BE (Production)

BE (PE) - I SEMESTER

THORY			SESSIONAL		
CODE	TITLE	UNIT	CODE	TITLE	UNIT
HU 1101	Technical English	1.0	ME 1102	Engineering Graphics	1.0
PH 1101	Physics- I	1.0	CP 1202	Unix & C Programming	1.0
CH 1201	Engineering Chemistry	1.0	PH 1102/	Physics Lab./	
MA 1101	Mathematics- I	1.0	CH 1202	Chemistry Lab.	0.5
ME 1101	Engineering Mechanics	1.0	PE 1102	Work Shop Practice- I	0.5
			GA 1002	NCC/ NSS/ PT & Games/ Creative Arts	0.5

BE (PE) - II SEMESTER

MA 2101	Mathematics- II	1.0	ME 2102	Computer Aided Drafting	1.0
EE 2101	Basic Electrical Engineering	1.0	CH 1202/	Chemistry Lab./	
CP 2101	Data Structure in C++	1.0	PH 1102	Physics Lab.	0.5
CH 2103	Environmental Science	1.0	ME 2104/	Engineering Mechanics Lab./	
PH 2103	Physics- II	1.0	EE 3102	Basic Electrical Engineering Lab.	0.5
			CP 2102	Data Structure Lab.	0.5
			PE 2102	Workshop Practice- II	0.5
			GA 2002	NCC/ NSS/ PT & Games/ Creative Arts	0.5

BE (PE) - III SEMESTER

EC 3101	Basic Electronics	1.0	EC 3102	Basic Electronics Lab.	0.5
MA 3101	Mathematics III	1.0	EE 3102/	Basic Electrical Engineering Lab./	
EE 3101	Introduction to System Theory	1.0	ME 2104	Engineering Mechanics Lab.	0.5
			CP 3102	Java Programming Lab.	0.5
			CP 3104	Digital Logic Design Lab.	0.5
			GA 3002	NCC/ NSS/ PT & Games/ Creative Arts	0.5

BE (PE) - IV SEMESTER

MA4101	Industrial Statistics	1.0	PE4204	Metallurgy Lab.	0.5
PE4203	Metallurgy	1.0	ME4202	Fluid Mechanics Lab.	0.5
ME4201	Fluid Mechanics	1.0	ME4204	Strength of Materials Lab.	0.5
ME4203	Strength of Materials-I	1.0	ME4206	Engineering Measurements Lab	0.5
ME4205	Engineering Measurements	1.0	ME4208	Energy Engineering Lab.	0.5
ME4207	Energy Engineering	1.0	GA4002	NCC/ NSS/ PT & Games/Creative Arts	0.5

BE (PE) - V SEMESTER

MA41203	Computational Methods	1.0	MA4104	Computational Methods/	
PE5205	Manufacturing Processes - I	1.0		Programming Lab	0.5
ME6205	Design of Machine Elements	1.0	PE5206	Manufacturing Process - I Lab	0.5
PE5203	Operations Research	1.0	ME6206	Machine Design Sessional	0.5
PE5201	Metrology	1.0	PE5202	Metrology Lab	0.5
PE5207	Industrial Organization & Management	1.0			

BE (PE) - VI SEMESTER

PE6201	Manufacturing Processes - II	1.0	PE6202	Manufacturing Process - II Lab	0.5
PE6203	Machine Tool Design	1.0	PE6204	Machine Tool Design Sessional	0.5
PE6205	Manufacturing Automation	1.0	PE6206	Manufacturing Automation	
PE6207	Project Engineering	1.0		Course Work	0.5
ME6201	Computer Aided Design	1.0	ME6202	Computer Aided Design Lab./	
ME6203	Theory of Machine - I	1.0		Course work	0.5

BE (PE) - VII SEMESTER

PE7201	Material Deformation Processes	1.0	PE7202	Material Deformation Processes Lab	0.5
PE7203	Work Study & Ergonomics	1.0	PE7204	Work Study & Ergonomics Lab	0.5
PE7207	Production Planning & Control	1.0	PE7208	Project I	0.5
PE7209	Engineering Economy	1.0	PE7206	Modern Manufacturing Process Lab	0.5
PE7205	Modern Manufacturing Processes	1.0			

List of Elective (Any one)

PE7211	Enterprise Resource Planning	1.0
PE7213	Metal Working Tribology	1.0
PE7215	Process Engineering	1.0
PE7217	Competitive Manufacturing Strategies	1.0
PE7219	Human Resource Development	1.0
EC7221	Microprocessor & Interfacing	1.0
PE7223	Powder Metallurgy	1.0

BE (PE) - VIII SEMESTER

PE8205	Plant Engineering	1.0	PE8202	Tool Design Lab./Sessional	0.5
PE8201	Tool Design	1.0	PE8204	FMS & Robotics Lab./Course work	0.5
PE8203	Flexible Manufacturing Systems		PE8208	Project - II	1.0
	& Robotics	1.0		Seminar	
PE8207	Quality Engineering	1.0			
ME8207	Industrial Pollution Control	1.0			

ELECTIVE-II (Any one)

PE8211	Human Factors & Safety Engineering	1.0
PE8213	Value Engineering	1.0
PE8215	Decision Support System	1.0
PE8217	Processing of Polymer & Composites	1.0
PE8219	Advanced Operations Research	1.0
PE8221	Maintenance Engineering	1.0
PE8223	System Dynamics	1.0
PE8225	Eco-friendly Manufacturing	1.0
PE8227	Advance Welding Technology	1.0

FIRST SEMESTER

HU 1101	TECHNICAL ENGLISH	1.0

MODULE – I

Single word substitution, Idioms and phrases, Pairs of words, Common errors, Précis, Comprehension, Expansion.

MODULE – II

Official Correspondence - Memorandum, Notice, Agenda, Minutes, Circular letter, applying for a job, Resume, Demo-official letter.

MODULE – III

Business Correspondence-Types, sales letters; Social Correspondence- Invitation to speak, Congratulations; etc.

MODULE – IV

Report writing; general and technical report, Definition, Types, structure.

MODULE – V

Technical proposals, Definitions, types and format.

MODULE – VI

Research papers and articles.

MODULE – VII

Mechanics of manuscript preparation.

BOOKS FOR REFERENCE:

1. Blickle, Margaret D., and K.W.Houp.
2. Reports for Science and Industry, Henry Holt & Co. N.Y.
3. Duddy, E.A. & M.J. Freeman Written Communication in Business, Amercian book Co. N.Y.
4. Berry, Thomas Elliot, The most Common Mistakes in English Usage; Tata McGraw Hill.
5. Stevensin, B.W., J.R. Spicer and E.C. Ames, English in Business and Engineering. Prentice Hall, Eaglewood
6. Cliffs, N.J.
7. Raul, Asha, Effective Business Communication, Prentice Hall of India.
8. Singh B. Business Correspondence including Bank letters.
9. Singh B. Theory and Practice of Business Correspondence, HPJ Kapoor Publications.
10. Report Writing and Business Correspondence Mohan and Sharma, Tata McGraw Hill Publications, India.
11. Best, W.D. The Students companion, Rupa & Co. Publications.

PH 1101	PHYSICS- I	1.0

MODULE – I

Waves and Oscillations: (SS* : Wave motion: longitudinal and transverse waves, plane waves, phase velocity). Wave packets and group velocity, wave equation, superposition of waves (RHK-Ch-18), equation of motion of simple harmonic oscillator and solutions, damped harmonic motion and forced oscillations(RHK 17.2-17.4,17.7,17.8)

[6]

MODULE – II

Fields: Vector and scalar fields, physical and mathematical concepts of gradient, divergence and curl (Cartesian coordinates only), Gauss's theorem and Stokes' theorem (Statements only, SAD-Ch.3).

[5]

MODULE – III

Electromagnetic Theory: Gauss's law in integral and differential form, electric potential and relation with E(SAD 4.5-4.8),(SS*- capacitance(SAD-6.5) and electrostatic energy density (SAD 4.10)), dielectrics, three electric vectors, dielectric susceptibility boundary conditions on E and D(SAD 5.5-5.7, 5.9).

[5]

Amperes law in integral and differential form, applications.(SAD 7.1-7.4), Hall effect (RHK-32.4), three magnetic vectors (SAD 7.5), magnetic permeability and susceptibility, boundary conditions on B and H (SAD 8.5-8.7).

[5]

Faraday's law in integral and differential form(SAD 9.2-9.3), (SS - Inductance, magnetic energy density (SAD 8.8, 8.9)), continuity equation for charge (SAD 5.8), displacement current (SAD 9.4), Maxwell's equations in free space (SAD 9.5), electromagnetic wave equation for plane waves in dielectric medium and free space, relation between $\vec{E}$, $\vec{B}$ and $\vec{k}$, Poyinting vector (SAD 10.3-10.7).

[5]

MODULE – IV

Plasma Physics: Plasma state, types of plasma, applications of plasma(FFC-Ch-1,2)

[4]

MODULE – V

Physical Optics:

Interference: Two-Beam Interference(AG 12.1-12.6), interference in thin films and wedge-shaped layers(AG 13.8-13.9), reflection and anti-reflection coatings(AG 13.2-13.4), applications of interferometry: Newton's rings(AG 13.10), Michelson' Interferometer (AG 13.11)

[5]

Diffraction: Fraunhofer diffraction by single slit(AG 16.1-16.3) , double slit and grating (AG 16.6-16.8), limit of resolution, Rayleigh criterion(AG 16.5), Fresnel diffraction(Qualitative, AG 17.1-17.3)

[5]

Polarization : (SS- Polarization of light, Malus's law, polarization by reflection, Brewster's law, Double refraction) Analysis of linearly and circularly polarized light(RHK 44.1-44.5), Fresnel's equations and their applications (AG 21.1-21.2)

[5]

Text Books:

1. Mathew N.O. Sadiku (SAD), Elements of Electromagnetics, Oxford University Press
2. (2001)
3. A.Ghatak(AG), Optics, 3rd Edition, Tata Mcgraw Hill, 2005
4. Resnick, Halliday and Krane(RHK), Physics- Part-I & II, 5th Edition, John Wiley (
5. 2002)
6. F.F.Chen(FFC), Introduction to Plasma Physics, 2nd Edition, Plenum Press, 1994

References:

1. W.H.Hayt and J.A.Buck, Engineering Electromagnetics, Tata McGraw Hill (2006)
2. M.R.Srinivasan, Physics for Engineers, New Age International, 1996
3. S.N.Sen, Introduction to Plasma Physics, Pragati Prakasan, Meerut -1, India

MODULE – I

Chemical Bonding: Trends in periodic properties (ionization energy, electron affinity, electro negativity), VBT, VSEPR theory, MOT for diatomic molecules and polyatomic molecules, coordination complexes & ligands, CFT, colour and magnetism of coordination complexes, spectrochemical series

MODULE –II

Kinetics and catalysis: kinetics of chain reactions, parallel reactions, side reactions, fast reactions in solutions, flash photolysis, kinetics of catalytic action (acid base catalysis, biological catalysis), application of catalyst in industrially important processes (Haber's processes, Ostwald process, Bergius process)

MODULE – III

Thermo-chemistry and Fuels: Hess's law, entropy, enthalpy and combustion calculations, characterization and application of fossil fuels, solid fuel (carbonization & gassification), liquid fuels (refining, reforming, petrol & diesel, knocking characteristics, octane and cetane number) and gaseous fuels (water gas, producer gas, coal gas and biogas), lubricants and its properties

MODULE –IV

Electrochemistry and corrosion sciences: Redox process cell, potential and free energy, galvanic cells, electrolysis and Nernst's equation, Fuel cells, and its applications, chemical and electrochemical corrosion, general methods of corrosion prevention (with brief introduction to chemistry of paints, varnishes and enamel)

MODULE –V

Fundamentals of spectroscopic techniques: Basic principles of vibrational, rotational and Mossbauer spectroscopy

MODULE – VI & VII

Macromolecules: Classification, Addition and Condensation polymers, molecular weight of polymers (M_n, M_w, M_v), glass transition temperature (T_g), structure property relationship in polymers (chemical, electrical, optical and mechanical), examples and use of inorganic polymers, synthesis of some commercially important polymers and their use (Nylon 6, Nylon 6, 6, PE, PET, PS)

MODULE – VI & VII

An introduction to computational chemistry

Text Book:

1. Applied chemistry A text book for engineers and technologists, H. D. Gesser, Plenum publishers.
2. Inorganic chemistry: J. D. Lee.
3. Engineering chemistry: Sashi Chawla

Reference:

1. Fundamentals of molecular spectroscopy: C. N. Banwell, TMH publication
2. Computational chemistry: E. Lewars, Kluwer publication
3. Physical chemistry: P. W. Atkins

Analytical Trigonometry:

De-Moivre's Theorem and its applications. Expansion of Sinx and Cosx in powers of x. Complex arguments. Separation into real and imaginary parts Gregory's Result. Expansions. Summation of trigonometric Series. Hyperbolic functions.

(8L)

Differential Calculus:

Successive Differentiation. Leibnitz's Theorem. Rolle's Theorem. Lagrange's and Cauchy's Mean value Theorem. Generatalised Mean value Theorem. Taylor's and Maclaurin's infinite series. Cartesion and polar subtangenent and Subnormal. Pedal equations. Orthogonal intersection of curves. Curvature and radius of Curvature in case of Cartesian parametric, polar, pedal and trangential polar forms. Centre of curvature and evolute. Indeterminate forms L Hospital's Rule. Concavity, convexity and points of inflexion. Asymptotes (cartesian Co-ordinates only).

Functions of two variables. Partial derivatives. Euler's Theorem on Homogeneous functions. Its generalisation and extension. Total differential and derivatives. Errors and Approximations. Taylor's series in case of two variables. Maxima and Minima of two variables. Lagrange's method of Undertermined multipliers in case of two and three variables. Jacobians. Envelope of curves. Tangent planes and Normal lines.

(22L)

Integral Calculus:

Reduction Formula. Beta and gamma functions. Area, length, volume and surface area without the use of multiple integrals.

(9L)

Infinite series:

Convergency and Divergency of infinite series. Tests for Convergence. Comparison Test, p series test, Cauchy's root test. D' Alembert's ratio test, Razabe's Test, Gauss's Test, Logarithmic and Higher logarithmic ratio test (No proof). Leibnitz's Rule for alternating series test.

(6L)

Books Recommended:

1. Higher Trigonometry. Das and Mukherjee (U.N. Dhur & Co.)
2. Differential Calculus. Pran Nath and Agarwal. Tara Publications, Varanasi
3. Integral Calculus. Das and Mukherjee (U.N. Dhur & Co.)
4. Engineering Mathematics. H.K. Dass
5. Higher Engineering Mathematics B.S. Grewal (Khanna Publishers)

Equivalent Force System and Equilibrium: Principles of statics, laws of mechanics, freebody diagram, coplanar, non-coplanar and spatial force system and conditions of equilibrium, vector representation and analysis of forces and moments, Varignon's theorem.

Structural Mechanics: Analysis of simple plane truss by method of sections and methods of joints, analysis of frames and parabolic cables, cantilever and simply supported beams with concentrated, distributed and moment loads, shear force and bending moment diagrams, concept of stress and strain.

Interfacial Friction: Friction and impending motion, static, kinetic and rolling friction, application to inclined planes, wedges, screws jacks and belts.

Kinematics and Kinetics of Particle and Rigid Bodies: Conceptual framework and vector representation of displacement, velocity, acceleration, linear and angular momentum, rectilinear and curvilinear motion in two dimensions, centroidal and non-centroidal rotation, general plane motion, Newton's laws of motion, D'Alembert's principle, equilibrium of dynamic forces.

Work and Energy: Translation and rotation of rigid body about a fixed axis, conservation of energy, energy and work equations in translation and rotational motion, virtual work.

Impulse and Momentum: Impulse force and momentum, conservation of momentum, coefficient of restitution, momentum equation. Vibrating Systems: Inertia, features of a vibrating system, free vibration, systems with single degree of freedom.

Books Recommended:

1. Kumar, Engineering Mechanics
2. Shames, Engineering Mechanics

SECOND SEMESTER

MA 2101	MATHEMATICS- II	1.0

Integral Calculus:
Operations under the sign of integration, Multiple integrals, change of order of integration, Transformation of Co-ordinates, Area, Volume and Surface area of solids using multiple integrals.

(8L)

Ordinary Differential Equations:
Linear differential equations: Bernoulli's from Exact equations, Nonlinear equations, Clairaut's form, Higher order equations with constant coefficients. Cauchy's and Legendre's differential equations. Solution of higher order equation by the change of independent variable, Method of variation of Parameters in Simple cases,
Applications to Engieering problems.
Series solution of Differential equations by the method of Frobenius.(Roots differing by non integer and equal roots).

(14L)

Algebra of Matrices:
Rank of a matrix. Consistency and inconsistency of a system of linear equations. Eigen values and eigen vectors. Cayley Hamiliton Theorem.

(3L)

Vector spaces:
Definition, examples and some simple properties. Subspaces, linear combination, linear dependence and independence, Basis and dimension. Norm of a vector, Inner Product. Cauchy-schwartz inequality, orthogonal sets. Gram-schmidt process of construction of orthogonal sets. Parallelogram law and Pythagorian theorem.

(8L)

Vector Calculus and Tensor Analysis:
Differentiation of vectors, Radial and transverse, tangential and normal acceleration of a particle moving on a plane curve. Directional derivatives, Gradient, Divergence and Curl. Expansion Identities. Vector integration. Conservative system of forces. Solenoidal and Irrotational vectors. Theorems of Green, Stoke and Gauss and their applications,
Tensors, transformation of Co-ordinates, contravariant and covariant vectors and Tensors. Rank of a tensor. Addition and multiplication of tensors. Mixed tensors Contraction.

(10L)

Books Recommended:

1. Advanced Engineering Mathematics byE. Kreyszig
2. Advanced Mathematics for Engineers By Chandrika Prasad (Prasad Mudranalaya)
3. Advanced Engineering Mathematics By H.K. Das.

MODULE – I

Introduction: Importance of Electrical Engineering in day-to-day life. Electrical elements and their classification. KCL and KVL equations. Loop current and Node voltage method. D.C. Circuits: Steady state analysis with independent and dependent sources; Series and Parallel circuits; Star-Delta conversion. D.C. Circuit Theorems: Superposition theorem; Thevenin's & Norton's theorem; Maximum Power Transfer theorem.

(12)

MODULE – II

A.C. Single-phase Series Circuits: Common signals and their waveforms. RMS and Average value. Form factor & Peak factor of sinusoidal waveform. Impedance of Series circuits. Phasor diagram. Power. Power factor. Power triangle.

(5)

MODULE – III

A.C. Single-phase Parallel Circuits: Admittance method, Phasor diagram. Power. Power factor. Power triangle.

(5)

MODULE – IV

Resonance and Q-factor, A.C. Circuit Theorems: Superposition theorem; Thevenin's & Norton's theorem; Maximum Power Transfer theorem.

(7)

MODULE – V

Three Phase Circuits: Line and Phase relation for Star and Delta connection. Power relations. Analysis of balanced and unbalanced 3 phase circuits.

(7)

MODULE – VI

Magnetic Circuits: Introduction. Series-parallel magnetic circuits. Analysis of Linear and Non-linear magnetic circuits. Energy storage. A.C. excitation. Eddy currents and Hysteresis losses.

(5)

MODULE – VII

Coupled Circuits (Dot rule), Self and mutual inductances, Coefficient of coupling.
Basic Indicating Instruments: Moving coil and moving iron type instruments.

(4)

Books Recommended:

1. Nagrath and Grabel, Basic Electrical Engineering
2. Fitzzerald and Higinbotham, Basic Electrical Engineering

MODULE – I & II

Introduction to C++ and algorithm analysis: C++ classes, C++ details, Using matrics, Mathematical background for algorithm analysis, model and what to analyze, Running Time calculations.

MODULE – III

Lists, Stacks and Queues: Abstract Data Types, The list ADT, The Stack ADT, The Queue ADT

MODULE – IV

Trees: Preliminaries, Binary Trees, The Search Tree ADT – Binary Search Trees, AVL Trees, Splay Trees, Tree Traversals, B-Trees.

MODULE – V

Hashing and Priority Queues: Model and Simple implementations, Binary Heap, Applications of Priority Queues, d-Heaps, Leftist and Skew Heaps.

MODULE – VI

Sorting: Preliminaries, Insertion sort, A Lower Bound for Simple Sorting Algorithms, Shell sort, Heap sort, Merge sort, and Quick short.

MODULE – VII

Graph Algorithms: Definitions, Topological Sort, Shortest Path Algorithms, Network Flow Problems and Minimum Spanning Tree.

Text Books:

1. Mark A. Weiss – Data Structures & Algorithm Analysis in C++, 2nd Edition, Pearson Education, New Delhi – 2002.

Reference:

1. Gregory L. Heilean – Data Structures Algorithms, and Object Programming, Tata McGrow Hill, New Delhi – 2002.
2. Adam Drozdek – Data Structures and Algorithms in C++, Thomson Learning (Vikas Publishing House) New Delhi – 2001.
3. John R. Hubbard – Data Structures with C++, Tata McGraw Hill, New Delhi, 2004

MODULE– I

Environmental Awareness: Multidisciplinary nature of environmental Science, Definition, scope , importance and need for public awareness.

(2)

MODULE– II

Ecology and Environment: concept of an ecosystem ,structure and function of an ecosystem, producer ,consumer and decomposer, energy and nutrient flow biogeochemical cycles, food chain ,food web, ecological pyramid.

(3)

MODULE– III

Environmental Pollution : Segments of environment, sources, pathways and fate of environmental pollutants, causes of environmental pollution , physical ,chemical and biological transformation of pollutants , population explosion, environment and human health, human rights, value education ,women and child welfare.

(5)

MODULE– IV

Air Pollution: various segments of atmosphere and their significance,classification of air pollutants, toxic effects, sampling and analysis, stationary and mobile emission, sources and their control, photochemical smog ,sulphurous smog, green house effect, global warming, ozone depletion, Air (prevention and control of pollution) Act.

(10)

MODULE– V

Water Pollution: Water resources ,sources of water pollution ,various pollutants, their toxic effect, potability of water , municipal water supply , disinfection, characteristics of waste water, primary and secondary waste water treatment, BOD and COD measurement and their significance ,rain water harvesting ,water shed management,Water (pollution and control) Act.

(12)

MODULE– VI

Natural Resources and Biodiversity: Renewable and non renewable resources, Forest resource, consequences of deforestation, floods and draughts, equitable use of resources for sustainable development, Dams benefits and problems, Biodiversity: ecosystem diversity , threats to biodiversity, conservation of biodiversity**.**

(4)

MODULE– VII

A brief introduction to Noise Pollution, Soil Pollution, Solid Waste Management.

(4)

Books Recommended:

1. Sharma and Kaur, Environmental Pollution
2. De, Environment Chemistry

MODULE – I

Special Theory Of Relativity

Postulates, Galilean transformations, Lorentz transformations, length contraction, time dilation, velocity addition, mass change and Einstein's mass energy relation. (AB: 1.1,1.2,1.4,1.7,1.8,1.9, and Appendix to chapter-1

[6]

MODULE – II

Quantum Mechanics:

Planck's theory of black-body radiation (AB: 2.2, 9.5, 9.6), Compton effect (AB: 2.7), wave particle duality, De Broglie waves, Davisson and Germer's experiment(AB:2.4, 3.1, 3.2, 3.3, 3.4, 3.5), uncertainty principle(AB:3.7,3.8,3.9), physical interpretation of wave function and its normalization(AB:3.2), expectation value(AB:5.4).

[8]

Schrodinger equation in one dimension(AB:5.2), solutions of time-independent Schrodinger equation for free particle(AB:3.6, 5.5, 5.6), particle in an infinite square well, potential barrier and tunneling(AB:5.7, 5.8), hydrogen atom (qualitative)(HRW:40-8).

[8]

MODULE – III

Statistical Physics And Thermodynamics:

Elementary ideas, comparison of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics (AB: 9.1, 9.2, 9.3, 9.4).

[4]

Zeroth law, first law, second law, entropy, heat transfer, steady state one-dimensional heat conduction [(HRW:19-2, 19-9, 21-3, 19-11),(SS:14.2, 14.7)].

[6]

MODULE – IV

Lasers And Applications:

Emission of light by atoms, spontaneous and stimulated emission (AB: 4.9, and AG: 23.1), Einstein's A and B coefficients, laser: population-inversion (AG: 23.4), properties of laser radiation, Ruby & He-Ne lasers, applications of lasers (AB: 4.9) and AG: 23.1), elementary ideas of holography (AG: 18.1) and fiber optics (AG: 24.1-24.3).

[8]

MODULE – IV

Nuclear Physics:

Nuclear forces, binding energy, liquid drop model (AB: 11.1-11.6), fission, nuclear reactors, fusion, energy processes in stars, controlled thermonuclear reactions (AB: 12.9-12.12).

[5]

Text Books:

1. Arthur Beiser, Concepts of Modern Physics, 5th edition, Tata McGraw Hill, 1997.
2. Ajoy Ghatak, Optics, 2nd edition, Tata McGraw Hill, 1997.

Reference Books:

1. Jasprit Singh, Modern Physics for Engineers, John Wiley & Sons, 1999.
2. Kenneth Krane, Modern Physics, 2nd edition, John Wiley & Sons, 1998.
3. Wehr, Richards and Adair, Physics of the Atom, 4th edition, Addison Wesley.

THIRD SEMESTER

EC 3101	BASIC ELECTRONICS	1.0

MODULE – I

Introduction: Importance of Electrical Engineering in day-to-day life. Electrical elements and their classification. KCL and KVL equations. Loop current and Node voltage method. D.C. Circuits: Steady state analysis with independent and dependent sources; Series and Parallel circuits; Star-Delta conversion. D.C. Circuit Theorems: Superposition theorem; Thevenin's & Norton's theorem; Maximum Power Transfer theorem.

(12)

MODULE – II

A.C. Single-phase Series Circuits: Common signals and their waveforms. RMS and Average value. Form factor & Peak factor of sinusoidal waveform. Impedance of Series circuits. Phasor diagram. Power. Power factor. Power triangle.

(5)

MODULE – III

A.C. Single-phase Parallel Circuits: Admittance method, Phasor diagram. Power. Power factor. Power triangle.

(5)

MODULE – IV

Resonance and Q-factor, A.C. Circuit Theorems: Superposition theorem; Thevenin's & Norton's theorem; Maximum Power Transfer theorem.

(7)

MODULE – V

Three Phase Circuits: Line and Phase relation for Star and Delta connection. Power relations. Analysis of balanced and unbalanced 3 phase circuits.

(7)

MODULE – VI

Magnetic Circuits: Introduction. Series-parallel magnetic circuits. Analysis of Linear and Non-linear magnetic circuits. Energy storage. A.C. excitation. Eddy currents and Hysteresis losses.

(5)

MODULE – VII

Coupled Circuits (Dot rule), Self and mutual inductances, Coefficient of coupling.

Basic Indicating Instruments: Moving coil and moving iron type instruments.

(4)

Text Books:

1. Basic Electrical Engineering, Fitzgerald, Hinginbotham
2. Basic Electrical Engineering I.J. Nagrath and D.P. Kothari, 2nd Edition, TMH, Delhi.

Reference Books:

1. Electric circuits- Schaum Series
2. Electrical Engineering- Del Toro.
3. Basic Electrical Engineering- Mittle.

MA 3101	MATHEMATICS- III	1.0

Special Functions:
Bessel's equation: solution and Bessel's function of the first kind, Recurrence relations. Orthogonality of Bessel's Functions. Generating function and Bessel's integral. Legendre's equation: solution and Legendre's polynomials, Rodrigue's Formula. Orthogonarity relations. Generating function and recurrence relation. Definition of Hankekl's function. Elliptic Integral of the first and second kind. Jacobi's form of elliptic integrals.

(8L)

Complex Variables:
Continuity, differentiability and analyticity of a function of a complex variable, Cauchy Riemann differential equations in Cartesian and polar forms. Harmonic functions, Bilinear and conformal transformations. Complex integration, Cauchy's integral theorem and formula. Derivatives. Taylor's and Laurent's Series. Poles and Singularities. Cauchy's Residue Theorem. Contour integration (Poles on real axis excluded)

(13L)

Partial differential equations:
Formation of partial differential equations. Lagrange's first order linear equations. Non linear equations. Higher order differential equations with constant Co-efficients. Non homogeneous equations: solution by separation of variables. Boundary value Problems. wave equation in one dimension and its solution. Derivation of one dimensional heat equation and its solution.

(10L)

Fourier Series and Fourier Transform:
Periodic functions Existence conditions Euler's formulae. Half range series. Fourier series of functions with arbitrary period.
Fourier Integral Formula, Fourier Transform, Inversion Theorem, Fourier sine and cosine transforms and inversion formulae, Linearity property, Convolution or Faltung theorem. Relationship between Fourier and Laplace transform. Finite Fourier Transforms. Heaviside, Unit step function and Dirac Delta Function

(10L)

Statistics:
Mean and variance. Moments. Concept of Random variable. Probability density and Distribution functions Problems, Elements of error analysis

(4L)

Books Recommended:

1. Engineering Mathematics – E. Kreyszig
2. Advanced Engineering Mathematics – C. Prasad
3. Fourier Transforms – I.N. Sneddon

MODULE – I

Introduction to signals and systems: Definition, Basis of classification, Representation of common signals and their properties, System modeling

(4)

MODULE – II

Analogous System: Introduction, D Alembert's Principle, Force-voltage and force-current analogies, Electrical analogue of mechanical, Hydraulic and thermal systems.

(5)

MODULE – III

Fourier Transform Method: Introduction, Fourier transform pair, Amplitude spectrum and phase spectrum of signals, Sinusoidal transfer function.

(3)

MODULE – IV

Laplace Transform Method: Introduction, Laplace transform pair, Laplace transformation of common functions, Gate function, Step function and impulse function, Laplace theorems shifting, initial value, final value and convolution theorems.
Inverse Laplace transform by partial fraction expansion and convolution integral method.

(12)

MODULE – V

System Analysis: System Analysis by Laplace Transform method, System response. Natural, forced, transient and steady state responses. Transfer function and characteristic equation, Superposition integral, Concept of poles and zeros, Nature of system response from poles and zeros.

(6)

MODULE – VI

System Stability: Concept of stability, Types, Necessary and sufficient conditions, Routh Hurwitz stability criterion, Limitations and its applications to closed loop systems.

(4)

MODULE – VII

State-Space Concept: Introduction, Definition: State, State variable, State vector and state space, State space representation, Derivation of State model from transfer function, Bush form and diagonal canonical form of state model, Non-uniqueness of state model, Derivation of transfer function from state model, Transition matrix and its properties, Solution of time invariant state equation.

(6)

Text Books:

1. Analysis of Linear Systems – D.K.Cheng.
2. Control System Engineering – Nagrath & Gopal
3. Control System – A. Anand Kumar

Reference Books:

1. Networks and Systems – D. Roy Choudhury
2. Signals and Systems - Basu & Natarajan

FOURTH SEMESTER

MA-4002	INDUSTRIAL STATISTICS	1.0

Methods of least squares, Linear and parabolic trends, Bivariate distribution, Correlation, Rank correlation, Linear regression, Sample space, Random experiments and randjom variables, Concept of probability, Conditional probnability, Addition and multiplication laws Baya's theorem . Probability distributjion: Binomial, Poison and Normal Distributions, Concept of geometric hypergeometric and exponential distributions, their properties and applicaktions to industrial problems.

Central limit theorem, Simple sampling and sampling of variables, Sample tests, Tests of significance, Chi-square test, Student 't' test. 'F' test and their properties and applications.

Analysis of variance: Analysis of variance of one and two criterion of classifications, Design of experiments, Basic principle of experimental design, Latin squares, Randomised block design, Concept of control charts and its applications in process control.

Suggested Books:

1. Erwin Miller and John E. Freund – Probability and Statistics for Engineers
2. Sharma and Goyal – Mathematical statistics.

PE4203	METALLURGY	1.0

Review of Engineering and industrial materials – their classification and application, recent development in metallic materials

A brief description of iron and steel making – Raw materials Principles and processes

Isomorphous, eutectic and peritectic systems, Iron – Carbon equilibrium diagram, classification of steels, effect of alloying elements on steels. Tool steels
Isothermal decomposition of austenite (TTT Curve), transformation of austenite upon continuous cooling, annealing, normalising, hardening, tempering, hardenability of steel, Jominey hardening test, end quench test, surface hardening, case hardening, recovery, recrystallisation and grain growth
Grey iron, S.G. Iron, white iron, malleable iron. Principles of corrosion, forms of corrosion, factors affecting the rate of corrosion, corrosive agents, protection against corrosion; weld metal zone, HAZ, parent metal zone, Joint efficiency, weldability, concepts of ductile and brittle fractures
Properties and applications of Non ferrous Metals and Alloys-Al & Cu

Text Books:

1. Elements of Metallurgy **D. Swaroop**
2. Materail Science and Engineering **V. Raghvan**
3. Metallurgy for Engineers **L.C.Rollagon**

MODULE – I

Concept of continuum and physical properties of fluids: like density, viscosity etc. Fluid Statics: Concept of pressure, equation of equilibrium, Forces on plane and curved surfaces, buoyancy and stability of floating bodies.

(7 Lectures)

MODULE – II

Kinematics of fluid flow: Eulerian and Lagrangian description of fluid flow, material derivative and acceleration, streamlines, Pathlines. Motion of fluid element: translation, rotation and vorticity, Concept of stress and stress tensor, deformation and strain rate tensor stress and strain rate relationship for Newtonian and non-Newtonian fluids.

(7 Lectures)

MODULE – III

Control volume analysis: Transport theorem, conservation laws of mass, momentum and energy. Ideal fluids, Continuity and Euler's equations, Bernoulli's equation and its applications. Two dimensional flow of ideal fluid: Stream function, velocity potential, simple flow, Uniform flow, sources and sinks, doublet.

(7 Lectures)

MODULE – IV

Viscous flows: Couette Flow, Hugen Poiseuille flow, concept of boundary layer, boundary layer on a flat plate. Dimensional analysis and similitude, Buckhingham's theorem.

(7 Lectures)

MODULE – V

Internal flows: Friction factor, Darcy-Weisbach friction factor, Moody's diagram. Boundary Layer theory, Boundary layer equation, Laminar and turbulent boundary layer and its growth over flat plate. Momentum boundary layer and its solutions, separation of boundary layer and its control.

(5 Lectures)

MODULE – VI

Compressible fluid flow: Introductory concepts, continuity momentum and energy equations. Sonic velocity, propagation of elastic waves due to compression of fluid, propagation of elastic waves due to disturbance in fluid, Stagnation properties. Isentropic flow: effect of area variation on flow properties, isentropic flow through nozzles, diffusers ejectors. Normal shock: property relations, performance of C.D. Nozzles.

(6 Lectures)

MODULE – VII

Introduction to C.F.D and softwares: Concept of C.F.D, Modeling and simutation of incompressible fluid flow problems through software, its one dimensional & two dimensional analysis of linear and non linear type of problems.

(6 Lectures)

Text Book:

1. Hydraulics and Fluid Mechanics by Modi and Seth, 12th ed. 1998, Standard Book House, Delhi .

Or

2. Fluid Mechanics and Hydraulic machines by R.K. Bansal, 8th ed. 2002, Laxmi Publication (P) Ltd.

Reference Books:

1. Fluid Mechanics and Machinery by D. Rama, Durgaiah. New Age International Pvt. Ltd.
2. Fluid Mechanics with engg. Application, by J.B. Franzini & Finnemore, 9th ed. 1997 Mc Graw Hill.
3. Foundations of Fluid Mechanics by S.W. Yuan, 1998, PHI (P) Ltd. New Delhi.
4. Fluid Mechanics by V.L. Streeter & E.B. Wylie, 1st SI metric ed. 1981, Mc Graw Hill Book Company.
5. Introduction to compressible flow by S.M. Yahya.

MODULE - I

Two dimensional state of stress at a point. Complementary shears, Principal stresses Graphical representation of state of stress.

(6 Lectures)

MODULE - II

Two dimensional state of strain at a point, Principal strains, Graphical representation state of strain, Strain rosettes.

(6 Lectures)

MODULE - III

Distribution of bending stress and shear stress in the cross-section of beams.

(6 Lectures)

MODULE - IV

Differential equation of the elastic curve-Deflection of beams by double integration method – Area moment theorems – Application to simply supported, Cantilever and overhanging beams.

(8 Lectures)

MODULE - V

Statically indeterminate beams: propped cantilevers, built in beam, fixed beams and continuous beams. Short and long columns.

(7 Lectures)

MODULE - VI

Strain energy for axial load, bending and torsion. Castigliano's theorem – Application. Deflection due to shear.

(6 Lectures)

MODULE - VII

Torsion of circular shaft and power transmitted by the shaft. Combined bending and torsion of circular shaft – Equivalent B.M. and Equivalent Twisting moment.

(6 Lectures)

Recommended Books:

1. Strength of Materials – Singer, F.L. Harper & Row 1962.
2. Elements of Strength of Materials, S.timoshenko, Nannostrand, 1970.
3. Strength of Materials, Ryder Mac Mllan, 1963.

MODULE - I

Generalized Measurement Systems: Introduction, Description of Stages in Measurements, Calibration, Accuracy, Precision and Error, Error Classification, Treatment of Test data, uncertainty Analysis.

(7 Lectures)

MODULE - II

Instrument selection and their Classifications: comparative Analysis of various types, Principle of operation, Uses, Advantages and limitations of each type.

(7 Lectures)

MODULE - III

Measurement of Force and Torque: and pressure Standards, Measuring Methods, Comparative study of different types of forces and torque Measuring systems. Description and working Principle of different types of Transducers for Measuring Pressure, Measurements of High Pressure and low pressure, calibration method.

(6 Lectures)

MODULE - IV

Measurement of Humidity and Temperature: Introduction, Different types of Transducers for measurement of Humidity, their performance characteristics and limitations.

Flow Measurement: Introduction, Principle of operation of various obstruction meters for compressible and incompressible fluid flow measurement, variable Area meter and other important flow meters and visualization methods.

(7 Lectures)

MODULE - V

Different types of Transducers: for Measurements of low and medium temperatures pyrometers, Temperature indicators, problems in temperature measurement.

(6 Lectures)

MODULE - VI

Measurement of Speed and Vibration: Velocity Acceleration: Speedometers, velocity measurement, Accelerometers, encoders, calibration and uses. Different pick-ups and their limitations Measurement of Radio-isotopes, Measurement of Radio activity.

(6 Lectures)

MODULE - VII

Coordinate Measuring Machines: CMM Construction, operation and programming CMM Application and Benefits, surface measurement, Stylus Instruments and other modern surface measuring Techniques.

(6 Lectures)

Reference Books:

1. Mechanical Measurement by Beckwidth and Buck (Edn. 1965, Addison Wesley Publishing Co. Inc. London)
2. Measurement systems, Application and Design by Docblin (Edn. 1976, Publisher TMH)
3. Introduction to Microprocesors by A.P. Mathur 2nd Edn. 1984, Publisher TMH.
4. Engineering Measurements and Instrumentation by Adams L.F. (Edition 1975, London English University Press).
5. Instrumentation Measurement and Analysis by B.C. Nakra, K.K. Choudhary (Edn. 1985, Publisher TMH, New Delhi).
6. Automation, Production system & Computer Integrated Manufacturing by Mikell. P. Groover, 2nd edition 2001, Person Education Asia.

ME4207	ENERGY ENGINEERING	1.0

MODULE -I

Introduction: Introduction of Energy Conversions, Thermo-mechanical Energy conversion in I.C. Engines, E.C. Engines, Gas turbines and Steam turbines, Combustion processes and calculation of air requirements, Actual and theoretical air- fuel ratio.

[5 Lectures]

MODULE - II

I.C. Engines: Classification of I.C. Engines- two stroke and four stroke engines, Spark ignition and compression ignition engines, Petrol and diesel engines, Indicated and brake power of S.I. Engines and C.I. Engines, Brake mean effective pressure (bmep), Mechanical and thermal efficiencies of engines.

[8 Lectures]

MODULE - III

Steam Power Systems: Components of steam power system, Rankine cycle and modified Rankine cycle, Steam Generators- introduction and classification, Fire tube and water tube boilers, Mountings and accessories of boilers, boiler performance-equivalent evaporation, boiler efficiency, use of steam tables.

[8 Lectures]

MODULE - IV

Steam Engine: Simple and compound steam engines, ideal and actual indicator diagrams, diagram factor, mep, ip, bp, mechanical efficiency, thermal efficiency.

[4 Lectures]

MODULE - V

Steam Turbine: Impulse and reaction turbines, compounding of turbines, velocity diagram for single and multi-stage impulse turbine, Impulse – reaction turbine, difference between impulse and reaction turbines.

[7 Lectures]

MODULE - VI

Air compressors: Introduction and working principles with constructional details of reciprocating and rotary type compressors, single and double - stage air compressors, single stage and multi-stage compressors, indicator diagram, equation of shaft work for compressor with and without clearance, volumetric efficiency.

[8 Lectures]

MODULE - VII

Refrigeration systems: Air refrigeration cycles - Reversed Carnot cycle, Reversed Jule & Brayton cycle, and Bell-Coleman cycle, vapour compression cycles, use of refrigeration table and charts, determination of coefficient of performance of various cycles, Absorption refrigeration systems.

[5 Lectures]

Recommended Books:

1. The Theory and Practice of Heat Engine – D.A. Rangham, Camb. Univ. Press.
2. Elements of Heat Engine – Pandey & Saha
3. Thermal Engineering – R.K.Rajput.

FIFTH SEMESTER

MA41203	COMPUTATIONAL METHODS	1.0

Computational Errors & Approximations:
Numbers & their accuracy, Errors & their Analysis, Errors in a series approximation.

(2L)

Solution of Algebraic & Transcendental Equations with Algorithms:
Graphical Method, The bisection method, The method of false position, Newton-Raphson Method & its rate of convergence. Solution of Non-linear equations in two variables by Newton-Raphson method & Bairstow's method for complex roots.

(6L)

Solutions of System of Linear Algebraic Equations with Algorithm:
Direct Methods: Gaussian Elimination method. Gauss-Jordan Method & Decomposition method, Iteration methods: Jacobi & Gauss-Seidal Methods.

(6L)

Interpolation:
Finite differences, Newton's forward and backward interpolation formula, Gauss's Central Difference formula Sterling's & Bassel's interpolation for unevenly spaced points, Newton's general interpolation formula with divided differences.

(7L)

Curve Fitting Cubic Splines and Approximation:
Principle of least squares, Curve fitting: Fitting a straight line. Polynomial of second degree, Data fitting with cubic splines.

(3L)

Numerical Differentiation & Integration:
Differentiation by using Newton's forward. Backward and central difference formulas, Differentiation by cubic spline method. Integration by Trapezoidal Rule, Simpson's 1/3' rd Rule. '3/8th Rule.

(7L)

Computational Algorithm:
Solution of initial value problems of first order: Picard's method Taylor's series, Euler's method, Runge-Kutta method, Milne-Simpson method, Finite Difference algorithms for solutionj of a two point, Second order boundary value problem.

Finite Difference:
Analogues of Partial Differential equations, Use jof standard five point algorithms and diagonal five point algorithms in solution of Laplace equation & Parabolic equations.

Suggested Books:

1. Introductory method of Numerical analysis – Prentice – Hall of India New Delhi, S.S. Sastry
2. Computer Oriented Numerical Methods – Prentice-Hall of India – V. Rajaraman.
3. Finite Differences & Numerical Analysis – S. Chand & Co. Ltd. New Delhji – H.C. Saxena.
4. Introduction to Numerical Analysis – Addision – Wesley Publishing Company – Froberg.)

Theory of Metal Cutting
Geometry of single point cutting tool, Orthogonal and oblique cutting, Tool forces in orthogonal cutting, types of chips, Machinability, tool failure, tool life, cutting fluids and cutting tool materials
Machine Tools
Constructional features, specification, operations and drives of lathe, working principles of capstan and Turret lathes

Constructional features, specification, operations and drives of Shaper, Planer, & Slotter

Constructional features, specification, operations and drives of milling & drilling machine, indexing in milling operations

Grinding and finishing operations
Cylindrical, surface and centreless grinding; Broaching, lapping, honing and buffing

Gear cutting by forming and generating methods, concept and applications of Jigs and Fixtures

Text Books

1. Workshop Technology –Vol. II	B S Raghuwanshi
2. Production Technology -Vol. II	OP Khanna & M Lal
3. Elements of workshop technology- Vol. II	Hajra Choudhry

Reference Books

1. Production Technology hand book	HMT
2. Principles of manufacturing materials and processes	J S Campbell
3. Principles of Manufacturing technology	P N Rao (Part I)

MODULE -I
Principles of Machine Design, standardization, designation and selection of materials, aesthetic and ergonomic considerations in design, Preferred numbers, Tolerances.
(6 Lectures)

MODULE -II
Design against static and fluctuating loads.
(6 Lectures)

MODULE -III
Threaded Joints, Cotter and Knuckle joints.
(6 Lectures)

MODULE -IV
Riveted and Welded Joints.
(7 Lectures)

MODULE -V
Shafts, keys, couplings, Belt, Rope and chain drives
(7 Lectures)

MODULE -VI
Power screws, Screw Jack, Helical and leaf springs.
(7 Lectures)

MODULE -VII
Clutches and Brakes
(6 Lectures)

Text Books:

1. Machine Design by Maleev and Hatman, CBS Publisher & Distributor, New Delhi, 1983.
2. Mechanical Engineering Design by J.F. Shegley, McGraw Hill Book 3. Company, U.S.A., 1986.

Reference Books:

1. Design of Machine by Khurmi and Gupta, S. Chand and Company Ltd., New Delhi, 2000.
2. Machine Design, Sharma and Agarwal, S.K. Kataria and Sons, New Delhi, 2001.
3. Design of Machine Elements, VB Bhandari, Tata McGraw Hill, New Delhi 1999.
4. Hand book of Properties of Engineering Materials and Design Data far Machine Elements, Abdulla Shariff, Dhanpat Rai & Sons, New Delhi – 2001.

(Treatment of the subject to be application oriented, theorems and derivations are not necessary)

Scope and Limitation of O.R.

Linear Programming

Mathematical formulation of the problem
Graphic solution, the simplex method
Big-M method, concept of duality, dual simplex method

Transportation Model

Basic feasible solution by different methods, finding optimal solutions, degeneracy in transportation problems, unbalanced transportation problems

Assignment Model

Balanced and unbalanced assignments, assignment to given schedules

Sequencing

Processing of 2 jobs through machines –graphical method, Processing of n jobs through two machines, processing n jobs through three machines

Queuing Model

Queuing systems and their characteristics, The M/M/1/FIFO/Queing system

Games Theory

Two-persons zero sum games, Pure and mixed strategies, Rules of dominance, Solution methods without saddle point

Text Books

1. Operations Research — Kanti Swaroop
2. Operations Research — P.K. Gupta & D. S. Hira

References

1. Linear Programming — Hadely
2. Quantitative Technique in management — N.D. Vohra

PE5201	METROLOGY	1.0

Standards of Measurement
Historical development, system of measurement, line, end & wavelength standards, type and source of measurement errors

Comparators
Principle and uses of mechanical, optical, Electrical, electronic and pneumatic Comparators

Limits, Fits & Limit Gauge Design
Interchangeable manufacture, selective assembly, concept of limits, fits and tolerances, Indian standard system , type of plain limit gauges, design of plain limit gauges, Taylor's principle of gauging

Optics in Metrology
Principle of interferometry, concept of optical flat, projector, microscope, autocollimator and interferometer

Screw thread And Gear Measurement
Measurement of minor, major, effective diameter, pitch and thread angle of screw threads, gear tooth thickness & titch measurement, involute profile pesting of gear

Geometrical Form and surface Finish
Straightness, flatness and squareness and circularity tests, numerical evaluation measurement of surface finish, construction detail and working of Taylor – Hobson instrument

Machine Tool Metrology
Types of machine tool tests, alignment tests for lathe, milling and drilling machine tools

Text Books
1. A Text book of Engineering Metrology — I. C. Gupta , Dhanpat Rai , New Delhi
2. Engineering Metrology — R.K. Jain ,Khanna Pub., New Delhi

References
1. Engineering Metrology — K. J. Hume
2. Engineering Metrology — M. Mahajan , Dhanpat Rai & Co. New Delhi

Business organization
Legal forms of business organization-single ownership, partnership and joint stock company and their formation
Share & their classes, rights and privileges, borrowing of capital through mortgages, debentures, unsecured notes and bonds, ownership and operation of a joint stock company through board of directors

Principles of Management
Elements of managerial functions-planning organizing, staffing, direction and control, authority and responsibility, leadership and principles of co-ordination, uses of committee as a management tool, span of control

Organization Structure
Line, line and staff, Functional, Lateral (Fayol's Bridge) and Metric organization structures, organization chart and organization manual

Budget and Budgetary control
Functions, types and preparation of budgets, working of budgetary control

Marketing Management
Functions of sales and marketing, channels of distribution, Sales promotion, advertising and publicity, product packaging and product printing

Human Resource Development
Main functions of personnel department, morale, motivation and behavior, handling of Industrial grievances through joint consultation and collective bargaining, workers participation in management.

Industrial legislations
Factories act, trade unions, trade dispute act, workmen's compensation act, payment of wages act.

Text Books
1. Industrial Organization and Management — Riggs, et al.
2. Industrial Engineering and Management — O P Khanna

References
1. Principles of Management — Koonze o'Donell

SIXTH SEMESTER

PE6201	MANUFACTURING PROCESSES – II	1.0

Introduction to foundry process and its importance, Patterns, pattern materials, types of patterns, pattern allowances, mould and core making, properties of molding and core sands. Sand testing, machine molding, gating, risers and solidification of casting

Centrifugal casting, investment casting, die casting and shell molding

Working principle and operation of cupola, cleaning of casting, inspection of casting, casting defects

Principle, working and application of oxy- acetylene gas welding and gas cutting, electric arc welding, MMAW

SAW, MIG, electroslag, TIG and plasma welding, thermit welding.

Resistance welding, spot, seam, projection and butt welding, soldering and brazing

Basic concepts of hot and cold working processes, shearing and forming operations

Text Books:

1. Foundry, Forming and Welding — P.N. Rao, Tata Mc Graw- Hill
2. Text book of welding technology — O.P. Khanna
3. A course in workshop Technology Vol. I — B.S. Raghuvansi, Dhanpat Rai & Co.

References

1. Foundry technology — K.P. Sinha and D.B. Goel Standard publishers, Delhi
2. Welding and welding Technology — Richard L. Little (TMH Edition)
3. Metal casting — Rossenthal, Tata Mc Graw- Hill

Introduction
Classification of machine tools, basic motion and general requirements of machine tool design

Kinematics of Machine Tools
Types of drives, selection and design requirements, stepped and stepless regulation

Layout of spindle speeds, preferred numbers, structure diagram, ray diagram, design of gear box for speed and feed

Design of Machine Tool Structures
Compliance, stiffness and rigidity, design criterion, materials and basic design procedures for beds, tables and columns

Machine Tool Slides, Guideways and Spindle
Function, requirements, constructional features, design criterion and tribological aspects of machine tool guideways and spindles, antifriction and roller slides

Machine Tool Vibrations
Sources, effects and elimination of vibration, chatter

Control Systems in Machine Tools
Control systems for changing speeds and feeds, ergonomic considerations applied to the design of control members

Text Books

1. Machine tool design — N.K. Mehta, Tata McGraw-Hill Pub. Co.
2. Design of machine tools — S.K. Basu & D.K. Pal, Oxford & IBH
3. Principles of Machine tools — G.C. Sen. & A. Bhattacharyya

Evolution of manufacturing, components and types of automation, automation scenario and factory configuration

Basic ideas, classification and structure of NC systems, NC-coordinate system, absolute and incremental positioning, fixed and floating zero points

Constructional features and feedback devices for CNC machine tools, machining and turning centre

DNC and adaptive control, CNC retrofitting, part programming and related languages

Electric and servo control in machine tools, stepper motor, PLC

High volume production system, principle, selection, classification and constructional features of transfer machines and automats

Transfer mechanism, buffer storage and control functions for transfer devices, feeding mechanism

Text Books

1. Automation, Production System, and CIM	M.P. Groover
2. CNC Machines	P. Radhakrishnan

References

1. Numerical Control of Machine Tools	Y. Koren
2. Technology of CAD/CAM	A.K. Jha and S. Kumar
3. Manufacturing Technology II	P.N. Rao
4. Industrial Robots and CIM	Surender Kumar

Project Management
Forms of project organization, project planning, project control, human aspects of project management, pre-requisite for successful project implementation

Social cost benefit analysis
Rationale for SCBA, net benefit in terms of economic prices, study of few scba project- bridge project, river valley project, power generation plant etc

Technical Analysis
Manufacturing process/technology, technical arrangements, material input and utilities, product mix, plant capacity, location and site, machineries and equipment, structures and civil work, environmental aspects, project charts and layouts, schedule of project implementation

Financial estimates and projections
Cost of project, land and site development, buildings and civil works, plant and machinery, technical know- how and engineering fees, projected cash- flow statement

Network Techniques for Project management
Development of bar chart, elements of network, development of network, time estimates, deterministic & probabilistic activity networks, probability distribution, time computations, network analysis

Project scheduling Techniques
PERT & CPM models, cost model & resource allocation

Project Documentation
Computer application is project engineering, exploring the project window and toolbars, starting a new Project and working with tasks, turning the task list into a schedule, linking tasks, exploring the PERT chart, using the GANTT chart wizard, defining resources and costs. Assigning resources and costs to tasks, optimizing the project plan, printing views and reports with resources, tracking work on the project, analyzing progress and revising the schedule, publishing projects on the web

Text Books

1. Project Management — Prasanna & Chandra, Tata McGraw Hill
2. Elements of Project Management — Pete Spinner, Prentice Hall, USA

Basic Concepts
Introduction, integrated CAD/CAM, designer Vs computer, computer as a design medium, system software's, comparison of languages, benefits and applications of CAD

Computer Graphics and Geometric Modelling
Introduction, point plotting techniques, line drawing displays, two and three dimensional transformations, clipping and windowing, segmentations

Wire frame modeling, surface modeling, solid modeling and their applications three dimensional graphics, curves and surfaces, hidden surface elimination, shading

Graphic input devices, graphic input techniques, input functions, Raster graphics fundamentals, interactive raster graphics, raster graphic systems

Computer Aided Drafting
Introduction, drafting packages, arrows and pointers, dimensioning, text, cross hatching, drafting examples

Computer Aided Design
Computer aided design, optimizations and drafting of following machine elements, shaft, coupling, gear, springs, etc. and Kinematics analysis of four bar mechanism

Text Books:

1. AutoCAD Release 12 — George Omura
2. Auto LISP — George Omura
3. LISP for Micros — Steve Uakey
4. CAD/CAM — S. Kumar & Jha
5. Computer Aided Designs and Manufacturer — C.B. Besant & C.W.K. Lui

MODULE – I

MECHANISMS: Kinematic concept of Link, Kinematic chain, Mechanism, degree of freedom, Inversions of four bar mechanism, single slider crank mechanism and double slider crank mechanisms, Straight line motion mechanism and Copying mechanism.

(5 Lectures)

MODULE – II

MOTION ANALYSIS:

Types of motion: Kinematic and Dynamic quantitites; Vector diagrams, Instantaneous centers.Velocity and acceleration diagram of plane mechanism including Coriolis components. Instantaneous center method. Klein's construction, Analytical treatment.

(10 Lectures)

MODULE – III

FORCE ANALYSIS:

Static force analysis, friction effets, dynamic force analysis, equivalent system.

(6 Lectures)

MODULE – IV

FLYWHEEL: Turning Moment on crankshafts, Turning Moment diagram, Fluctuation of energy and speed and determination of M.I. of fly wheel.

(5 Lectures)

MODULE – V

GEARS, Fundamental laws of gearing: classification and basic terminology, involute tooth profile and its kinematic consideration, spur gears, other types of gears, standards in tooth forms.

(8 Lectures)

MODULE – VI

Gear trains : Simple, compound and epi-cyclic gear trains

(5 Lectures)

MODULE – VII

CAMS: Various types of cams, Displacement, velocity and acceleration of followers, Graphical determination of CAM profiles with different types of followers, specified Cam Profile.

(6 Lectures)

Text Book:

1. Theory of Machine by Thomas Beven

Reference Books:

1. Theory of Machines and Mechanism by Ghosh and Malik
2. Mechanism and Machine Theory by J.S. Rao and R.V. Dukkibati
3. Theory of Machine by S.S. Rattan, Tata McGrow Hill.

SEVENTH SEMESTER

PE7201	MATERIAL DEFORMATION PROCESSES	1.0

Basic Concepts

State of stress at a point, equilibrium equations, stress tensor, spherical tensor and deviator stress tensor, principal stress, deformation tensor

Theory of Plasticity

Engineering and true stress –strain, flow curve, idealized stress-strain model, plastic deformation equations, levy–mises equations, prandlt–reuss equations, strain hardening, strain rate and bauschinger effects

Flow Rule and Yield Criterion

Velocity field and strain rate, compatibility equation, von – mises and tresca yield criterion, biaxial and triaxial yield surfaces, experimental verification of yield criterion, lode–stress parameter

Friction and Lubrication

Interfacial friction laws–Coulombs friction law, constant shear factor law, composite friction law and hydrodynamic friction law, friction mechanism during plastic deformation, lubrication mechanisms– boundary, hydrodynamic and solid lubrication, metal working lubricants–types and characteristics

Plain Strain Deformation Processes

Basic concepts of slip-line method, slab method (equilibrium technique) and energy method (upper bound technique), analysis of following deformation processes

Forging of strip: pressure distribution and forging load

Rolling of strip: pressure distribution, roll–separating force and driving torque

Axi-Symmetric Deformation Processes

Analysis of following deformation processes:-

Forging of disc: pressure distribution and forging load

Extrusion of cylindrical rod: extrusion load and frictional power loss

Drawing of cylindrical wire: drawing load and maximum allowable reduction

Emerging Deformation Processes

Isothermal forging, water hammer forging, liquid metal forging (squeeze casting), continuous extrusion (conform extrusion), hydro–static extrusion, hydro–dynamic wire drawing, spray forming, explosive forming

Textbooks:

1. Principle of Industrial Metal Working — G.W. Rowe, Edward Arnold , London
2. Principles of Metal Working — S. Kumar, IBH & Co., New Delhi

References

1. Engineering Plasticity — R.A. C. Slater, Macmilan, USA
2. Metal Working Processes and Analysis — B. Avitzur, McGraw Hill, USA

PE7203	WORK STUDY & ERGONOMICS	1.0

Introductory Concepts
Definition, objective and scope of work study and ergonomics and its historical background, Interrelationship between work study & ergonomics, role of work study & ergonomics in productivity improvement

Method Engineering
Definition, objectives and methodology of method engineering

Motion Economy & Analysis
Principles of motion economy and methodology of motion analysis

Work Measurement
Definition, objective and different methods of work measurement

Work Sampling
Principle, techniques and applications of work sampling studies

Job Evaluation and Merit Rating
Definition, objectives and techniques of job evaluation and merit rating

Wages & Salary
Definition and principles of wage and salary administration, comparative study of incentive schemes

Ergonomics
Man – machine interaction, design of man-machine environment system, workstation design

Text Books
1. Motion & Time Study — Barnes R.M.
2. Work Study — O. P. Khanna

Reference Books
1. Work Study — I. L. O.

Introduction to Production Planning and Control
Production system, type of manufacturing systems and their characteristics, objectives and functions of production planning and control

Preplanning
Demand forecasting, common techniques of demand forecasting, estimating factors of production, product mix and batch size decisions, aggregate planning

Production Planning
Routing, Loading and scheduling with their different techniques, dispatching, Progress Report, Expediting and corrective measures

Inventory Control
Field and scope of inventory control, inventory types and classification
Inventory control models, static model, dynamic model both deterministic and stochastic
Economic lot size, reorder point and their application, material resource planning and JIT
ABC analysis, VED analysis and value analysis, modern practices in purchasing and store Keeping, concept of productivity

Text Books
1. Production and Inventory control G.W. Plossel
2. Principles and Design of Production Control Systems
   E.D. Scheele, W.L. Westerman and R.J. Wimment
3. Production Control Engineering D. K. Corke
4. Operation Research Kanti Swarup

Accounting of Business Transactions
Accounting principles, journal and ledger entries, balance sheet, profit and loss statement, ratio analysis

Cost and Cost Analysis
Cost structure, methods of allocating overhead costs, standard cost, concept of opportunity cost, sunk cost, fixed cost and variable cost

Break Even Analysis
Drawing of brake even charts, effect of different variable on break even point, cost comparison of two or three alternatives

Time Value of Money
Single sum and series of cash flow, uniform and gradient series, multiple compounding periods in a year, continuous compounding, bonds

Comparison of Alternative Proposals
Bases of comparison- present worth amount, annual equivalent amount, future worth amount, rate return, defining mutually exclusive alternatives, decision criteria for selection of investment proposals, comparison of alternatives, with unequal service life, sensitivity analysis

Replacement Analysis
Reasons for replacement, evaluation of replacement involving excessive maintenance cost, decline in efficiency inadequacy and obsolescence

Depreciation and Decision Making Under Uncertainty
Methods of depreciation and their comparison, decision making on the basis of expected value decision tree in the evaluation of alternatives

Text Books:
1. Modern Accountancy I.M. Pandey
2. Engineering Economy E.P.Degarmo

PE7205	MODERN MANUFACTURING PROCESSES	1.0

Introduction to Modern Manufacturing Processes & their classification

Abrasive Jet Machining (AJM)

Fundamental principles, application possibilities, process parameters, schematic layout of machine and operational characteristics

Calculation of material removal rate (MRR) for ductile and brittle materials

Water Jet Machining (WJM) and Abrasive Water Jet Machining (AWJM)

Fundamental principles, application possibilities, process parameters, schematic layout of machine and operational characteristics

Ultrasonic Machining (USM)

Fundamental principles, application possibilities, process parameters, schematic layout of machine and operational characteristics

Calculation of material removal rate (MRR) by empirical approach, Cook's model, Shaw theory

Ultrasonic Welding (USW)

Fundamental principles, application possibilities, process parameters, schematic layout of machine and operational characteristics

Electro Discharge Machining (EDM)

Fundamental principles, application possibilities, process parameters, schematic layout of machine and operational characteristics

Electrochemical Machining (ECM)

Fundamental principles, application possibilities, process parameters, schematic layout of machine and operational characteristics, Dynamic of ECM, Tool Design

Electrochemical Grinding (ECG)

Fundamental principles, application possibilities, process parameters, schematic layout of machine and operational characteristics

Chemical Machining (CHM)

Fundamental principles, application possibilities, process parameters, operational characteristics and equipments

Laser Beam, Electron Beam and Plasma Arc

Fundamental Principal, application and schematic layout of machine

Layered Manufacturing

Definition, concept & principle of operations of layered manufacturing processes

Text Books:

1. Modern Machining Processes	P. C. Pandey, H. S. Shan, Tata McGraw-Hill Publication
2. Non-conventional Machining	P. K. Mishra ,Narosa Publishing House
3.	
4. New Technology	A. Bhattacharyya, The Institution of Engineers (India)

Reference Books

1. Manufacturing Science	Amitabha Ghosh and Asok Kumar Mallik Affiliated East- West Press
2. Rapid Prototyping	A. Ghosh

ELECTIVE I

PE7211	ENTERPRISE RESOURCE PLANNING	1.0

Evolution, characteristics, features and need of ERP

Enterprise modeling, information mapping and integration for ERP

Definition, scope and benefits of supply chain management, performance of supply chain, role of supply chain in ERP

Business reengineering, GERP, process improvement and process innovation, failure minimization of BPR projects, information technology assessment for ERP, ERP domain, integrated SAP model

Technologies in ERP system, electronic data interchange, mapping of data base, EDI services, message configuration

Selection & implementation of ERP, approaches to ERP selection, methodology for ERP implementation, factors for successful implementation

Text Books

1. Enterprise Resource Planning Ravishankar and S. Jaiswal, Galgotia Publication Pvt. Ltd.

ELECTIVE I

PE7213	METAL WORKING TRIBOLOGY	1.0

Basic concepts, Definition and scope of tribology in metal working

Work die interface, interaction between lubricant, workpiece and die, Hydrodynamic action at work-die interface

Interfacial friction: mechanisms of friction applicable to metal working processes, effect on pressure and die loads

Lubrication in metal working: Different regimes of lubrication, attributes of a good lubricant, properties, composition and characteristics

Lubricants for industrial processes, e.g. rolling, forging, extrusion, sheet metal etc

Metal working processes: governing laws

Analysis of basic processes under different tribological conditions, e.g. rolling, forging, wire drawing, extrusion, hydrostatic extrusion, hydrodynamic wire drawing, water hammer forming, melt spin process

Text Books

1. Metal Deformation Processes, Friction and lubrication	J.A. Schey ,Marcel Debber, INC, New York
2. Principles of Metal Working	Surender Kumar ,Oxford & IBH Publishing Co., New Delhi

Reference Book

1. Tribology in Metal Working	John A. Schey, ASME ,OMIO

ELECTIVE I

PE7215	PROCESS ENGINEERING	1.0

Product life cycle, process of product design, components, parts and units

Process planning, concept of dimensional chain, calculation of process parameters, preparation of process sheet

In process measurement and feedback, process reengineering

Expert system and artificial intelligence for process control

Optimal selection of manufacturing processes, tools and fixtures, coolants and other consumables required for manufacturing

Cost analysis & cost control for different processes, make or buy decisions
Methods of process cost estimation and its application in preparation of manufacturing dudget

Text Books

1. Process Engineering for manufacturing — Donald F. Eary and Gerald E. Johnson
2. Process Engineering techniques Evaluation — W.F. Waller

Reference Book

1. Product Planning systems — L.N.Goslin

ELECTIVE I

PE7217	COMPETITIVE MANUFACTURING STRATEGIES	1.0

The competitive environment in the market, The WTO agreement and its effect on Indian Industries, Manufacturing as a competitive strategy, Competitive Advantages and Disadvantages

Product Variety, Modular Design, Design for manufacturability, Selection of manufacturing technologies, Vendor Development, Vendor rating.

Just in time manufacturing, Kanban system, and Agile Manufacturing

Reengineering, TQM, MRP

ERP, and simulation as tools for competitive manufacturing, Intelligent Manufacturing

Selection of manufacturing systems for different manufacturing scenarios - Dedicated manufacturing system, Flexible manufacturing system (FMS), cellular manufacturing system (CMS), and Re-configurable manufacturing system (RMS); Elementary of DMS, FMS, CMS, and RMS.

Concept of CIM, FOF, Network based manufacturing, and E-Manufacturing

Books Recommended:

1. Manufacturing Excellence in Global Markets — W. Euershelm
2. Manufacturing Systems Design & Analysis — B. Wa.
3. Computer Automation in Manufacturing — T.O.Boucher
4. Intelligent Manufacturing Planning — P. Gu.

ELECTIVE I

PE7219	HUMAN RESOURCE DEVELOPMENT	1.0

Human resource planning, human resource utilization, simplified human resource system of an organization

Procedure for constructing a man power plan, job design, recruitment, selection, training and career development programmes

Working conditions and work behavior, supervisory behavior, morale and discipline, pate of communication in the improvement of human behavior

Performance evaluation and human resource accounting, motivation, compensation and reward systems

Job satisfaction, quality of work life, Industrial stress and its removal

Group and group behavior, conflicts and co-operation in groups involving groups in decision making organization development goals, team building techniques, organizational change, productivity and human resource development, job enlargement, job enrichment, job rotation, human values & industrial psychology

Text Books:

1. HRD Training & Development — Robert F. Mayer, Peter Pipe; Jaco Publishing House
2. Corporate Human Resources Development a Management Tool — Leonard Nadlor, Van Nestrand
3. Managing Human Resource — Wayne F. Cascio, Tata McGraw Hill
4. Human Resource Management — Ian Beardwell Len Holden, Macmillan India
5. Human Resource Management — Wendell L. French, Houghton Mifflin Company

ELECTIVE I

PE7223	POWDER METALLURGY	1.0

Definition and scope of powder Metallurgy in Industry, Merits and demerits

Types of Powders and their manufacturing

Fundamental properties of powders. Mech. Pulverisation, Electrolytic process, chemical reduction, Atomization

Process of Powder Metallurgy, Mixing, Compaction, Sintering infiltration, sieving, coining, Machining etc

Use of metal powder performs for producing industrial products

Industrial application of powder metallurgy

Text Books

1. Powder Metallurgy — A.K. Sinha
2. Powder Metallurgy — Dixon

Reference Books

1. Source Book on Powder Metallurgy — ASM
2. Powder Metallurgy –Practice and Application — R.L. and C.R. Shakespheare

EIGHTH SEMESTER

PE8205	PLANT ENGINEERING	1.0

Objectives and principles of facility design, facility design process, facility design problems and their analysis

Factors affecting the location and site selection, techno economic analysis, multi-plant location,

Concept of location theory and models – design and types of building

Plant layout, types of layout problems, objectives of good plant, factors affecting plant layout, types of plant layout, techniques and tools of layout

Types of flow patterns, material handling, types of load, objectives and principles of material handling, Diagnosis and analysis of handling problems, material handling equipment and their selection

Industrial applications, Interrelationship between material handling and plant layout, Design of an integrated plant/facility layout. Life cycle costing

Plant maintenance, importance of maintenance in plant, types of maintenance, preventive and breakdown maintenance, inspection decisions, economics of maintenance, evaluation of maintenance policy, terotechnology

Text Books:

1. Plant Layout Design Moore, J.N. MacMuller Co.

Jigs & Fixtures: Principal of design and construction, Location and clamping

Basic concept for design of turning, Milling, Drilling & Indexing Jigs and fixtures

Classification of dies, components of dies assembly, Simple dies, compound dies, combination dies and progressive dies

Punch and die clearance, centre of pressure, calculation of blank diameter

Design of tools for the production of holes, surfaces of revolution, and flat surfaces like single point tools, form tools, drills, milling cutters

Materials for cutting tools, cutting dies and forming dies, Economics of Tooling

Text Books

1.	Production Engineering Design (Tool Design)	Umesh Chandra & Surender Kumar, Satya Prakashan, New Delhi
2.	Tool Design by C. Donaldson	G.H.Lecain and V.C.Goold, Tata McGraw Hill

Reference Books:

1.	Principles of Tool Design	S.K. Basu
2.	Jigs & Fixtures	Fred H. Colvin
3.	Handbook, Fundamentals of Tool Design	ASTME
4.	Basic Die Making	Osterguard E., Mc-Graw Hill Book Co.
5.	Metal Cutting & Tool Design	V.Arshinov, Mir Publication.
6.	Design and Production of Metal-Cutting Tools	P.Rodin, Mir Publishers, Moscow.
7.	Fundamentals of Tool Design	Frank W. Wilson
8.	Properties and Selection of Tool Material	Kortesoja, Victor A., ASM.

Definition and concept flexible automation and mechatronics, conventional vs mechatronics systems, need and role of mechatronics in flexible manufacturing and factory automation

Flexible manufacturing systems: concept, need, structure & operation, objectives and benefits

Computer integrated manufacturing and the factory of the future. Factory configuration, MAP/TOP

Robot technology: basic elements, classification, physical configuration and work volume, basic robot motions, concept of resolution, accuracy and repeatability of robot, end effector /grippers and tools

Robot applications: application characteristics and areas such as material handling, welding, assembly, inspection, processing operation, spray painting etc, economics of robots in industry

Planning and implementation of robotized and FMS projects, planning, system implementation, evaluation and justification, socio-economic impact

Text Books

1. Industrial Robot & CIM Oxford — Surender Kumar , & IBH , New Delhi
2. Robot Technology — M.P. Groover

References

1. Robotics for Engineers — Yoram Koren ,McGraw Hill ,USA
2. Robot Technology Fundamentals — James G. Keramas

PE8207	QUALITY ENGINEERING	1.0

Introduction to Quality Control, Objective, Applications and Cost Consideration, Graphical and Analytical Methods for Central Tendency and Dispersion

General Theory of Control Charts, Theory and Application of Control Charts for Averages, Range, Standard Deviation, Fraction Defective and Number of Defects, Process Capability Study, Interpretation of Control Chart

100% Sampling Vs. Statistical Sampling, Elementary Concepts of Acceptance Sampling by Attributes, Concept and Characteristics of O.C. Curves

Single, Double and Multiple Sampling Plans, Construction and Use of O.C. Curves for Sampling Plans, MIL – STD Plans, Sequential Sampling Plan

Basic Concept of Reliability, Reliability and Hazard Functions for Well-Known Distributions, System Reliability, Reliability Improvement

Concept of Quality Circle and Quality Loop, ISO–9000 Quality Systems, Quality Audit, Quality Costs and Cost of Quality, Six–Sigma Technique

Total Quality Control: Basic Approach, Deming Theory, Quality and Competitiveness in a Global Market Place, Establishing a Quality Culture and Customer Focus, Employee Involvement

Text Books:

1. Statistical Quality control — M. Mahajan, Dhanpat Rai & Sons
2. Mechanical Reliability — L.S. Srinath, Affiliated East – West Press
3. Statistical Quality Control & Reliability — D.H. Besterfield, Prentice Hall
4. Total Quality Management — D.H. Besterfield, Prentice Hall

MODULE I
Introduction
Environment and Ecology problem, Fossil fuel related pollutants in the environment, Environmental Impacts of Hydro-electric, Nuclear energy and Chemicals, forwards a solution.

(4 Lectures)

MODULE II
Air Pollution:
Definition and Scales of concentration, classification and properties of air pollutants, Emission on sources and their classification. Air pollution laws and standards, Inversion. Ambient air sampling, stack sampling, sampling system, analysis of air pollutants.

(6 Lectures)

MODULE III
Air Pollution Control Methods And Equipments
Source correction methods, cleaning of gaseous effluents, particulate emission control, selection of a particulate collector, control of gaseous emission, combustion.

(9 Lectures)

MODULE IV
Water Pollution:
Hydrologic cycle and water quality, origin of waste water and its composition, Type of water pollutants and their effects, water pollution laws and standards, waste water sampling and analysis, water quality standard, waste water treatment, Biological systems (Aerobic and Faculative Ponds), Recovery of material from process effluents.

(10 Lectures)

MODULE V
Noise Pollution:
Different noise environments and their sources, measurement of noise and the equipments, Noise pollution laws and standards, vibration isolation and noise control in industries.

(5 Lectures)

MODULE VI
Solid Waste Management:
Sources and classification, public health aspect, effluent treatment processes and solid waste management, solid-solid separation technique for recovery and reuse.

(5 Lectures)

MODULE VII
Case Study:
Modern environmental assessment method, Pollution control in steel plants, coal industries, chemical industries, etc. (6 Lectures)

BOOKS RECOMMENDED:

1. Introduction to Environmental Sciences and Technology by G.M. Masters.
2. System Approach to Air Pollution Control by Bibbero, R.J. & I.G. Young.

ELECTIVE II

PE8211	HUMAN FACTORS & SAFETY ENGINEERING	1.0

Introductory concepts
History, scope and objective of ergonomics/human factors engineering and its interdisciplinary concepts, occupational factors affecting the workers

Concept of human work
Energy and energy sources of the body, categories of work and classification of work-load, fatigue, physical working capacity and its evaluation, work-rest scheduling

Work space and work place design
Engineering authropometry, workplace design problems and general principles of work-station design, methods of workspace design, clearance, access and safety distances

Man-Machine Systems
Choice of control and display types, design, location and layout of controls and displays, control-display compatibility and control-display (C/D) ratio

Environmental design
Vibration, noise, temperature and light and their effect on health, safety comfort and performance

Occupational health and safety
Postural, habitual and occupational health problems and their solutions, Human error, accident and safety, management of hazard, perception, sources, evaluation and control of hazards

Text Books:

1. Human Factors in engineering and Design	M.S. Sandes & E. J. McCormick
2. Occupational Ergonomics	F. Tayyari

Reference Book

1. Ergonomics	K.F.H. Murrell

ELECTIVE II

PE8213	VALUE ENGINEERING	1.0

Concept and evolution of VE, value cost and quality, types of values, value ratio, value assessment, value engineering, value analysis and cost reduction, unnecessary costs and its reasons and elimination, Product life cycle.

Analysis of needs and generation of Ideas, need analysis, need and customer satisfaction, ideas and ideonomies. Creative thinking and brain storming, requirements and phases of creativity.

Design requirements and design process, Task analysis, Principles of modern design, concept of concurrent engineering, preparation of specifications, Design for manufacturability.
Methodologies and techniques of VE/VA, phases of VA/VE programmes, Function cost worth analysis, FAST, factor comparison method, decision and confidence level matrix, DARSIRI method. .

Value engineering and decision making, acceptance problems and its social influences, effectiveness of VE.

Build up of product cost, cost reduction and cost control, applications of group technology in value engineering projects/programmes, Value engineering and standardization, Role of ISI

Applications and case studies in industrial and Business operations – engineering, design, and materials Management.

TEXT BOOKS:

1. Value Engineering – S.S. Iyer
2. Value Engineering and value Analysis by L. D. Miles.
3. Economic Product Design – Herm Buck & Butler,.

ELECTIVE II

PE8215	DECISION SUPPORT SYSTEM	1.0

Systems concepts, characteristics, elements of systems and types of systems

System environment and architecture of system, systems approach information in organization, organizational information system and information system policy & strategic information system

B.P.R. & supply chain concept, system analysis, tools for determining systems requirements
Fact finding techniques, decision trees, decision table, structured analysis
Data flow analysis, data flow diagrams, data dictionary, system development life cycle
Preliminary analysis feasibility study, systems design, conversion and maintenance
The basic concepts of DSS, decision analysis & modeling, approaches to development & implementation of D.S.S. are studies and a project in D.S.S.

Text Books:

1. Manufacturing Decision Support Systems — H.R. Parasel ,Chapman & Hall
2. Decision Support Systems — G.W. Keen & Michel S. Scott Morton, Addison Wesley Publishing Co. London

ELECTIVE II

PE8217	PROCESSING OF POLYMER & COMPOSITES	1.0

Classification, structures and properties of polymers

Formulation of plastic products: additives and compounding, testing of plastics

Processing of plastics: molding (compression, transfer, injection, blow) extrusion (pipe, sheet, film),

Thermoforming, calendaring, casting, surface coating, tube forming, foaming, machining and joining of plastics

Drilling, cutting, polishing, welding, adhesive bonding, mechanical fastening etc.

Fabrication of composite materials, processing of composite materials

Text Books:

1. **Textbook of Polymer Science** — F.W. Billmeyer Interscience Publishers A Division of John Wiley & Sons .3rd Edn. 1984
2. **Principles of Polymer Processing** — Jadmor Z and Gogos ,C.G. Wiley Interscience ,John Wiley & sons N. Y. ,1982

PE8219	ADVANCED OPERATIONS RESEARCH	1.0

Revised simplex method, sensitivity analysis, decision theory: steps in decisions theory approach, types of decision-making environments

Decision making under uncertainty, theory of games: two – person zero sum games, pure and mixed strategies, rules of dominance, solution methods without saddle point

Replacement and maintenance models, failure mechanism of items, replacement of items deteriorating with time

Queuing theory: essential features of queuing systems, operating characteristics of queuing system, classification of Q-models. (M/M/I) (∞/FCFS/M/M/1: ∞ /SIRO, M/M/1: N/FCFS, M/M/S: N/FCFS).

Dynamic Programming: characteristics of D.P. dynamic programming under certainty, calculus and tabular method of solution.

Simulation: introduction, stochastic simulation and random numbers, simulation of inventory & queuing and PERT problems.

Non-Linear programming methods: general N.L.P.P. graphical solution, quadratic programming-Beales method.

Text Books

1. Operations Research — Gupta & Hira
2. Operations Research — Kanti Swroop & Manmohan Gupta

Reference Book

1. Operations Research — H.A. Taha

ELECTIVE II

PE8221	MAINTENANCE ENGINEERING	1.0

Definition, Importance, Purpose and results of maintainability efforts, maintainability in product life cycle, maintainability tools; failure mode, effect and critical analysis, fault tree analysis, cause and effect diagram, total quality management,

Reliability, maintainability, both-tub curve, concept of repair ability

Principle, relative advantage, limitation and application of various maintenance strategies like, preventive maintenance, predictive maintenance, Reliability based maintenance, computer integrated maintenance etc

Concept and strategies for tero-technology, and condition based maintenance

Maintainability testing, costing, budgeting and control index for maintained system

Industrial safety-concept and relevance, occupational diseases, electrical and mechanical hazards, personal protective equipment and clothing

Safety responsibility and function of various functionaries and departments, safety & profitably employee training and safety

Text Books

1. Engineering Maintainability — B.S. Dhillon, Eastern Economy Edition PHI
2. Reliability Engineering and Technology — A.K. Gupta, Macmillan India Limited
3. Industrial Maintenance Management — S.K. Srivastav, S. Chand & Company
4. Effective Maintenance Management — E.T. Newbrough, Mc Graw Hill
5. Industrial Safety Management — N.K. Tarafadar, K. J. Tarfdar, Dhanpat Rai

ELECTIVE II

PE8223	SYSTEM DYNAMICS	1.0

Introduction to simulation
Continuous time simulation; Numerical solution vis-à-vis analytical solution

Problem definition in time domain
Key variables, Reference behavior

Graphical Modeling Tools
Casual-loop and flow diagrams, causality, loop polarity, stock and floor variables, delays, smoothing, and table functions

Behavior of low order systems
Growth, decay, oscillation and logistic growth behavior of simple and coupled feedback loops

Numerical solution
Use of S/W packages for-numerical solution. Sensitivity analysis, policy analysis, policy analysis and design, scenario building, simulation design of experiments

Text Books

1. Introduction to System Dynamics Modeling — Universities Press (Orient Layman)
2. Introduction to System Dynamics Modeling with Dynamo — G.P. Richardson & Push, A.L., MIT Press.
3. System Thinking & Modeling — K.E. Manni & R.Y. Cavana, Prentice Hall

ELECTIVE II

PE8225	ECO-FRIENDLY MANUFACTURING	1.0

Manufacturing, agile manufacturing, lean manufacturing, rapid response manufacturing, and molecular manufacturing

Definition and concept of Eco friendly manufacturing, world-class manufacturing, manufacturing challenges, manufacturing audit, dynamic customer

Effect of industrial activity on environment, clean technologies; concepts, development and limitation

Design, planning and implementation of clean production technologies and process

Type of wastes, causes of waste generation and its elimination in manufacturing industries, impact on manufacturing cycle time, waste minimization programmed resource recovery and recycling

Lean vision and lean principles, value added and non-value added activities, JIT and waste, Core process reengineering, concept of KAIZFN & its impact on waste Minimization

Waste free manufacturing drivers, workplace organization, uninterrupted flow, error free processing and insignificant change over tools for waste free manufacturing, Hidden waste in industries

Text Books

1. Fast Track to Waste Free Manufacturing — J.W. Davis, Productivity Press USA
2. Clean Production — K.B. Misra, Springer – Verlog – 1996

ELECTIVE II

PE8227	ADVANCE WELDING TECHNOLOGY	1.0

Solid state welding
Principle, advantages ,limitations and applications of cold welding, diffusion welding, forge welding, friction welding, explosive welding, ultrasonic welding

Radiant Beam Welding (EBW)
Principle, advantages ,limitations and applications of electron beam welding , hard vacuum welding, soft vacuum welding, principle of key hole for EBW, advantages, disadvantages, applications Principle, advantages, limitations and applications of laser beam welding, lasing elements, principle of key hole technique for laser welding

Underwater Welding Processes
Introduction, principles, types and applications of under water welding processes

Residual stress and distortion
Principle of residual stress, types of residual stress, methods of identifying residual and the stress reliving methods. Numerical problems in residual stresses
Principle of distortions, types of distortion methods of the eliminating distortion

Weldability of specific materials
Weldability of carbon steels, high strength low alloy steels, stainless steels, high alloy steels, cast iron, aluminium, copper and titanium

Design of weldments, preheat treat, post heat treatment
Types of welded joints, design of butt joints, lap joints, eccentrically loaded joints, welding symbols, estimation of preheat temperature and post heat temperature

Welding applications
Application of welding in automobile industries, aerospace industries, ship building industries, boiler industries
Concept of robotized welding and welding automation

Text Books

1. Welding Process and Technology	R.S. Parmar
2. Welding Technology	O.P. Khanna