writing**

Descriptive Paragraph on various related topics.

### **SUGGESTED READINGS:**

1. Essential English Grammar with Answers by Raymond Murphy (Cambridge University Press)
2. English for Polytechnics by Dr Papori Rani Barooah (Eastern Book House Publishers)
3. English Grammar by Annie Brinda (Cambridge University Press)

**llabus**  
**Semester II**

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
IS104	Mathematics-II	3	1	0	11

**Unit-I: Determinants and Matrices:**

Elementary properties of determinants up to 3rd order; Consistency of equations; Cramer's rule; Algebra of matrices; Inverse of a matrix; Matrix inverse method to solve a system of linear equations in 3 variables.

**Unit-II: Integral Calculus:**

Integration as inverse operation of differentiation; Simple integration by substitution, by parts and by partial

fractions (for linear factors only); Use of formula  $\int_0^{\pi/2} \sin^n x dx$ ,  $\int_0^{\pi/2} \cos^n x dx$  &  $\int_0^{\pi/2} \sin^m x \cos^n x dx$  for solving

problems where m and n are positive integers.

**Unit-III: Co-ordinate Geometry:**

Equation of straight line in various standard form (Without Proof); Intersection of two straight lines; Angle between two straight lines; Parallel lines and perpendicular lines; Perpendicular distance formula;

Sections of a cone: Circle, Parabola, Ellipse and Hyperbola; General equation of a circle and its characteristics. ; Definition of conics (Parabola, Ellipse, Hyperbola) their standard equations (without proof). Problems

**Unit-IV: Vector Algebra:**

Definition, notation and rectangular resolution of a vector; Addition and subtraction of vectors; Scalar and vector products of 2 vectors; Simple problems related to work; moment and angular velocity.

**Unit-V: Differential Equations:**

Definition of differential equations; Order and degree of a differential equation; General and particular solution of a differential equation; Formation of differential equation whose general solution is given; Solution of first order and first degree differential equation by variable separation method; Solution of Linear differential equations of the forms:

(i)  $\frac{dy}{dx} + Py = Q$ ; P & Q are functions of x or constants

(ii)  $\frac{dx}{dy} + Px = Q$ ; P & Q are functions of y or constants

. MATLAB – Simple Introductions.

**TEXT BOOKS:-**

3. B.S. Grewal, Higher Engineering Mathematics, Khana Publishers, New Delhi, 40<sup>th</sup> Edition, 2007
4. Murray R. Spiegel, Robert E. Moyer, College Algebra, Tata McGraw Hill, New Delhi, 2<sup>nd</sup> Edition, 2000
5. Frank Ayers, Elliot Mendelson, Calculus, McGraw Hill, New York, 4<sup>th</sup> Edition

**REFERENCE BOOKS:-**

3. G. B. Thomas, R.L. Finney, Calculus and Analytical Geometry, Addison Wesley, 9<sup>th</sup> Edition, 1995

4. Murray R. Spiegel, Vector Analysis, McGraw-Hill Book Company, New York,
5. Richard Bronson, Differential Equations, Tata McGraw-Hill, New Delhi, 2<sup>nd</sup> Edition, 2004

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
IS105	Physics-II	3	1	0	11

### Unit - 1: Wave motion and its applications

Wave motion, transverse and longitudinal waves with examples, definitions of wave velocity, frequency and wave length and their relationship, Sound and light waves and their properties, wave equation ( $y = r \sin \omega t$ ) amplitude, phase, phase difference, principle of superposition of waves and beat formation.

Simple Harmonic Motion (SHM): definition, expression for displacement, velocity, acceleration, time period, frequency etc. Simple harmonic progressive wave and energy transfer, study of vibration of cantilever and determination of its time period, Free, forced and resonant vibrations with examples.

Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time and their applications, Ultrasonic waves – Introduction and properties, engineering and medical applications of ultrasonic.

### Unit - 2: Optics

Basic optical laws; reflection and refraction, refractive index, Images and image formation by mirrors, lens and thin lenses, lens formula, power of lens, magnification and defects. Total internal reflection, Critical angle and conditions for total internal reflection, applications of total internal reflection in optical fiber.

Optical Instruments; simple and compound microscope, astronomical telescope in normal adjustment, magnifying power, resolving power, uses of microscope and telescope, optical projection systems.

### Unit - 3: Electrostatics

Coulomb's law, unit of charge, Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference, Gauss law: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere.

Capacitor and its working, Types of capacitors, Capacitance and its units. Capacitance of a parallel plate capacitor, Series and parallel combination of capacitors (related numerical), dielectric and its effect on capacitance, dielectric break down.

### Unit - 4: Current Electricity

Electric Current and its units, Direct and alternating current, Resistance and its units, Specific resistance, Conductance, Specific conductance, Series and parallel combination of resistances. Factors affecting resistance of a wire, carbon resistances and colour coding.

Ohm's law and its verification, Kirchhoff's laws, Wheatstone bridge and its applications (slide wire bridge only), Concept of terminal potential difference and Electro motive force (EMF)

Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy.

### Unit - 5: Electromagnetism

Types of magnetic materials; dia, para and ferromagnetic with their properties, Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic flux and units, magnetization.

Concept of electromagnetic induction, Faraday's Laws, Lorentz force (force on moving charge in magnetic field). Force on current carrying conductor, force on rectangular coil placed in magnetic field.

Moving coil galvanometer; principle, construction and working, Conversion of a galvanometer into ammeter and voltmeter.

### **Unit - 6: Semiconductor Physics**

Energy bands in solids, Types of materials (insulator, semi-conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction, junction diode and V-I characteristics, types of junction diodes. Diode as rectifier – half wave and full wave rectifier (centre taped).

Transistor; description and three terminals, Types- pnp and npn, some electronic applications (list only). Photocells, Solar cells; working principle and engineering applications.

### **Unit - 7: Modern Physics**

Lasers: Energy levels, ionization and excitation potentials; spontaneous and stimulated emission; population inversion, pumping methods, optical feedback, Types of lasers; Ruby, He-Ne and semiconductor, laser characteristics, engineering and medical applications of lasers.

Fiber Optics: Introduction to optical fibers, light propagation, acceptance angle and numerical aperture, fiber types, applications in; telecommunication, medical and sensors.

Nano-science and Nanotechnology: Introduction, nanoparticles and nano-materials, properties at nanoscale, nanotechnology, nanotechnology based devices and applications.

### **TEXT BOOKS:-**

1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi

### **REFERENCE BOOKS:-**

1. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi
2. Concepts in Physics by HC Verma, Vol. I & II, BhartiBhawan Ltd. New Delhi
3. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi.
4. Modern approach to Applied Physics-I and II, AS Vasudeva, Modern Publishers.
5. A Textbook of Optics, N Subramanyam, BrijLal, MN Avahanulu, S Chand and Company Ltd.
6. Introduction to Fiber Optics, AjoyGhatak and K Thyagarajan, Cambridge University Press India Pvt. Ltd, New Delhi.
7. Nanoscience and Nanotechnology, KK Choudhary, Narosa Publishing House, Pvt. Ltd. New Delhi.
8. Nanotechnology: Importance and Applications, M.H. Fulekar, IK International Publishing House Pvt. Ltd, New Delhi.
9. e-books/e-tools/ learning physics software/websites etc.



Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
IE106	Chemistry-I	3	0	0	9

### **Unit-1: Environmental Chemistry**

Definition, types of pollution, Pollutants, Water Pollution – Causes, Effect and health hazards, Water quality parameters – D.O, B.O.D, C.O.D, T.D.S, Controlling of water pollution, Air pollution – Sources, Effect and controlling, Green house effect, Acid rain, Ozone layer depletion, photochemical smoke, Soil Pollution – Sources and controlling

### **Unit-2: Metallurgy**

General principles of metallurgy, Explain the terms mineral, ore, gangue, slag, flux, roasting, calcinations etc., Metallurgy of Iron and Aluminum, Manufacture of steel by Bessemer, open heart and L-D process, Introduction to alloys.

### **Unit-3: Fuel**

Definition and classification of fuel, calorific value, Gross and net calorific value, Solid fuel-Origin of coal, classification of coal by rank, pulverized coal, principle of carbonization of coal, distinguish between High temperature carbonization and low temperature carbonization, Liquid fuel-definition of Petroleum or crude oil, Classification of three varieties of crude oil, Fractional distillation of petroleum. Important properties of liquid fuel-flash point, fire point, aniline point, smoke point, knocking and octane number, cetane number, Cracking of petroleum.

### **Unit-4: Building Materials**

Portland Cement : Composition, raw materials, Types of manufacturing, setting and hardening of cement, special cements, Glass : Definition, types, raw materials and manufacturing, Bricks : Classification and preparation

### **Unit-5: Lubricant**

Definition of lubricant and lubrication, Classification of lubricants, Important functions of lubricants, Selection of lubricants

### **Unit-6: Metallic Corrosion**

Definition, causes of Corrosion, Different types of Corrosion and factors affecting corrosion rate, Explanation of rusting of iron, Methods of Corrosion Control

### **Unit-7: Plastic and Polymer**

Definition, types of polymerization, classification of polymers, Thermoplastic and Thermosetting polymers,

Important Plastic materials-Monomers, properties and uses of Polythene, Polypropylene, Polystyrene, PVC, Bakelite, Teflon, neoprene, Buna-s, Nylon, Terelene.

### **Unit-8: Organic Chemistry**

Classification and Nomenclature of Organic compounds, Homologous series and functional groups, Isomerism- structural and stereo isomerism, General preparation, properties and uses of alkanes, alkenes and alkynes, Types of organic reactions-addition, substitution, elimination and rearrangement reaction, Aromatic compounds- Benzene and its derivatives (preliminary idea only)

#### **SUGGESTED BOOKS:**

1. NCERT Text book (Class XI and XII)
2. Engg. Chem, B. K. Sharma
3. A Text Book of Engineering Chemistry, SashiChawla
4. Engineering Chemistry, Jain and Jain
5. Applied Chemistry, Dr. Raman Rani Mittal
6. Organic Chemistry, Volume I: I. L. Finer
7. Concise Inorganic Chemistry: J. D. Le

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
IE104	Fluid Mechanics & Fluid Flow Operations	3	1	0	11

### **Unit 1: Introduction to Fluid Mechanics**

Fluid and fluid characteristics, Dimension and Units, International System (SI), Measures of fluid mass and weight -Density, Specific Weight, Specific Gravity, ideal gas law, Viscosity, Kinematic viscosity, Compressibility, Vapour Pressure, Surface Tension

### **Unit 2: Fluid Statics**

Pressure at a point, Compressible and Incompressible fluid, Measurement of pressure, Manometry, Buoyancy - Archimedes' Principle and stability

### **Unit 3: Fluid kinematics**

Ideal Fluid, Flow Types and comparisons, Reynold's Number, Fluid Flow rate, The Bernoulli's equation and its application

### **Unit 4: Flow in pipelines**

Flow regimes in a pipe, Energy loss in pipes – through Darcy-Weisbach equation and Hagen-Poiseuille Equation, Friction factor, Turbulent flow in pipes, Moody's Diagram

### **Unit 5: Pipeline systems**

Basic of Pipe Network system, Gathering System used in Oil & Gas Industry, Minor losses in pipes, Energy and Hydraulic grade line, valves in pipeline- Flow control valve, Check valve, Pressure relief valve/safety valves

### **Unit 6: Pumps and Compressors**

Pumps: Introduction, PD (Reciprocating) Pump, Rotary Pump, Centrifugal Pump; Compressors: Basics, Centrifugal compressor, Axial flow compressor.

### **TEXT BOOKS:**

- 1) R. W. Fox and A. T. McDonald, Introduction to fluid mechanics, 5<sup>th</sup> Ed
- 2) Unit Operations of Chemical Engineering, McGraw - Hill, International Edition.

### **REFERENCE BOOKS:**

- 1) K. A. Gavhane, Fluid Flow Operations, NiraliPrakashan.
- 2) R.K. Bansal, A textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
IE 104	Fundamentals of Mechanical Engineering	2	0	0	6

### **Unit 1- Fundamentals of Engineering Mechanics**

Fundamentals of Engineering Mechanics, Vector quantity, Scalar Quantity, Resolution of forces, Resultant of concurrent forces, parallel forces, Moment of force about a point, Couples, Centre of gravity, Centroid, C.G of simple plane figures, Moment of Inertia, Theorem of Parallel axis and Perpendicular axis, M.I of simple plane figures

### **Unit 2- Properties of gases:**

Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between  $C_p$  and  $C_v$ , Various non-flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Poly-tropic process Properties of Steam: Steam formation, Types of Steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables, steam calorimeters. Steam Boilers: Introduction, Classification, Cochran, Lancashire and Babcock and Wilcox boiler, functioning of different mountings and accessories.

### **Unit 3- Thermodynamics and Heat Engines:**

Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Change of state, Path, Process, Cycle, Internal energy, Enthalpy, Statements of Zeroth law, First law and Second law of thermodynamics, Classification of heat engines, Description and thermal efficiency of Carnot; Rankine; Otto cycle and Diesel cycles

### **Unit 4- Pumps and Compressors:**

Types and operation of Reciprocating, Rotary and Centrifugal pumps, Priming Air Compressors: Types and operation of Reciprocating and Rotary air compressors, significance of Multistage. Refrigeration & Air Conditioning: Refrigerant, Vapor compression refrigeration system, vapor absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners.

### **Unit 5- Fundamentals of I.C Engines:**

Introduction, Classification of Engines, Parts of a I.C Engine, Engine details, Working of four-stroke and two-stroke cycle, Working of Petrol and Diesel engines, Indicated power, Brake Power, Efficiencies etc.

### **Unit 6- Couplings, Clutches and Brakes:**

Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc). Transmission of Motion and Power: Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive.

**TEXT BOOKS:-**

1. Basic Mechanical Engineering / Pravin Kumar/ Pearson.
2. Introduction to Engineering Materials / B.K. Agrawal/ McGraw Hill.
3. Thermodynamics and Heat Engines / R. Yadav / Central Book Depot.
4. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.
5. Thermal Engineering-P.L.Bellaney/ Khanna publishers.
6. Elements of Environmental Science and Engineering-Meenakshi/Anjali Bagad.
7. Engineering Mechanics / R.K Bansal
8. Internal Combustion engine / V. Ganesan

**REFERENCE BOOKS:-**

1. Fundamental of Mechanical Engineering/ G.S. Sawhney/PHI.
2. Thermal Science and Engineering / Dr. D.S. Kumar/ Kataria.
3. Engineering Mechanics /Timoshenko.
- 4.Heat transfer / J. P Holman.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
IE105	Computer Programming	2	0	2	8

### **Unit 1- Information Storage and Retrieval**

1.1 Need for information storage and retrieval

1.2 Creating data base file

1.3 Querying database file on single and multiple keys

1.4 Ordering the data on a selected key

1.5 Programming a very simple application

### **Unit 2- Programming in C**

2.1 Basic structure of C programs

2.2 Executing a C program

2.3 Constants, variables, and data types

2.4 Operators and expressions

2.5 Managing input-output operations like reading a character, writing a character, formatted input, formatted output through print, scan, getch, putch statements etc.

2.6 Decision making and branching using IF-else, switch, go to statements

2.7 Decision making and looping using do-while, and for statements

2.8 Arrays – one dimensional and two dimensional

2.9 File

### **Unit 3- Computers Application Overview**

3.1 Commercial and business data processing application

3.2 Engineering computation

3.3 CAD, CAM , CAE, CAI

### **RECOMMENDED BOOKS**

1. Programming in C by Sachaum Series, McGraw Hills

2. Programming in C by Kerning Lan and Riechle Prentice Hall of India, New Delhi

3. Programming in C by BalaguruSwamy, Tata McGraw Hill, New Delhi

4. Let us C – YashwantKanetkar, BPB Publications, New Delhi

5. Vijay Mukhi Series for C and C++

6. Programming in C by R Subburaj, Vikas Publishing House Pvt Ltd., Jangpura, New Delhi

7. Programming in C by Kris A Jansa, Galgotia Publications Pvt.Ltd., Daryaganj, New Delhi

8. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi

9. Elements of C by MH Lewin, Khanna Publishers, New Delhi

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		0	0	2	
<b>IS106L</b>	Chemistry Lab	0	0	2	2

**LIST OF CHEMISTRY PRACTICALS:**

1. Preparation of standard solution of oxalic acid or potassium permanganate.
2. Determination of strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
3. Standardization of  $\text{KMnO}_4$  solution using standard oxalic acid and determine the percentage of iron present in given Hematite ore by  $\text{KMnO}_4$  solution.
4. Estimation of total hardness of given water sample using standard EDTA solution.
5. Determination of Alkalinity of given water sample using 0.01M sulphuric acid.
6. Determination of the conductivity of given water sample.
7. Determination of pH of given water sample.
8. Determination of the total dissolved solid of a given water sample.
9. Gravimetric estimation moisture in given coal sample.
10. Determination of viscosity of a solution using Ostwald viscometer.

**SUGGESTED READING:**

1. A text book of quantitative Inorganic analysis: A. I. Vogel
2. Analytical Chemistry: G. D. Christian
3. Advanced Practical Physical Chemistry: J. B. Yadav
4. A textbook of Elementary Practical Chemistry (Part I and II): Sudarshan Barua

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		1	1	0	
HU 102	Community Internship	1	1	0	5

**Unit-1: Understanding Society**

- Social structure and relationships,
- Social institutions and social groups,
- Socialization and social control : development of self

**Unit-2: Community Health**

- Illness and Disease, Health and public health: Meaning, components, determinants of health,
- Wellbeing and Quality of life, Health as an aspect of social development,
- Nutrition and malnutrition,
- Community Health: relevance, needs assessment, developing mechanisms for people's participation,
- Community Mental Health

**Unit-3: Working with Groups**

- Social Groups: Definitions, characteristics, functions and group structure,
- Principles of group work and Models of group work practice,
- Leadership - Theories of leadership, roles and responsibilities of group leader, Leadership Power, Leadership Styles, Leadership in Administration,
- Techniques and skills in group work ,Group worker: roles and functions

**Unit-4: Work with Communities**

- Understanding Community: Definitions, types, approaches and framework,
- Community dynamics: Caste, class, religion and gender , Issues of identity, inclusion and exclusion, Community power structure,
- Community organization- principles, steps and process,
- Community work and community participation - Strategies and principles; Models and processes,
- Professionalism and inculcation of ethics in community practice

**Unit-5: Personality Development**

- Definition of Personality, Determinants of Personality- biological, psychological and sociocultural factors, Communication, Flow and barriers of Communication, Listening,
- Spirituality and its role in personality development
- Stress: Causes, Management and Impact,
- Groups in organization, Interactions in group, Group Decision Taking, Team Building

**Unit-6: Development Communication**

- Communication: concept, principles and its significance
- Process of Communication, Forms of communication: Verbal, non-verbal and written.
- Self-awareness in communication
- Barriers to communication

**SUGGESTED READINGS:**

1. Davis, K. 1969. *Human Society*, New York: The Macmillan.



2. Giddens, A. 1999. *Sociology*, Cambridge: The Polity Press.
3. Dasgupta, M. & Lincoln, C.C. 1996, *Health, Poverty and Development in India*. New Delhi: Oxford University Press.
4. Trecker, H.B. 1972, *Social Group Work: Principles and Practices*. New York: Association Press.
5. Weil, M. (ed.) 1996, *Community Practice: Conceptual Models*. New York: The Haworth Press Inc.
6. Hergenhahn, B. R., & Olson, M. H. 2003, *An Introduction to Theories of Personality*, New Jersey: Prentice Hall.

**Syllabus**  
**Semester III**

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
IE201	Materials Science	3	0	0	9

**UNIT-1**

Introduction: Historical Perspective of Materials, Classification of Materials, Engineering Materials, Advanced Materials and Future Materials like ceramics, polymers, composites etc.

Atomic Structure, Bonding and Crystal Structure of Solids: Atomic Structure, Atomic Bonding in Solids, Bravais Lattices, Crystal Structures, Crystalline, Quasi Crystalline and NonCrystalline Materials, Miller Indices, Miller-Bravais Indices for Planes and Directions of Cubic and Non-Cubic Structures, structure of ceramics, polymers, and composites materials.

**UNIT – 2**

Diffusion: Diffusion Mechanisms, Steady & Non-steady State Diffusion.

Phase Diagrams: Phase Rule, Equilibrium Phase Diagrams, Phase Systems - Isomorphous, Eutectic with No and Limited Solid Solubility and Peritectic, Iron-Carbon Phase Diagram, TTT Diagram.

Imperfections in Solids and Strengthening Mechanisms: Point Defects, Line Defects and Dislocations, Interfacial Defects and Bulk or Volume Defects, Recovery, Recrystallization and Grain Growth.

**UNIT – 3**

Mechanical Behaviour of Metals and Alloys : Types of Loading, Stress-Strain Curves for Brittle and Ductile Materials, Theoretical and Observed Shear Stress, Critical Resolved Shear Stress, Deformation – Elastic, Anelastic, Plastic and Super Plastic, Yield Criteria, Macroscopic Aspects of Plastic Deformation, Toughness Measurements by – S-S Curve, Impact Testing and Fracture Toughness Testing, material behavior in micro-Nano regime.

Types of Mechanical Loading and Failures : Ductile and Brittle Fracture, Modes of Fracture Toughness, Impact Fracture, Ductile-Brittle Transition, Types of Impact Testing, Fatigue, Crack Initiation and Propagation, Fatigue Testing, Creep, Stages of Creep Curve, Stress and Temperature Effects. Non-destructive testing of materials

**UNIT-4**

Properties Alteration of Materials: Alteration of properties by heat treatment, Heat treatment method, Quantification of altered material properties by heat treatments.

**TEXT BOOKS:-**

- 1) Materials Science, V. Raghavan, PHI Learning Private Ltd., 2010.
- 2) Materials Science, G.K. Narula, K.S. Narula, V.K. Gupta, Tata McGraw Hill, 2010.

**REFERENCE BOOKS:-**

- 1) Engineering Materials: Polymers, Ceramics and Composites, A.K. Bhargava, PHI Learning (P) Ltd.
- 2) Callister's Materials Science and Engineering, W.D. Callister, Jr, R. Balasubramaniam Wiley India, 2010

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		3	0	0	
EP 201	Workshop Technology	3	0	0	9

### **Unit -1: Introduction**

Methods of manufacturing processes - casting, forming, metal removal processes, joining processes, surface finishing processes, basic workshop processes - carpentry, fitting, hand forging, machine forging, sheet metal work, cold and hot working of metals.

### **Unit -2: Carpentry and Fitting shop**

Marking & measuring tools, Cutting Tools, Striking tools, Holding devices, Miscellaneous tools, Carpentry Processes, Carpentry joints: Halving Joint, mortise and tenon joint, bridle joint, butt joint, dowel joint, tongue & groove joint, screw & slot joint, dovetail joint, corner joint, Wood working machines Wood working lathe (wood turning lathe), circular saw, band saw, wood planer, sanding machine, belt sander, spindle sander, disc sander and grinder, specifications and uses, Checking and measuring instruments used in fitting, Fitting Operations: Marking, sawing, chipping, filing, scrapping, grinding, drilling, reaming, tapping and dieing.

### **Unit -3: Forging**

Hand forging tools: Anvil, swage block, hand hammers - types; sledge hammer, specifications and uses, tongs - types, specifications & uses, chisel - hot & cold chisels specifications & uses. swages - types and sizes, fullers, flatters, set hammer, punch and drift - sizes and uses. 1.3.2 Equipment: Open and closed hearth heating furnaces, hand and power driven blowers, open and stock fire, fuels-charcoal, coal, oil gaseous fuels. 1.3.3 Smith Operations: Upsetting, drawing down, setting down, punching, drifting, bending, welding, cutting, swaging, fullering and flatterring. 1.3.4 Machine Forging: Need of machine forging, forging hammers - spring hammer, pneumatic hammer, drop hammer, forging press, hydraulic press - line diagram, machine forging operations - drawing, upsetting, punching, tools used in machine forging. Forging defects: Types and remedies.

### **Unit -4: Drilling**

Type of drilling machines: sensitive & radial and their constructional detail and specifications. Drill bits: Terminology - geometry of twist drill - functions of drill elements. Operations: Drilling, reaming, boring, counter boring, counter sinking, tapping, spot facing and trepanning.

### **Unit -5: Mechanical working of metals**

Introduction: Hot working and cold working ,Hot working processes: rolling - types of rolling, two high mill, three high mills, four high mills, piercing or seamless tubing, drawing or cupping, spinning, extrusion - direct or forward extrusion, indirect or backward extrusion, tube extrusion, Impact extrusion. Effects of hot working of metals, advantages & limitations of hot working of metals. Cold working process: Rolling, drawing - wire drawing, tube drawing, bending, roll forming, angle bending, spinning, extrusion, squeezing, cold heading, thread rolling, peening, Effects of cold working of metals, advantages & limitations of cold working.

### **TEXT BOOKS-**

1. Production Technology by Jain & Gupta (Khanna Publiahers)
2. Elementary Workshop Technology by HazraChowdary& Bhattacharya (Media Promotors)
3. Manufacturing Technology (Vol I ) by P N Rao (Mc Graw Hill) 3. Workshop Technology Vol I & II by

**REFERENCE BOOKS:-**

1. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi
2. Foundry Technology by KP Sinha and DB Goel; RoorkeePublishng House, Roorkee.
3. A Text Book of Manufacturing Science and Technology by A Manna, Prentice Hall of India, Delhi.
4. Mechanical workshop practice by K. C. JOHN, PHI Learning Pvt. Ltd.
5. Mechanical Experiments and Workshop Practice by G S Sawhney.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
IE202	Fundamentals of Electrical & Electronics Engineering	3	1	2	13

### UNIT I

Overview of Electronic Components & Signals: Passive Active Components: Resistances, Capacitors, Inductors, Diodes, Transistors, FET, MOS and CMOS and their Applications. Signals: DC/AC, voltage/current, periodic/non-periodic signals, average, rms, peak values, different types of signal waveforms, Ideal/non-ideal voltage/current sources, independent/dependent voltage current sources.

### UNIT II

Overview of Analog Circuits: Operational Amplifiers-Ideal Op-Amp, Practical op amp, Open loop and closed loop configurations, Application of Op-Amp as amplifier, adder, differentiator and integrator.

### UNIT III

Overview of Digital Electronics: Introduction to Boolean Algebra, Electronic Implementation of Boolean Operations, Gates-Functional Block Approach, Storage elements-Flip Flops-A Functional block approach, Counters: Ripple, Up/down and decade, Introduction to digital IC Gates (of TTL Type).

### UNIT IV

Electric and Magnetic Circuits: EMF, Current, Potential Difference, Power and Energy; M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor and BH curve; Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations of self and mutual inductance; Analogy between electric and magnetic circuits.

### UNIT V

A.C. Circuits: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor Peak Factor, impedance, phase angle, and power factor; Mathematical and phasor representation of alternating emf and current; Voltage and Current relationship in Star and Delta connections; A.C in resistors, inductors and capacitors; A.C in R-L series, R-C series, R-L-C series and parallel circuits; Power in A. C. Circuits, power triangle.

### UNIT VI

Transformer and Machines: General construction and principle of different type of transformers; Emf equation and transformation ratio of transformers; Auto transformers; Construction and Working principle of motors; Basic equations and characteristic of motors.

### RECOMMENDED BOOKS:-

1. RituSahdev, Basic Electrical Engineering, Khanna Publishing House
2. Mittl and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN :978-0-07-0088572-5
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition ISBN : 9781107464353
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405

5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN:9788121924375
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN : 97881236529513
7. Sedha, R.S., A text book of Applied Electronics, S.Chand, New Delhi, 2008, ISBN-13: 978-8121927833
8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi,2015, ISBN-13: 0070634244-978
9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13-9788121924504
10. Bell Devid, Fundamental of Electronic Devices and Circuits, Oxford University Press, New Delhi.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
IE203	Heat Transfer Operations	3	0	0	9

### Unit 1: Introduction:

Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's Law, Combined modes of heat transfer, Thermal transfer, Thermal diffusivity, Overall heat transfer coefficient.

### Unit 2: Conduction:

The thermal conductivity of solids, Liquids and gases, Factors influencing conductivity measurement. The general differential equation of conduction, One dimensional steady state conduction, Linear heat flow through a plane and composite wall, Tube and sphere, Critical thickness of insulation, Effect of variable thermal conductivity, Conduction with heat generation in slab and cylinders, Spheres.

### Unit 3: Fins:

Conduction convection system, Extended surfaces rectangular, Triangular, Circumferential and pin fins, General conduction analysis, Fins of uniform and non-uniform cross sectional area. Heat dissipated by a fin. Effectiveness and efficiency of fins.

### Unit 4: Transient/Unsteady State Heat Conduction:

System with negligible internal resistance, Lumped capacity method and its Validity. Unsteady state conduction through finite and semi- infinite slab without surface resistance, convection boundary conditions. Solution through Heisler's chart.

### Unit 5: Forced Convection:

Physical Mechanism of Forced Convection, Dimensional analysis for forced convection, velocity and Thermal Boundary layer, Flow over plates, Flow across cylinders and spheres, Flow in tubes, Reynolds's analogy

### Unit 6: Natural Convection:

Physical Mechanism of Natural Convection, Dimensional analysis of natural convection; Empirical relationship for natural convection.

### Unit 7: Boiling and condensation:

Condensation and boiling heat transfer – film and drop wise condensation – film boiling and pool boiling – boiling curve – empirical relations for heat transfer with change of face. Boiling heat transfer, Pool boiling.

### Unit 8: Heat Exchangers:

Different types of heat exchangers; Determination of heat exchanger performance, Heat exchanger transfer units, Analysis restricted to parallel and counter flow heat exchanger (LMTD and NTU method)

### Unit 9: Thermal Radiation:

Introduction, absorption and reflection of radiant energy, Emission, Radiosity and irradiation, Black and non black bodies, Kirchhoff's law, intensity of radiation, Radiation exchange between black surface, Geometric Configuration factors. Grey body relation exchange between surface of unit configuration factors, Electrical analogy to simple problems. Non-luminous gas radiation. Errors in temperature measurement due to radiation.

**Text Book(s):**

1. S.P. Sukhatme, Heat Transfer, 4th Ed., Tata McGrawHill, 2008
2. J.P. Holman, Heat Transfer, 10th Ed., Tata McGrawHill, 2011

**Reference Book(s):**

1. Yunus A. Cengel, Heat Transfer – A Practical Approach, 2nd Ed., McGrawHill, 2002
2. P.S. Ghoshdastidar, Heat Transfer, 2nd Ed., Oxford University Press, 2012
3. D.S. Kumar, Basics Heat & Mass Transfer, 8th Ed., S.K. Kataria & Sons, 2010



Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
DC201	Thermal Engineering	3	0	0	9

### **Unit-I: Analysis of Second Law of Thermodynamics**

Review of second law of thermodynamics, Concept of entropy, Clausius' Theorem, property of Entropy, Clausius' inequality, entropy change in various processes, Entropy Principle and its application, Entropy generation in a closed system and open system. Entropy and Disorder.

### **Unit-II: Availability or Exergy**

Exergy-work potential of energy, exergy associated with K.E and P.E, reversible work and irreversibility, second law efficiency.

### **Unit-III: Properties of Gases and Gas Mixture**

Avogadro's law, Equations of State, Virial Expressions, Law of corresponding states, Properties of Mixtures of Gases, Internal Energy, enthalpy, specific heats and entropy of Gas mixtures.

### **Unit-IV: Vapour and Vapour Power Cycles**

Properties and processes of ideal vapour, Qualities of steam, Simple steam power cycle, Rankine Cycle, Actual Vapour Cycle, Actual Vapour Cycle Processes, Reheat cycle, ideal and Practical Regenerative Cycles, Characteristics of an ideal Working Fluid in Vapour Power Cycles, Binary Vapour Cycles.

### **Unit-V: Reciprocating Gas Compressor**

Classification of air compressors, Advantages and Disadvantages of Air compressors, Compression Processes, Working of Reciprocating Compression, Analysis of Single Stage Reciprocating Air Compressor, Analysis of Multi-Stage Compressors

### **Unit-VI: Thermodynamics of Fluid Flow**

Velocity of pressure pulse in a fluid, Stagnation Properties, One dimensional Steady Isentropic Flow, Choking in Isentropic Flow, Critical Properties, normal Shocks, Adiabatic Flow with Friction and Diabatic Flow without Friction.

### **Unit-VII: Thermodynamic Relations**

Maxwell's Equations, Tds Equations, relationship of heat capacities, Energy Equation, Joule-Kelvin Effect, Clausius-Clapeyron Equation, Evaluation of Thermodynamic Properties from an Equation of State

**Text Book(s):**

1. P.K. Nag ,Engineering Thermodynamics, TMHPublishers
2. J. SelwinRajadurai ,Thermodynamics & Thermal Engineering ,New Age International Publishers

**Reference Book(s):**

1. C.P. Arora ,Thermodynamics ,TMHPub.
2. D.S. Kumar ,Thermal Science & Engineering ,S.K. Kataria&Sons
3. S.C. Gupta ,Thermodynamics , PearsonEducation
4. Cengel& Boles ,Thermodynamics- An Engineering Approach ,McGrawHill
5. K. Ramakrishna ,Engineering Thermodynamics, AnuradhaAgencies

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
DC202	Engineering Mechanics	2	1	0	8

### **Unit I: Review of Basic Force Systems**

Dimensions and units of mechanics, idealization of mechanics, laws of mechanics, vector algebra review, moment of a force about a point and axis, the couple and couple moment, addition and subtraction of couples, moment of a couple about a line, translation of a force to a parallel position, resultant of a force system.

### **Unit II: Resolution of a force and composition of a force system**

Parallelogram law of forces; triangle law of forces; polygon law of forces. Resultant and Equilibrant, Varignon's theorem of moments. Basic principles: Equivalent force system; Equations of equilibrium; Free body diagram; Reaction; Static indeterminacy.

### **Unit III: Friction**

Coulomb dry friction laws, simple surface contact problems, friction angles, types of problems, wedges. Wheel friction and rolling resistance. Virtual work and Energy method: Virtual Displacement; Principle of virtual work; Mechanical efficiency;

### **Unit-IV: Analysis of structures**

Analysis of structures: Assumptions followed in the analysis of truss; Analysis of truss by method of joints and sections. Analysis of frames.

### **Unit V: Centroid and Moment of inertia**

Centroid of plane figures - Locating centroid of basic regular figures from first principles including sector of a circle, parabola, locating centroid of built-up sections. Moment of inertia (Second moment of area)- Perpendicular and parallel axis theorems; radius of gyration; Mass moment of inertia.

### **Unit VI: Kinematics and kinetics of Particles**

Rectilinear motion; Curvilinear motion; Force, mass and acceleration; Work and energy; Impulse and momentum;

### **Unit VII: Kinematics and Kinetics of Rigid Bodies**

Relative velocity, Translation, Pure rotation and plane motion of rigid bodies, D'Alembert's principle, linear momentum, principle of conservation of momentum, Impact of solid bodies, work, energy, power, principle of conservation of energy

**Text book(s):**

1. I.H. Shames, Engineering Mechanics: Statics and Dynamics, 4th Ed., PHI,2012
2. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers: Statics and Dynamics,Tata McGraw Hill,2003.

**ReferenceBook(s):**

1. J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I – Statics, Vol II – Dynamics, 5th Ed., John Wiley, 2002.
2. R. C. Hibbler, Engineering Mechanics, Vols. I and II, Pearson Press,2002.

**Syllabus**  
**Semester IV**

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
DC203	Theory of Machines	2	1	0	8

**Unit I:**

**Introduction:** Link or element, kinematic pairs, degrees of freedom, Grubler's criterion, Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine.

**Mechanisms:** Quick return motion mechanisms- Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms –Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms –Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

**Kinematic Chains And Inversions** Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

**Unit II**

**Velocity And Acceleration Analysis Of Mechanisms (Graphical Methods):** Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

**Velocity Analysis By Instantaneous Centre Method:** Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method.

**Unit III**

**Klein's Construction:** Analysis of velocity and acceleration of single slider crank mechanism.

**Velocity And Acceleration Analysis Of Mechanisms (Analytical Methods):** Analysis of four bar chain and slider crank chain using analytical expressions. (use of complex algebra and vector algebra)

**Unit IV**

**Gears:** Introduction and classification of gears, Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding interference, Back lash, Comparison of involute and cycloidal teeth.

**Gear Trains:** Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

**Unit V**

**Cams:** Introduction, types of cams, types of followers, motion of the follower, uniform velocity, SHM uniform acceleration and retardation, profile of cams, cams with specified contours –tangent cam with roller follower and Circular arc cam with Flat-Faced follower.

**Text Book(s):**

1. J. J Uicker (Jr), G. R Pennock and J. E Shigley, Theory of Machines and Mechanisms, 3rd Ed., Oxford International Student Edition,2010
2. S. S. Rattan, Theory of Machines, 4th Ed., Tata McGraw Hill,2014

**Reference Book(s):**

1. J. S. Rao, R. V. Dukupati, Mechanism and Machine Theory, 2nd Ed., New Age International,2008.
2. T. Bevan, Theory of Machines, CBS Publishers and Distributors,1984
3. Ghosh and A. K. Mallik, Theory of Mechanisms, and Machines, 3rd Ed., East West Press Pvt Ltd, 2009

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
DC 204	Piping Elements, Codes and Standard	3	0	0	9

### UNIT 1 - Piping Materials:

Introduction to pipe elements, Metals: Ferrous, Nonferrous, Alloys: Effects of Alloying Elements in materials. Steel Manufacturing Processes: Blast Furnace Process, Open Hearth Process, Bessemer Process Plastic (Properties), Thermoplastics, Thermosetting plastic Properties of Piping Materials

### UNIT 2 - Pipe Fittings

Elbow, Tee, Cross, Reducer, Cap and plug- Their Functions and Mechanical Properties, Union and Couplings, Flanges, Types of Flanges, Mechanical Properties of Flanges, Serration: Types of Serration, Advantages of serrated finish in flanges

### UNIT 3- Valves

Classification, Methods of Controlling Flow through a valve, Basic parts of the valves, Features, Valve selection: Advantages and Disadvantages, Maintenance of Valves, Safety handling of valves

### UNIT 4-Pumps

Classification of pumps, Parts of pump, Centrifugal and Reciprocating, Single and Double Acting, Types of Impellers, Gear Pumps, Lobe Pump, Cavitation, NPSH, Gas Lock in Pumps.

### UNIT-5- Piping Codes & Standards

Introduction to piping design, The basics of piping System, Introduction to piping codes and standards, Piping design standards for material specifications, criteria and applicability, Piping design codes: Requirements, Selection and recommended practices, Definitions, Terminology and Essential Vocabulary.

### TEXT BOOKS:-

- 1) Pressure Vessels and Piping: Codes, Standards, Design and Analysis, by B.K.Choudhary, Baldev Raj.
- 2) Oil and Gas Pipelines and Piping Systems: Design, Construction, Management, and Inspection, Book by Alireza Bahadori.
- 3) Piping Handbook, Book by Mohinder L. Nayyar.

### REFERENCE BOOKS:-

- 1) Piping Systems Manual, Book by Brian Silowash
- 2) Piping Systems Handbook, Book by Michael Frankel

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
DC205	Strength of Materials	2	1	0	8

**Unit-I : Simple stress and strain**

Basic of stress & strain, Generalized Hooke's law, Elastic constants and Relationship.

**Unit-II : Generalized stress and strain**

Stresses and strains on oblique planes under uniaxial and biaxial loading., Analysis of plane stress and plane strain, Mohr's circle of stress and strain.

**Unit-III: Beams**

Shear force and Bending moments for different types of beams, Simple bending theory, Bending stress analysis for symmetrical and unsymmetrical sections, Strain energy due to bending, Shear stress distribution in massive and thin walled cross section, Shear centre, Strain energy due to shear,.

**Unit-IV : Slope and deflection of beams**

Relationship between curvature, deflection and slope, Method of Superposition, Macaulay's method, Moment-Area method, Conjugate Beam method.

**Unit-V: Torsion**

Torsional rigidity, Torsion of circular bars, Torsion in thin tubular section, Strain energy due to Torsion.

**Unit –VI : Column and struts**

Elastic buckling concept, Euler's theory for crippling load, Empirical formulae for crippling load.

**Text Book(s):**

1. Ramamrutham, S. Strength Of Materials, Dhanpat Rai Publishing Company
2. Bansal, R.K. Strength Of Materials, Laxmi Publications Pvt Ltd.
3. Nag, D., Chanda, A. Strength Of Materials, Wiley-India.
4. Subramaniam, R. Strength Of Materials, Oxford University Press.
5. Singh, S. Strength Of Materials, Katson Book.

**Reference Book(s):**

1. Shames, I.H. Introduction to Solid Mechanics, Prentice Hall of India.
2. Rajput, R.K. Strength of Materials, Dhanpat Rai & Sons.
3. Singh, S. Strength of Materials, Khanna Publications.



Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
DC 206	Welding Technology	3	0	0	9

### **Unit 1-Introduction:**

Evolution of welding; classification of welding processes; heat sources and shielding methods.

### **Unit 2-Physics of Welding Arc:**

Welding arc; voltage distribution along the arc; thermionic and non-thermionic cathodes; theories of cathode and anode mechanism; arc characteristics and its relationship with power source; arc efficiency; heat generation; effect of type of shielding gas on arc; isotherms of arcs.

### **Unit 3-Welding Power Sources**

Conventional welding power sources; constructional features; static and dynamic characteristics; duty cycle; influence of inductance on arc and power source characteristics; internal and external regulation; specific power source requirements; special welding power sources.

### **Unit 4-Arc Welding Processes**

Consumable electrode welding processes. Manual metal arc (MMA) welding; Gas metal arc welding; pulsed MIG welding; Submerged arc welding, Significance of flux-metal combination; Electro slag welding; heat generation; principle; Gas tungsten arc welding; selection of polarity, Plasma arc welding; transferred and nontransferred plasma arc welding; selection of gases; welding parameters; keyhole technique.

### **Unit 5-Design of weld joints**

Introduction to design; engineering properties of steels; Type of welds and weld joints; description of welds: terminology, definitions and weld symbols; edge preparation; sizing of welds in structure; Design for Static loading, Weld Calculations in lap, butt and fillet welds; design for fatigue loading, Introduction to Fatigue; nature of the fatigue process; fatigue strength; factors affecting fatigue life; improvement methods for fatigue strength; reliability analysis and safety

### **Unit 6- Testing and inspection of weld joints**

Chemical tests; Metallographic tests; Hardness tests; Mechanical test for groove and fillet welds-full section, reduced section and all-weld- metal tensile tests, root, face and side bend tests, fillet weld break tests, creep & fatigue testing. Non-Destructive Testing of Weldments; Visual inspection; Dye-penetrant inspection; Magnetic particle inspection; Ultrasonic inspection principle of ultrasonic testing, Radiographic inspection – principle of radiography, X-ray tubes, gamma-ray sources, defect discernibility; Eddy current inspection; Leak tests: N.D.T. Standard procedure for specification and qualification of welding procedure; WPS and PQR, WPQ

### **TEXT BOOKS:-**

1. Welding Processes and Technology Author :R.S.Parmar, Publisher : Khanna
2. Welding Technology Author : O. P. Khanna, Publisher : Dhanpat Rai & Sons

**Reference Books:**

1. The Metallurgy of Welding, 6th Edition , Lancaster, William Andrew Publishing, NY.
2. Principles of Welding (Processes, Physics, Chemistry and Metallurgy), Robert and Messler, Wiley Interscience Publishers.
3. Welding Hand Book Vol. 5; 7th edition,AWS, 1984.
4. Welding METALLURGY,S Kou, John Wiley, USA, 2003

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
DC207	Design of Machine Elements	2	1	0	8

### Unit-I: General Considerations

Selection of Materials, Design Stress, Factor of Safety, Stress concentration factor in tension, bending and torsion, Theories of failures. Notch sensitivity, Design for variable and repeated loadings, Fatigue stress concentration factor, Endurance diagrams, Introduction to fracture mechanics.

### Unit-II: Basic Elements Design

Types of keys and Splines, Design of Socket-Spigot, Cotter joint, Sleeve and Cotter joint, Gib and Cotter joint, Design of Knuckle joint, Design of Splines.

**Couplings:** Types of couplings, Design of flange and flexible couplings, Compression coupling, Muff coupling.

**Shaft and Axles:** Transmission shaft, Design against static load, Design for strength, Rigidity and stiffness, Design under continuous loading for fatigue.

### Unit-III: Threaded fasteners

Geometry of thread forms, Terminology of screw threads and thread standards, Specifications of steel bolts, Initial tension, Relation between bolt tension and torque, Design of statically loaded tension joints, Design of bolted joints due to eccentric loading.

**Power Screws:** Power screws, Force analysis for square and trapezoidal threads, Collar friction, Stresses in screw, Coefficient of friction, Efficiency of thread, Design of power Screw.

### Unit-IV: Riveted & Welded Joints

Types of rivet heads, Types of riveted joints, Failure of riveted joint, Strength of rivet joint, Efficiency of riveted joint, Design of riveted joint, Eccentrically loaded riveted joint.

Types of welded joints, Stresses in butt and fillet welds, Strength of welded joints, Location and dimension of weld design, Eccentrically loaded joint, Welded joint subjected to bending moment, Design procedure, Fillet welds under varying loads, Stress relieving techniques.

### Unit-V:

**Pulley & Flywheel:** Flywheel Inertia, Stresses in Flywheel and pulleys, failure criterion.

**Chain Drives:** Chain drives, Roller chains, Geometric relationships, Dimensions of chain components, Polygonal effect, Power rating of roller chains, Selection of Chain drives.

**Belt & Rope Drive:** Design of Flat and Round belt drives, V-Belt, Timing belt, Wire Rope.

**Text Book(s):**

1. V.B. Bhandari ,Design of Machine Elements, McGraw HILL Publications. 3<sup>rd</sup>edition,
2. K.Mahadevan / K.BalveeraReddy,Design Data Handbook for mechanical engineers, CBS publication, 4<sup>th</sup>Ed.,2013
3. Design of Machine Elements by V.B. Bhandari, McGraw HILL Publications. 3<sup>rd</sup>edition

**Reference Book(s):**

1. M.F Spotts, T.E Shoup, L.E. Hornberger, S.R Jayram and C V Venkatesh, Design of Machine Elements, 8th Ed., PersonEducation.
2. V. B. Bhandari, Design of Machine Elements, 2nd Ed., Tata McgrawHill.
3. R. C. Juvinall and K. M Marshek, Fundamentals of Machine Component Design, 3rd Ed., Wiley StudentEdition

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
DC208	Manufacturing Engineering	3	0	0	9

### **Unit-I: Introduction to Manufacturing Processes**

Importance of manufacturing processes, classification, economic and technological definitions of manufacturing processes.

### **Unit-II:**

#### **Foundry Practice**

Pattern making, Types, material, allowances, core – types, materials and its properties.

**Mould Making and Casting:** Types of sand moulding, moulding machines & moulding procedure, moulding sand – types, properties, composition and applications, design considerations - riser, gate etc., Casting defects.

**Special Casting Processes:** Investment casting, centrifugal casting, shell moulding, CO<sub>2</sub> moulding, slush casting, die casting.

### **Unit-III: Forging processes**

**Forging:** Principle, types, tools and fixture of forging, forging dies, forging machines, forging design, drop forging die design, upset forging die design, forging practice and process capability, forging defects, Inspection and testing of forged parts.

**Rolling:** Principle, classification of rolled products, types of rolling, rolling mill train components, roll pass design for continuous mill

**Extrusion:** Principle, extrusion processes, process parameters, extrusion equipment, extrusion defects.

**Drawing:** Wire drawing, Rod and tube drawing-Principle, setup, types.

**Press Working:** Types of presses, selection of press, components of a simple press, press working operations – shear, bending, drawing etc., types of dies, die sets, considerations in die design.

### **Unit-IV: Welding**

Principles of Welding, survey and allied processes Arc Welding: TIG and MIG processes and their parameter selection, atomic hydrogen welding, welding of cast iron, welding electrode – types, composition, specification.

**Resistance Welding:** Principle, equipment and processes. Thermit Welding, brazing & soldering,

Internal and external welding defects, Inspection & testing of weld, Introduction to advanced welding process.

### **Unit-V: Powder metallurgy**

Introduction, production of metallic powder, processing methods, advantaged and limitations.

**Text Book(s):**

1. P.N.Rao, Manufacturing & Technology: Foundry Forming and Welding, 3rd Ed., Tata McGraw Hill. Volume-1, 2008
2. Amitabha Ghosh & Mallik, Manufacturing Science, 2nd Ed., East West Press, 2010

**Reference Books:**

1. James Campbell, Principle of Manufacturing Material And Processes, TMH, 1st Ed., 1984
2. Serop Kalpakjian & Steuen R. Schmid, Manufacturing Technology, Pearson Education Asia
3. Roy A Lindberg, Process and Materials of Manufacturing, Pearson Edu.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
DC208L	Engineering Workshop Practices Lab II	0	0	3	3

### **Unit-1**

#### Carpentry Shop

1. Introduction and practice of Wood Turning Lathe operation along with a job preparation.
2. Introduction and practice of wood Surface Planner operation along with a job preparation.
3. Introduction and practice of wood sawing operations (circular & jig saw) along with a job preparation.
4. Introduction and practice of wood grinding operation along with a job preparation.
5. Introduction and practice of wood Disc Sander operation along with a job preparation.
6. Study of different carpentry tools

### **Unit-2**

#### Machine Shop

1. Introduction and practice of Shaper machining operation along with a job preparation.
2. Introduction and practice of milling machining operation along with a job preparation
3. Introduction and practice of drilling machining operation along with a job preparation
4. Introduction and practice of grinding machining operation along with a job preparation
5. Introduction and practice of hydraulic hacksaw machining operation
6. Introduction and practice of shaper machining operation along with a job preparation

#### **Text Book(s):**

1. P.N. Rao, Manufacturing Technology (Vol. - I & II), Tata McGraw Hill Pub. Company, NewDelhi
2. P.C. Sharma, A Text Book of Production Technology (Manufacturing Processes & Technology), S. Chand and Company Ltd., NewDelhi.

#### **Reference Book(s):**

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

**Syllabus**  
**Semester V**

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
DC 301	Pipe Hydraulics & Hydraulic Machinery	3	0	0	9

**UNIT – I** 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.

**UNIT – II** Momentum Principles Action of jets on stationary 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; Similarity laws; Concept of specific speed and unit quantities; Selection of Turbines; Operational characteristics.

**UNIT – III** Centrifugal Pumps Manometric head; Losses and efficiencies; Work done; Working Principle; Priming; Velocity triangles; Performance and characteristic curves; Cavitation effects; Similarity considerations. Dimensional Analysis and Similitude Dimensional homogeneity; Rayleigh's method; Buckingham  $\pi$  -method ; Geometric, Kinematic and Dynamic similarities; Reynold's, Froude, Euler, Mach and Weber numbers; Model laws; Scale effect; Distorted models.

**Unit IV: 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) Minor losses in pipe flow, Hydraulic gradient and total energy line for different pipes, Pipes in series(Compound pipe) and equivalent pipe ,Calculation of discharge, velocity, diameter of pipe etc., for pipes connecting two reservoirs (considering frictional losses only), 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), Expressions for power transmitted through pipes carrying liquid under pressure, Expressions of transmission efficiency, condition for maximum efficiency (without proof), Simple problems on power transmission through pipes.

**TEXT BOOK**

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.

**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](http://www.nptel.iitm.ac.in)

[www.springerlink.com](http://www.springerlink.com) for e-journals

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
DC302	Advanced Manufacturing Process	3	0	0	9

### Unit-I:

#### **Machinability**

Concept and evaluation of Machinability, Mechanism of Tool failure, Tool wear mechanism, Tool life, Taylor's Tool life equation, Machinability index, factors affecting Machinability.

**Thermal Aspects in Machining and Cutting Fluid:** Source of heat in metal cutting and its distributions, temp measurement in metal cutting, function of cutting fluid, types of cutting fluid.

### Unit-II:

**Cutting Tool** – Types, requirements, specification & application Geometry of Single Point Cutting Tool – Tool angle, Tool angle specification system, ASA, ORS and NRS.

**Mechanics of Metal Cutting:** Theories of metal cutting, Chip formation, types of chips, chip breakers, Orthogonal and Oblique cutting, stress and strain in the chip, velocity relations, power and energy requirement in metal cutting.

### Unit-III: Machine Tools

**Lathe:** Introduction, type, specification, construction, work holding devices & tools, mechanism and attachments for various operations, taper turning, thread cutting operations, capston and turret lathe.

**Shaper:** Introduction, type, specification, Quick return Mechanisms, Table feed mechanism, work holding devices, shaper operations.

**Slotter & Planner:** Introduction, specification, types of drives, types of machines.

**Milling Machine:** Introduction, specification, types, mechanisms and attachments for milling, milling operations, Indexing-simple, compound and differential.

### Unit-IV:

**Grinding:** Processes, machines, design consideration for grinding, specification of grinding wheel, process parameters, economics of grinding.

**Gear Cutting:** Principle of gear generations, Gear manufacturing by casting processes, forming processes and Metal removal processes, gear cutting on milling machines (Forming and Generation). Gear finishing processes.

**Jigs & Fixtures:** Degree of freedom, principles of location and clamping, locating, clamping and indexing devices, principles of design, design of simple jigs and fixtures.

### Unit-V.

**Unconventional Machining:** Advantages, application and limitation, mechanics of metal removal, Principles and process of EDM, ECM, USM, EBM, LBM and AJM. Applications, advantages and limitations of the processes.

**Thread Rolling:** Principle, Processes, Types of Thread Rolling, and Grinding.

### Text Book(s):

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.
3. A B Chattopadhyaya, Manufacturing technology, Wiley India Pvt Ltd, 2011

**Reference Books(s):**

2. SeropeKalpakjian&Schmid, Manufacturing Engineering and Technology , Pearson Education, Delhi.
3. Kibbe Richard R – PHI ,Machine Tool Practices , NewDelhi

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
DC303	Health, Safety and Environment	2	0	0	6

**Unit-I: Introduction to Environmental Studies and Natural Resources** Definition, scope and importance, Need for public awareness. Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer/pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's-benefits and problems. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.

### **Unit-II: Ecosystem and Biodiversity**

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries), Introduction to biodiversity – definition: genetic, species and ecosystem diversity, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, national and local levels – India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Conservation of biodiversity

### **Unit-III: Environmental Pollution**

Definition, Causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution: oil field spillage, Condition of spillage, contaminants (e) noise pollution (f) thermal pollution (g) nuclear hazards, Solid waste management: causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution.

### **Unit-IV: Social Issues and the Environment**

From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns, case studies, Environmental ethics: issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, Wasteland reclamation.

### **Unit-V: Occupational Hazards**

Tonicity, physiological, asphyxiation, respiratory, skin effect of petroleum hydrocarbons and their mixture- Sour gases with their threshold limits- Guidelines for occupational health monitoring in oil and gas industry. Corrosion in petroleum industry- Additives during acidizing, sand control and fracturing.

### **UNIT- VI: Hazard Identification**

Hazard evaluation- HAZOP and what if reviews- Developing a safe process and safety management- Personal protection systems and measures.

Guidelines on internal safety audits (procedures and checklist – Inspection and safe practices during electrical installations- Safety instrumentation for process system in hydrocarbon industry- Safety aspects in functional training-Work permit systems.

### **UNIT-VII: Fires**

Classification of fires- The fire triangle- Distinction between fires and explosions- Flammability characteristics of liquids and vapour Well blowout fires and their control- Fire fight equipment-Suppression of hydrocarbon fires.

**Text Book(s):**

Gilbert M.Masters, "Introduction to Environmental Engineering and Science", PHI Learning education Pvt., Ltd., second edition, ISBN 81-297-0277-0,2004.

Miller T.G. jr., "Environmental Science", Wadsworth publishingco.

Townsend C., Harper J and Michael Begon, "Essentials of Ecology", Blackwellscience.

4.TrivediR.K.andP.K.Goel,"Introductiontoairpollution",techno-sciencepublications.

**Reference Book(s):**

Bharuchaerach, "The Biodiversity of India", Mapin publishing Pvt. Ltd., AhmedabadIndia,

Trivedi R.K., "Handbook of Environmental Laws", Rules, Guidelines, Compliances and Standards, Vol.I and II, Enviromedia.

Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai,2001.

Wager K.D., "Environmental Management", W.B. Saunders Co., Philadelphia, USA,1998.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
HU301	Humanities	2	0	0	6

### Unit - 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.

### Unit - 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.

### Unit - 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, falsificationism, 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, behaviorist and cognitivist.

Ethics: Impact of science and technology on man and society: elements of environmental and professional ethics.

## **TEXT / 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 subject*, 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.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		2	1	0	
LM301	Engineering Economics	2	1	0	8

**Unit 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.

**Unit 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.

**Unit 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.

**TEXT BOOKS:-**

- PanneerSelvam, R., “Engineering Economics”, Prentice Hall of India Ltd, 2001.
- Smith, G.W., “Engineering Economy”, Iowa State Press, 1973.

**REFERENCE BOOKS:-**

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



Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
DC 304	Quality Analysis and Quality Control	3	0	0	9

**UNIT  
1:**

**UNIT 1: Inspection, Quality, Process and Control**

The basic concepts, Objectives and functions of inspection in industry, Meaning and significance of quality, Essential components of quality, Phases or elements for building quality, Evolution of the concepts of quality, Spiral of progress of quality, Changing scope of quality activities, Quality Circles, Quality system economics, Hidden quality costs, Economic models of quality costs, Quality loss function.

**UNIT 2: Statistical Process Control**

Understanding the process, Process data collection and presentation, Process variability, Process control, Variable control charts (  $\bar{X}$ - R,  $\bar{X}$  - S etc.), Attribute control charts( p,np,c, $\mu$ ) , Cumsum charts, Acceptance sampling.

**UNIT 3: Process Capability Analysis**

Need and significance, Process capability for variable data, Process capability indices, Interpreting the indices, Use of control chart and process capability data. Process Improvement: Quality improvement process, Quality tools for process improvement viz. Pareto Charts, C & E analysis, Scatter Diagrams, Stratification.

**UNIT 4: Six Sigma Process Quality**

Introduction, DMAIC process, role of design of experimentation, Parametric design.

**UNIT 5: Engineering Metrology**

Scope of engineering metrology, Types of measurement methods, Characteristics of a measurement system (Range/span, Precision/Accuracy, Hysteresis, Dead Zone, Drift, Sensitivity), Calibration process, Line measurement and end measurement, Importance of surface texture, Gauge R & R, Radius and Curvature measurement, Angle measurement, Thread and Gear measurement.

**Text Books:**

1. Oakland, J. S., Statistical Process Control, Butterworth and Heinemann, New York (2008).
2. Gupta, I. C., Engineering Metrology, Dhanpat Rai and Sons, New Delhi (2007)

**Reference Books:**

1. Grant, E. L. and Leavenworth, R.S., Statistical Quality Control, McGraw Hill International, New York (2008).
2. Besterfield, D.H., Total Quality Management, Pearson Education Asia, New Delhi (2003).
3. Juran, J. M. and Gryna, F. M., Quality Planning & Analysis, Tata McGraw Hill, New Delhi (1995)

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
DC 302L	Engineering Workshop Practices III	0	0	2	2

#### Unit-1

1. 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.

#### Unit-2

1. 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.

#### Unit-3

1. Study of different Smithy & Foundry shop tools along with its specifications
2. Introduction and practice of Smithy & Foundry shop operations along with job preparation.

#### **Text Book(s):**

3. P.N. Rao, Manufacturing Technology (Vol. - I & II), Tata McGraw Hill Pub. Company, NewDelhi
4. P.C. Sharma, A Text Book of Production Technology (Manufacturing Processes & Technology), S. Chand and Company Ltd., NewDelhi.

#### **Reference Book(s):**

3. SeropeKalpakjian&Schmid, Manufacturing Engineering and Technology, Pearson Education, Delhi.
4. Kibbe Richard R – PHI, Machine Tool Practices, NewDelhi.

**Syllabus**  
**Semester VI**

subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
DC305	Pipeline Transportation of Oil & Gas	2	0	0	6

**UNIT I: Introduction**

Mode of transportation, scope, advantages of pipeline transportation, planning and evaluation, technical, financial and economics and cost structure, Lease Automatic Custody Transfer

**UNIT II: 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

**UNIT III: 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

**UNIT IV: 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

**Unit V: Pipeline Pigging**

Introduction of Pigs, Types of Pigs, pig launchers, Smart pigs/Intelligent pig, Plugs

**UNIT VI: Corrosion protection**

Causes, Types, Protection: coating, cathodic protection, Internal corrosion, Corrosion Monitoring and control.

**TEXT BOOKS:**

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, Mohinder L. Nayyar, McGraw Hill
4. NACE Corrosion Engineer's Reference Book, Robert Baboian, NACE International

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
DC306	Mechatronics	3	0	0	9

### Unit-I: Introduction

Definition of Mechatronics , Multi-disciplinary scenario, origins.Evaluation of Mechatronics, an over view of mechatronics.Design of mechatronics system.Measurement system and function of main elements of measurement systems. Need for mechatronics in industries.

Objectives, advantages and disadvantages of mechatronics. Microprocessor based controllers. Principle of working of automatic camera, engine management system, automatic washing machine.

**Review Of Transducers And Sensors:** Definition and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensors and Hall effect sensors.

### Unit-II: Elements Of CNC Machines

Structure, guide ways – Friction, Antifriction and Frictionless guide ways, Merits and demerits. Drives – Recirculating ball screw and nut. Advantages and disadvantages over conventional screw and nut. Concept of stick-slip phenomenon, Concept of preloading of ball nuts.Roller screw- planetary roller screw recirculation roller screw. Spindle and spindle bearings in machine tool. Various types of loads encountered by spindle and spindle bearing.Types of bearings – friction, antifriction and frictionless bearing.Merits and demerits of each.Selection of spindle and spindle bearing, preloading of bearings, different method of preloading in detail.

### Unit-III:Electrical Actuators

Actuator and actuator system.Classifications of actuator system with examples. Mechanical switches, Concept of bouncing Methods of Preventing bouncing of mechanical switches. Solenoids, Relays. Solid state switches – Diodes, Thyristors, Triacs, Transistors, Darlington pair. Electrical actuator.Principle, construction and working of AC, DC motors, stepper motors, permanent magnet motors, servomotors, Servo systems and control.

### Unit-IV:Hydraulic Actuators

Valves, Classification, Pressure Control valves-Pressure relief valves, Pressure regulating/reducing valves, Pressure sequence valve. Flow control valves – principle, needle valve, globe valve. Direction control valve-sliding spool valve, solenoid operated. Symbols of hydraulic elements.Hydraulic cylinders – constructional features, classification and applications. Hydraulic motors – Types, vane motors and piston

### Unit-V:Signal Conditioning

Concept, necessity, op-amps, protection, filtering, wheat stone bridge digital signals- Multiplexer.Data acquisition-Introduction to digital signal processing-Concepts and different methods.

### Text book(s):

- 1.W.Bolton, Longman ,Mechatronics, , 2Ed, Pearson Publications,.
2. HMT ltd. Mechatronics, Tata Mcgraw-Hill, New Delhi

### Reference Book(s):

1. G.W. Kurtz, J.K. Schueller, P.W. Claar . II, Machine design for mobile and industrial applications,SAE.
2. T.O. Boucher, Computer automation in manufacturing - an Introduction, Chappman and Hall.

3. Mechatronics, Intl. J. published by PergamonPress

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
DC307	Pipe Drawing Basics & Development of Plot Plan	3	0	0	9

### **Unit 1**

Interpenetration of simple solids Orthographic views of machine parts from pictorial views.

### **Unit 2**

Thread forms, Bolts, nuts and screws

### **Unit 3**

Joints and couplings, Bearings, Assembly drawings

### **Unit 4**

Introduction: Plot Plan in the process industry

### **Unit 5**

Plot Plan Development

### **Unit 6**

Types of Plot Plans

### **Unit 7**

Location of Equipment and Supporting facilities

### **Unit 8**

Pipe Rack System

### **Unit 9**

Equipment Spacing and access ways along with sample plot plan arrangement

### **Text Book(s):**

1. N.D.Bhatt, R.C. Patel, Machine drawing, Charotar Book Stall TulshiSadan, Station Road, Annad, India.
2. P.S. Gill, Machine drawing, S.K. Kataria & Sons Delhi.
3. Process Plant Layout and Piping Design By Ed Bausbacher Roger Hunt, Prentice-Hall, Inc., New Jersey, USA (1993).
4. Pipe Drafting and Design • 3rd Edition • 2012. Authors: Roy A. Parisher and Robert Rhea.
5. Piping Systems Handbook, Book by Michael Frankel.

### **Reference Book(s):**

- 1) Process piping design, Book by Rip Weaver.

2) Piping Handbook, Book by Mohinder L. Nayyar .

3) Process pipe drafting, Book by Terence M. Shumaker.

4) Basudeb Bhattacharyya, Machine drawing, Oxford University Press

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
DC 308	Corrosion & Material Selection	3	0	0	9

**UNIT  
1:**

**Corrosion Mechanism**

Corrosion Mechanism of iron-group metals, In active and prepassive state. Corrosion of cast alloy and constructive steel in water solutions. Atmospheric corrosion. Low alloyed steel – effect of alloying elements. Stainless steel. Influence of microstructure of cast alloy and steel on corrosion resistance. Passivation of alloys of iron-group metals. Effect of alloying elements and microstructure. Local corrosion of alloyed steels. Stress corrosion. Acid brittleness. Effect of chemical composition and microstructure of copper alloys on corrosion resistance in water solutions of salts and in atmosphere.

**UNIT 2: Corrosion Protection**

Convertible coatings. Formation of decorative surface products. Galvanic coatings. Anticorrosive and decorative properties of galvanic coatings. Types of anticorrosive and decorative coatings. Chemical techniques of metallic coatings formation. Examples of metallic coatings application. Types of convertible coatings: chromate, phosphate, silicate coatings. Types of decorative coatings formation. Electrochemical and chemical aging of metallic surface (artificial patine). Modern techniques of applying protective coatings (sol-gel, PVD, CVD). Techniques of applying semiconductor materials on metallic surface (electrochemical, vacuum techniques)

**Unit 3: Mechanical properties of materials**

Elastic, Inelastic and Viscoelastic behaviour, Engineering stress and engineering strain relationship, True stress - true strain relationship, review of mechanical properties, Plastic deformation by twinning and slip, Movement of dislocations, Critical shear stress, Strengthening mechanism, and Creep.

**Unit 4: Equilibrium diagram**

Solids solutions and alloys, Gibbs phase rule, Unary and binary eutectic phase diagram, Examples and applications of phase diagrams like Iron - Iron carbide phase diagram.

**Unit 5: Electrical and magnetic materials**

Conducting and resistor materials, and their engineering application; Semiconducting materials, their properties and applications; Magnetic materials, Soft and hard magnetic materials and applications; Superconductors; Dielectric materials, their properties and applications. Smart materials: Sensors and actuators, piezoelectric, magnetostrictive and electrostrictive materials.

**Text Books:**

1. W.D. Callister , Materials Science and Engineering; John Wiley & Sons, Singapore, 2002.
2. W.F. Smith, Principles of Materials Science and Engineering: An Introduction; Tata Mc-Graw Hill, 2008.
3. V. Raghavan, Introduction to Materials Science and Engineering; PHI, Delhi, 2005.
4. M. Pourbaix: Lectures on electrochemical corrosion. NACE International, Houston 1995,
5. G. Wranglen: Introduction to corrosion and protection of Metals, Chapman & Hall., London, 1985

**Reference Books:**



1. S. O. Kasap, Principles of Electronic Engineering Materials; Tata Mc-Graw Hill, 2007.
2. L. H. Van Vlack, Elements of Material Science and Engineering; Thomas Press, India, 1998.
3. K. G. Budinski, Engineering Materials – Properties and selection, Prentice Hall India, 1996
4. Pierre R. Roberge: Handbook of Corrosion Engineering, ed. by Mc Graw-Hill, N.York 2000,
5. R. Winston Revie: Uhlig's Corrosion Handbook, Electrochemical Society Series, ed. by John Wiley & Sons Inc. N.York 2000.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
DE301	Power Plant Engineering	3	0	0	9

### **Unit-I: 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, Siting of different power stations, Foundation, Elements of Electric power systems primary and secondary distribution substations (in brief).

### **Unit-II: Steam Power Plant**

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.

### **Unit-III: 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 powerstations.

### **Unit-IV: Diesel power station**

Application of Diesel in power field, Suitability of diesel engines for bulk power, Layout of Diesel Power Plant, Advantages and limitations of diesel, Power stations, Performance Characteristics.

### **Unit-V: Nuclear Power Station**

Evolution of nuclear energy from atoms by fission and fusion, Chain reactions, Fission materials, Types of 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.

### **Unit-VI:**

**Variable load problems:** Idealized and realized load curves, Effect of variable load on plant design and operation variable load operation and load dispatch.

**Power station Economics:** Source of income, Cost of plant and production, Elements of cost, depreciation and replacement theory of rates.

### **Text Book(s):**

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

### **Reference Book(s):**

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

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
DE 301	Pipe Support Design and Engineering	3	0	0	9

### **UNIT 1: Pipe Supports**

Types and Functions of Supports, Anchors, Pipe Guides Limit Stops, Pipe Shoe Dummy Leg / Trunion, Field Support / Base Support, Rigid Hangers Flexible or Resilient Supports, Variable & Constant, Load Pipe Rack and Yard Piping Design.

### **UNIT 2: Support Location**

Determination of Support Location, Maximum sag or deflection between supports for self-draining lines. Design pressure integrity, Concept of Pressure Integrity Pressure Design of Straight Pipe under Internal Pressure. – Wall thickness Calculations.

### **UNIT 3: Stresses in Pipe support**

Normal and shear stresses, Hoop's stress due to Internal Pressure, Bending Load, Radial Stresses Due to Internal Pressure, Shear Force on a Pipe, Axial stresses due to Bending, Torsional Load.

### **UNIT 4: Hydraulic Design of Piping Systems**

Fluid Flow Sizing, Pipe Sizing Recommended Velocities for Water and Steam, Piping etc. Reynolds Number, Types of Flow in Piping, Pressure Drop due to Friction / viscosity Darcy Weisbach Equation.

### **UNIT 5: Theories of failure**

Maximum Stress Theory, Maximum Shear Theory, Octahedral Shear Theory, Design under secondary load.

#### **Text Book:**

1. M.V.Joshi & V.V. Mahajani, "Process Equipment Design", MacMillan, India Ltd., 1996.
2. J.F.Hanvey, "Pressure Vessels Design", Von Nostrand Co. Ind., 1963
3. ASME code Section 8th div 1, div 2
4. K.P.Singh & A.L. Soler, "Mechanical Design of Heat Exchangers", Arcturus Pub.

#### **Reference Book:**

1. Demis R. Moss, Pressure Vessel Design Manual, Gulf Publishing Co., Houston, 1987.

2. Sahu G.K., "Hand Book of Piping Design", New Age International (P) Ltd. 1998,
3. ASHRAE fundamentals – 1985.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
DE 301	Offshore and Cross country pipeline	3	0	0	9

### **UNIT-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.

### **UNIT-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.

### **UNIT-3: Ocean environment**

Introduction, Ocean water properties- Airy's Wave theory, Wave kinematics along the depth of water.

### **UNIT- 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

### **UNIT-5: Receiving Terminals**

Receiving terminals in India – Main components and description of marine facilities – Storage capacity – Process descriptions.

### **UNIT-VI: 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.

#### **Text Books:**

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

#### **Reference Book:**

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.

Subject Code	Subject Name	Credit Lecture (L-T-P)			Total Credits
		L	T	P	
DE301	Industrial Engineering and Management	3	0	0	9

**Unit-I: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.

**Unit-II: Plant Location, Site Selection and Plant Layout:**

Need for a suitable location, Urban, Suburban, Systems approach, Factors affecting location, Quantitative method for evaluation of plant location, Objectives & Principles of plant layout, Types of layout and their suitability, Software packages for layout analysis.

**Unit-III:Work Study:**

Productivity and work study, Introduction and definition of Work-study, Prerequisites of conducting a work study.

**Unit-IV: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.

**Unit-V:Work Measurement:**

Definition, Objectives, Techniques of Work measurement, Selection & timing the job, Rating, Allowances, Normal and standard time determination, Work sampling.

**Unit-VI:Ergonomics**

Introduction to ergonomics and its application.

**Unit-VII:Maintenance Management:**

Objectives and need for maintenance, Types of maintenance, Breakdown, Predictive and Preventive Maintenance, Condition based maintenance system.

**Unit-VIII: Value Engineering & Value Analysis:**

Definition, Objectives & use of value analysis, Application & techniques. Project Management, PERT, CPM, Network Representation, Techniques for drawing network, Resource smoothing and levelling, Project cost, Optimum project duration, Project crashing, Updating, Time estimation in PERT .

**Unit-IX: Industrial Engineering and Information Technology:**

Role of IT/ IS 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.

**Unit-X: Business Process Re-Engineering:**

Definition, Need & characteristics, Industrial Engineering & Reengineering, Framework for Reengineering, Process of Reengineering, Information Technology leverage in Reengineering, advantages of Re-engineering.

**Unit-XI:TradeUnion:**

Meaning and Origin, Objectives of Trade Union, History of Trade Union in India, Laws related to Trade Union.

**Text book(s):**

1. MartandTelsang ,Industrial Engineering and Production Management ,S Chand & Company
2. S. K. Sharma, Savita Sharma, Industrial Engineering and Organization Management, 1st Ed., SK Kataria&Sons

**Reference Book(s):**

1. Philip E Hicks ,Industrial Engineering & Management –A new perspective, , McgrawHill
2. S. Dalela, Mansoor Ali, Industrial Engineering and Management Systems ,Standard PublishingDistributors.