B.E. II YEAR (4YDC) INDUSTRIAL PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
MA 2303	Mathematics-III	**3**	**1**	**0**	**04**	**00**	70	30	-	-	**100**

1. Advance Calculus: Jacobians, Taylor's and Maclaurin's series of two variables, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers and their applications, Elementary ideas of multiple integrals, Change of order of integration, and change of variables in double integrals using Jacobians, beta and gamma functions, Vector Calculus , Gauss Divergence Theorem , Stoke's Theorem .

2. Fourier Series and Partial Differential Equations: Expansion of functions in a Fourier series, Half range series Sine and Cosine series and change of interval. Fourier Integral. Formation of partial differential equations, partial differential equations of first order and first degree i.e., Pp + Qq = R, Linear homogeneous partial differential equation of nth order with constant coefficient, separation of variables, Application to simple problems of vibrations of strings and beam and heat conduction equation.

3. Laplace and Fourier Transforms: Definition of LT, LT of elementary and periodic functions, properties of LT including LT of derivatives, Inverse Laplace Transform and its properties. Convolution Theorem. Application of LT to ordinary differential equations with constant and variable coefficients, Simultaneous differential equations. Fourier transforms: sine and cosine transforms and their application to solution of linear PDE.

4. Calculus of Finite Differences: Difference table, Operators E and Δ, Newton's forward and backward interpolation formula, Lagrange's interpolation formula, differentiation and integration, difference equations with constant coefficients.

5. Statistics: Brief idea of sampling, t, F and χ^2 distributions and their applications, ANOVA, Statistical Quality Control (SQC), Control Charts, Sampling inspection, Acceptance sampling, Producer's and Consumer's risk, O. C. curve , Taguchi method .

Books & References Recommended:

1. Ramana B V, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.
2. Jain, R.K. and S.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House, New-Delhi, 2006.
3. Erwin. Kreyszig, Advanced Engineering Mathematics, 8th edition, John Willy and sons Publications, 1999.
4. Ramesh Sircar, Statistical Techniques & Applications, New Control Book Agency, Calcutta.
5. Balagurusamy E. , Numerical Methods, Tata McGraw-Hill Publishing Company Ltd. , New Delhi

B.E. II YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
ME-2304	Mechanics Of Solids	2	1	2	3	1	70	30	40	60	200

UNIT I

Stress and Strain : Tension, compression and shear, Complementary shear stresses. Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus, Poisson's Ratio, Relations among the moduli, Stress due to temperature, Statically indeterminate system, Shear stress in a circular member due to Torsion.

UNIT II

(a) Bending Moment and Shear Forces: Diagrams of Shear Forces and Bending Moment for cantilevers beams and simply supported beams with or without over hanging ends. Relation between Loads and Shearing Forces and Bending Moments.

(b) Bending Stress : Theory of Bending, bending and shearing Stress in beams and their distribution with varied load, modulus of section and modulus of rupture, beams of varying cross section, beams of uniform strength.

(c) Introduction to Composite Beams

UNIT III

Stress on oblique section of a bar subjected to axial stress, Complex Stresses, Principal stress and strain, Mohr's Circle, Combined direct and bending stress

UNIT IV

(a) Deflection : Uniform Curvature, Relation between curvature and deflection, cantilevers and simply supported beams of varying cross-section, MaCauley's Method, Deflection due to Shear. Propped Beam,

(b) Parts subjected to column action with and without lateral loadings, Euler's theory of columns.

UNIT V

(a) Elastic strain energy: Resilience, Proof Resilience. Materials under tension, Static, Sudden and Falling Loads, Strain Energy due to Direct Shear, bending and torsion, Castigliano's theorem.

(b) Introduction to thin and thick cylinder.

Sessional Work :

Each candidate will be required to undergo a laboratory course based on the theoretical course prescribed above and will hand over a journal containing full record of his laboratory work and this shall constitute Sessional Work.

Book & References Recommended :

1. Popov, E.P., *Mechanics of Solids,* Prentice-Hall India.
2. Ryder, G.H., *Strength of Materials*, Macmillan India.
3. Beer & Johnston, *Mechanics of Material.* Tata McGraw-Hill.
4. Ramamrutham, *Mechanics of Solids*, Dhanpat Rai.

B.E. II YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
ME-2305	Mechanical Metallurgy	2	1	2	3	1	70	30	40	60	200

UNIT I Metal Structures and Crystallization: Atoms Structure, Atomic binding, Crystal Structure, Allotropy Structure of Alloys. Equilibriums, Lever Rule, Phase Rule, Iron, Iron Carbide Equilibrium Diagram.

UNIT II Mechanical Properties and Mechanical Working of Metals : Strength, Stiffness, Elasticity, Plasticity, Ductility, Hardness, Impact Strength, Malleability, Brittleness, Toughness, Resilience etc. Hot and Cold Working of Metals and their Effects on Properties and Microstructure of Metals.

UNIT III Heat Treatment of Metals and Alloys : TTT Diagram, Continuous Cooling Curves, Annealing, Normalizing, Spheriodizing, Hardening, Tempering, Austempering, Martempering, Case Carburizing, Nitriding, Cynading, Carbontriding, Induction Hardening, Flame Hardening, Age Hardening and Hardenability.

UNIT IV Ferrous and Non-Ferrous Metals and Alloys: Modern Trends in the Manufacture of Iron and Steel, Cast Steel Composition, Micro Structure, Properties and Applications of Plain Carbon Steels and Cast Irons. Effect of Impurities in Ferrous Metal. Effect of Common Alloying Elements on properties of plan Carbon the Steels. Common Alloy Steels. High Speed Steel. Hard Field Mn Steel, Stainless Steel. Corrosion and its Prevention. Composition Micro Structure, Properties and Application of Aluminium and its Principle Alloys, Copper and its Principle Alloys. Bearing Metals.

Rare Metals: A Brief Discussion of the Properties and Application of Rare Metals, Viz. Platinum, Uranium, Beryllium and Zirconium.

UNIT V Destructive and Non-destructive Testing : Tensile test, Hardness Compression, Impact test Shear, Torsion Fatigue test, Radiography Impact, and Hardness Tests. Ultrasonic, Magnetic, Eddy Current Testing, Penetration Testing and Magnetic Particles Inspection Testing Radiographic Test Etc.

Power Metallurgy: Theory of Power Metallurgy, Manufacturing of Metal Powers, Sintering and Secondary Operations, Properties of Finished Parts, Design Consideration and Application.

Sessional Work :

Each candidate will be required to undergo a laboratory course based on the course prescribed above. Each student shall maintain a Journal containing full record of his laboratory work.

Books & References Recommended :

1. Nayak S. P., *Metallurgy for Engineers*, Chatotar Publication.
2. Lakhtin, *Engineering Physical Metallurgy*, MIR.

B.E. II YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
PE	MANUFACTURING PROCESSES - I	2	1	4	3	2	70	30	40	60	200

Theory :

1. Welding : Classification of the process, Electric arc welding - Joint design, Welding symbols, Arc welding equipments, Characteristic curves, Welding parameters, Electrode classification, Types of metal transfer, Manual metal arc welding. Electrodes used and their nomenclature, TIG welding, MIG welding, Submerged arc welding, Atomic hydrogen welding. Other Joining & Cutting Techniques : Resistance welding, Thermit welding, Electroslag welding, Electron beam welding and laser beam welding, brazing, Braze welding and soldering, Thermal cutting of metals, Defects in welds and weld distortion.
2. Foundry : Types of patterns and selection of pattern materials, pattern allowances, Moulding and core sands, Moulding sands - their properties and ingredients, Core & mould making, Moulding machines, Fettling and cleaning of castings, Defects in casting.
3. Special Casting Techniques : Gravity die or permanent mould casting, Pressure die casting, Centrifugal die casting, CO_2 moulding, Investment mould casting, Shell moulding, Plaster mould casting and continuous casting.
4. Mechanical Working of Metals : Rolling - Principle, Rolling stand arrangement (Rolling mills).

   Forging - Forging operations, Drop, Press and Machine forging, forging defects.

   Extrusion - Principles, hot and cold extrusion processes, tube extrusion, wire, rod and tube drawing.
5. Plastics : Composition of plastic materials, Moulding methods - Injection moulding, compression moulding, transfer moulding, extrusion moulding, Calendering, Blow moulding, Laminating & Reinforcing, Welding of plastics.

Books Recommended :

1. Rao P. N., Manufacturing Technology.
2. Lindberj, Manufacturing Process.
3. Campbell, Principles of Manufacturing materials & Process.

References Recommended :

1. Parmar R. S., Welding Processes and Technology.
2. Jain P. L., Principle of Foundry Technology

B.E. II YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
EI 2317	**Basic Electronics**	**2**	**1**	**2**	**3**	**1**	70	30	40	60	**200**

Theory:

1. Diode Characteristics: V-I characteristics & their temperature dependence, static & dynamic resistances, C_T, C_D, switching times. Special diodes – breakdown, photodiodes, LEDs, Introduction to BJT, FET,UJT & SCR. Diode Applications : Load Line concept, clippers, clampers, comparators, samplers, rectifiers & filters, voltage doublers, peak detectors.

2. Transistors Characteristics : The junction transistor, BJT, current components, transistors as amplifier, CB, CE & CC configurations, static & dynamic transistors characteristics, analytical expression of characteristics, transistor rating, photo transistors.

3. Transistors Biasing & Thermal Stabilization : The Q point, bias stability, different biasing techniques, stabilization against variation of I_{CO}, V_{BE} & β, bias compensation, biasing in linear ICs, thermal compensation, thermal runway & stability.

4. Transistors at low frequency: Graphical analysis, hybrid model, h-parameter conversions, analysis using h-parameters, classification of amplifier, (Class A, B, C). Emitter follower, comparison of CB, CE, CC, simplified model, common emitter with emitter resistor, high i/p impedance circuits, Darlington pair, bootstrapping.

5. Field effect transistors : The JFET, pinch off, V/I Characteristics, small signal model, MOSFET, the CS & CD amplifiers, Biasing techniques for JFET & MOSFET, FET as VDR. Introduction about sensor and transducer and their interfacing.

Books & References Recommended:

1. Millman & Halkias , Integrated Electronics
2. Robert Boylested, Electronic devices & circuits.

B.E. II YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
ME-2355	**Theory Of Machines**	**2**	**1**	**2**	**3**	**1**	70	30	40	60	**200**

UNIT I

(a) Motion and Force Analysis : Plane motion, Kinematic concept of links, Basic terminology and definitions, Inversion of kinematic chains, Absolute and relative motion, Vector diagram, Instantaneous centre, Velocity and Acceleration Polygons, Special Graphical Methods for Slider Crank Mechanism.

(b) Concept of Free Body and its Equilibrium, Kinematic and dynamic quantities and their relationships, Static Force Analysis, Piston Effort, Dynamic Force Analysis, Equivalent Dynamical Systems.

UNIT II

Power Transmission : The Kinematic design of pulleys, Flat belts and V-belt, Transmission of power by belts, Conditions for maximum power transmission, Efficiency of power transmission.

UNIT III

Friction Devices, Coulomb friction, Pivot and Collars, Power screw, Plate clutch and Cone clutch, Band and Block Brakes.

UNIT IV

Gears : Fundamental laws of gearing, Classification and basic terminology, Involute tooth profile and Kinematic consideration, Spur gears, other types of Gears, Standards in tooth forms, Gear trains, Simple, Compound and Epicyclic Gear Trains.

UNIT V (a) Balancing : Static and Dynamic Balancing or Rotating Masses in Same and Different Planes.

(b) Vibrations : Degree of Freedom, Natural Frequency of Single Degree of Freedom Systems, Damped and un-damped systems, Forced Vibration, Whirling of Shafts and Critical Speeds.

Books Recommended :

1. Bevan T., *Theory of Machines*, CBS Publication.
2. Ambekar A. G., *Mechanism & Machine Theory*, Prentice Hall of India.
3. Myszka David H., *Machines and Mechanism,* Prentice hall of India.

B.E. II YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
ME 2356	Fluid Mechanics And Thermal Engg	2	1	2	3	1	70	30	40	60	200

Theory :

A. Fluid Mechanics :

1. **Fundamentals** : Types of Flows, One and Two Dimensional Flows, Ir-rotational and Rotational Flows, Stream and Potential Functions. Basic Laws of Fluid Flow : Continuity, Momentum and Energy Equations as Applied to System and Control Volume. Euler's and Bernoulli's Equations. Application to Flow through Office, Venturimeter, Pitot Tube, Moment of Momentum Theorem and its Application to Fixed and Moving Vanes.

2. **Dimensional Analysis** : Buckingham's Theorems, Similarities, Physical Significance of Reynold's, Mach and Froude Numbers etc.

3. **Viscous Flow** : Concept of Boundary, Drag, Lift, Flow through Pipes, Hydraulic Gradient and Losses due to Friction and Sudden Enlargement/Contraction, Pipes in Series and Parallel.

B. Thermodynamics :

4. **Fundamentals** : Application of Mass and Energy Equation to Steady Flow System, Heat and Work Transfer in Flow and Non-Flow Processes. Second flow, Kelvin Planck's and Clausius Statement, Concept of Entropy, Clausius Inequality, Entropy Changes in Non-Flow processes, Properties of Gases and Vapours, Rankine Cycle.

5. (a) **Heat Transfer** : Conduction in Parallel, Radial and Composites Walls, Connective Heat Transfer with Laminar and Turbulent Flows, Overall Heat Transfer Coefficient, Flow Through Heat Exchanger,

(b) **Refrigeration and Air Conditioning** : Principles of Refrigeration, A/C Cycles, Coefficient of Performance.

Books & References Recommended :

1. Kumar K.L., *Engineering Fluid Mechanics*.
2. Irwing Shames, *Fluid Mechanics*.
3. Kapoor H. R., *Thermal Engineering*, Vol.1 and II.
4. Mathur M. L. and Mehta F. S., *Thermal Engineering*, Vol.1 and II.

B.E. III YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
PE-33_ _	**Industrial Inspection**	**2**	**1**	**2**	**3**	**1**	70	30	40	60	**200**

1. Standard of Measurements : Principles of measurement, Line and end standards, Slip gauges, End bars, Wavelength standards, Primary, Secondary, Tertiary and working standards for length. Angle measurement, Angle gauges.

2. Measuring Instruments : Linear measurement - Direct measuring tools, Comparators, Types, use and limitations, Optical Instruments, Projectors, Tool makers microscope, Sine bar, Angle gauge clinometers, Optical dividing head. Measurement and representation of Geometrical Features: Measurement of straightness, Flatness, Parallelism, Perpendicularity, Roundness, Cylindericity, Squareness and Symmetry, Interferometry and its applications.

4. Measurement of Surface Roughness : Measurement of surface roughness, E & M System, Surface roughness in various manufacturing processes.

   Measurement of Screw, Threads and Gears : Measurement of elements of screw, threads, pitch and effective diameter measurement and errors in screw threads elements and their effect, Inspection of gears, Various methods of measuring gear tooth thickness, Measurement of base pitch, PCD and profile, lead and roll testing

3. Interchangeability: Concept of limits fits and tolerances, Types of fits, Universal and local interchangeability, Systems of limits, fits and tolerances, Selective assembly and matched fits, B.S., I.S.O. and I.S. systems. Design of limit gauges, Types and their manufacture. In process inspection and control

4. Manufacturing Analysis : Pre and Post Production Analysis, Process Planning, Part Print Analysis, Determination of Principle Processes, Blank making process, Determination of Functional surfaces of W/pc, Machining Allowances (limits of size for initial and intermediate W/pc dimensions). Work-piece control, Influence of Process Engg. on product design.

Books Recommended :

1. Gupta I. C., Metrology, Dhanpat Rai & Sons.
2. Jain R. K. , Metrology, Khanna Publishers.
3. Hume K. J., Engineering Metrology, McDonal.
4. Khare & Bajpayee, Dimensional Metrology, Oxford & IBH Publishing Co.
5. Eery and Johnson, Process Engineering, Prentice Hall
6. Kovan V K, Process Engineering, MIR publication Moscow

References Recommended :

1. Sharp K. W. B., Sir Issac Pitman , Engineering Metrology.

B.E. II YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
PE 23_	**MANUFACTURING PROCESSES - II**	**2**	**1**	**3**	**3**	**1.5**	70	30	40	60	**200**

Theory :

1. Principle of generation of surface, classification of machining processes and machine tools, cutting tool materials, their properties & types of single point cutting tools.

   Type of lathe and operation such as turning, taper turning, thread cutting, grooving, parting off. Use of multiple tool for manufacturing of simple components, Concepts of feed, speed and depth of cut.

   Machining time estimation : Evaluation of machining time for turning, facing, drilling, milling and shaping operations.

2. Shaping, Planning and slotting operation and machines, Quick return mechanism, Hydraulic system for shaper.

   Drilling and drilling machines, Types of drills, tapes and reamers, Geometry of drills, reamers and taps, Tapping and Spot facing operations.

   Milling machines, Types and operations. Types of milling cutters, Up and Down milling, gang craddle milling. Broaching operation, types of broaching machines and broaches design of broaching tools.

3. Grinding process and grinding machines, Grinding wheel, Types nomenclature and their selection. Centreless grinding and job feeding arrangement, Dressing and trueing of grinding wheels.

   Super finishing processes : Honning, lapping, superfinishing, polishing and buffing.

4. Press working : Types of presses, Classification and specifications, press working operations as Blanking, piercing, shearing, bending, forming, embossing, coining drawing and deep drawing, operations. Elements of dies and punches, Clearance, Compound, combination, progressive and inverted dies and their operations, Blank layout, Metal spinning.

5. Gear and their types, elements of gears, different method of producing gears, gear cutting on milling m/c and by generating methods viz, hobbing, shaping, and rack cutting, gear finishing by shaving and grinding.

Books Recommended :

1. Campbell J. S., Principles of Manufacturing Materials & Processes.
2. Lindberg, Manufacturing Processes.
3. Chapman W. A. J., Workshop Technology part II and III.

References Recommended :

1. ASME, Fundamentals of Tool Design.

B.E. II YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING

SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
CO2359	**Object Oriented Programming System**	**2**	**1**	**3**	**3**	**1.5**	70	30	40	60	**200**

1. Review of object oriented programming concepts using C++ or Java.
2. Basics of Object Orientation: Objects and Classes. Identifying candidates for Classes and Objects, Attributes and Methods. Abstraction, Encapsulation, Inheritance, Polymorphism. Relationships-Association, Aggregation, Composition, Generalization and Specialization.
3. Object Oriented Analysis: Basic Concepts, Comparison with Structural methodology, Modelling Techniques: Object, Dynamic, and Functional Models**.** CRC, Introduction to Rational Unified Process. OOA method.
4. Object Oriented Design and Programming: Basic Concepts, Comparison with Structural methodology. Concepts of Interface, Components (Packages), OOD method: Introduction to UML Class diagram. OOP consideration: Reusability, extensibility, robustness (Exception Handling), programming language support for object orientation in Java (or C++).
5. Rapid Prototyping. Introduction to Conventional Testing, Object Oriented Testing.

Text Books

1. Atul Kahate, "Object Oriented Analysis and Design", Tata McGraw Hill Publishing Company Limited.
2. R.S. Pressman, "Software Engineering, A Practitioner's Approach", Tata McGraw Hill Publishing Company Limited.
3. Grady Booch, "Object Oriented Analysis and Design", 2nd edition, Pearson Education.

Reference Books

1. James Martin, "Principles of Object Oriented Analysis and Design"
2. Clayton Walnum, "Java by Example", Que Corporation, USA.
3. Peter Coad and Edward Yourdon, "Object Oriented Analysis", Pearson Education.

B.E. III YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
ME 3306	Prime Movers And Pumps	4	0	0	04	00	70	30	-	-	100

Unit 1 Internal Combustion Engines : Introduction, Classification of I.C. Engines, Constructional details of two-stroke & four-stroke engines and rotary engines, Important parameters of design of engines, Volumetric efficiency and scavenging, Fuel-air cycle analysis.

Carburation and ignition systems of spark ignition engines. Carburettor details, TCI & CDI ignition systems, Air fuel mixture & requirement, combustion process and detonation, compression ignition engines, injection systems for single and multi-cylinder engines, combustion and knocking.

Fuel rating, alternative fuels, Supercharging and turbo-charging,

Unit 2 Steam Engineering : Rankine cycle, Reheat and regenerative cycles, Fuel and combustion, Industrial boilers, draught.

Steam turbines : Impulse and reaction turbines, Velocity diagrams, reheat factors, condensers and cooling, Elementary idea of governing.

Unit 3 Gas Turbines and Gas Propulsion : Turbine cycles with intercooler and comparative studies constructional details of axial-flow and centrifugal compressors. Elementary of Jet-propulsion and calculation of force, work and efficiency.

Unit 4 Theory of Fluid Machinery : Classification of rotor-dynamic turbines and pumps, Velocity triangles, Euler's equation of work done and efficiencies. Constructional details of Pelton, Francis and Kaplan turbines. Characteristics and specific speed.

Unit 5 Pumps, Compressors and Blowers : Positive displacement pumps, rotary compressors and blowers their constructional details, characteristics and efficiencies,

Books & References Recommended :

1. K. L. Kumar, *Engineering Fluid Mechanics*.
2. S. M. Yahya, *Pumps, Compressors and Fans*.
3. H. R. Kapoor, *Thermal Engineering, Vol.I & II.*
4. M. L. Mathur & F. S. *Mehta*, *Thermal Engineering, Vol. I & II.*

B.E. III YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
ME 3308	**Design of Machine Elements**	**4**	**0**	**3**	**04**	**02**	70	30	40	60	**200**

THEORY

1. Machine Drawing**:** Orthographic projections of machine components and assemblies viz. knuckle joints, cotter joints, flange couplings, bushed bearings (Plummer blocks and foot-step bearing).
2. Introduction to machine design; Design and drawing of parts subjected to tensile, compressive, bending, and shear stresses such as pins, keys, cotters, levers.
3. Design of fastening elements under direct and eccentric loading:
    a. Riveted joints: Lap joint, butt joint, diamond joint
    b. Welded joints
    c. Threaded and bolted joints
4. Theories of failure. Design of machine elements subjected to combined loading. Design of shafts.
5. Design of machine components subjected to stress concentration and dynamic loading.

SESSIONAL WORK

Drawings and journal based on above course will constitute the sessional work.
Drawings on Imperial size drawing sheets (04 to 06 sheets) to be prepared based on above course work.

PRACTICAL EXAMINATION

Each candidate shall appear for a viva-voce test based on the sessional work and shall be awarded marks by professional examiners up to a maximum of 50.

Books and References:

1. Shigley and Mischke, Mechanical Engineering Design
2. Bhandari, Machine Design
3. Juvinall, Machine Design
4. N.D. Bhatt, Machine Drawing

B.E. III YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
ME-3309	**Mechatronics**	**4**	**0**	**2**	**04**	**02**	70	30	40	60	**200**

Theory :

1. **Open loop and closed loop control systems:** Dynamic modelling of simple mechanical, electrical, electromechanical, thermal and fluid systems. Transfer function and block diagram representation of control system. Zero order, first order and second order systems and their dynamic response, Routh Hurwitz stability criteria, Introduction to Bode plot and root locus method. System modelling using MATLAB
2. **Measurement Systems:** Generalized measurement system. Sensors and transducers, intermediate elements, indicating and recording elements. Static and dynamic characteristics of measuring instruments. Amplitude linearity, phase linearity, bandwidth, frequency response. Proximity sensors and switches, potentiometers, optical encoders, electrical strain gages, load cells, thermocouples, piezoelectric accelerometers, pressure and flow sensors, semiconductor sensors.
3. **Signal Conditioning & Data Acquisition:** Amplification. Filters. Operational amplifier and its applications. Analog to digital conversion. Data acquisition. Interfacing with micro-controller and micro-processor.
4. **Actuators:** Electro-mechanical actuators, solenoids and relays, types of electric motors and their characteristics, speed control of electric motors. Stepper motors and their control. Electro-hydraulic and electro-pneumatic actuators, Servomotor.
5. **Controllers:** Basic control actions. Proportional, integral and derivative control. Op Amp based PID controller. Combinatorial and sequential logic. Simple logic networks. Introduction of micro-controllers.

Sessional Work :

Each candidate will be required to undergo a laboratory course based on the theoretical course prescribed above and will hand over a journal containing full record of his laboratory work and this shall constitute Sessional Work. Such SW will be awarded marks maximum up to 50.

Practical Examination :

Each candidate shall appear for a Practical exam / Viva-voce Test based on the sessional work and shall be awarded marks by Examiner upto to a maximum of 50.

Books & References Recommended :

1. Beckwith and Buck, *Mechanical Measurement*.
2. K. Ogata, *Modern Control Theory*
3. Nakra & Choudhary, *Instrumentation, Measurement and Analysis*
4. Alciatore and Histand, Introduction to Mechatronics & Measurement Systems
5. Bolton, Mechatronics

B.E. III YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM-3310	**Industrial Engineering & Ergonomics**	**4**	**0**	**2**	**04**	**02**	70	30	40	60	**200**

1. **Introduction**: Place of Industrial Engineering in Industries and Business. History of development of Industrial Engineering, work of Taylor and Gilberth, Modern industrial Engineering.

   Productivity: Productivity & Standard of living, productivity in individual enterprise, Reducing work content and ineffective time. Introduction to work-study and its applications.

2. **Method Study** : Definition, Objectives and procedures, Selection of job, various recording techniques like outline process charts, Flow process charts, Man machine charts, Two handed process charts, String diagram, flow diagram, Multiple activity chart, Therbiligs, SIMO chart, Cyclographs and Chrono cyclographs.

   Critical examination, Development, Installation and Maintenance of improved methods. Principles of Motion economy and their application in work design. Micro motion study, Memo motion study & their use in study of methods.

3. **Work Measurement:**
   a. Introduction: Definition, Objectives and procedure.
   b. Time Study: Procedure, Methods of measuring time, selection of jobs, breaking a job into elements. Number of cycles to be timed, Rating and methods of rating, Allowances, Calculation of Standard time.
   c. Work Sampling: Basic procedure, Design of work sampling study, conducting work sampling study and establishment of standard time.
   d. Predetermined Motion time systems, Work factors system and other standard data systems.

4. **Wage Incentives**: Measured day work and wage incentives and Productivity, different types of wage incentive plans. Design of incentive plans managing incentive schemes, Supervisory incentives plans.

5. **Introduction to Ergonomics** : Ergonomics as a multi-disciplinary field, components. Importance of ergonomics in equipment and work design. Concept of man-machine system; Types and characteristics of Man-machine systems.

Books & References Recommended :

1. **I. L. O**., Introduction to Work Study.
2. Maynard, Industrial Engg. Hand Book.
3. Barnes R. M., Motion & Time Study.
4. Mundel "Motion and Time Study"
5. Salvendy "Hand Book of Industrial Engineering"
6. Jhamb L.C. "Work Study and Ergonomics"

B.E. III YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
PE-3311	**Metal Casting**	**4**	**0**	**2**	**04**	**02**	70	30	40	60	**200**

1. Foundry : Types of patterns and selection of pattern materials, pattern allowances, Molding and core sands, Molding sands - their properties and ingredients, Core & mould making, Molding machines, Fettling and cleaning of castings, Defects in casting. Classification of Casting Processes, Sand casting, Gravity Die Casting, Pressure Die casting, Investment Casting, Special Casting techniques: CO_2 molding, Shell molding, EPC castings, centrifugal casting, continuous casting, Ferrous Casting, Non ferrous castings

2. Melting Furnaces & Practices: Melting of casting iron, Steel & Non ferrous materials Cupola, Charge calculation, Open Hearth furnace, Converter, Crucible furnace, Electric furnace, Direct are furnace, Induction furnace. Furnace charge calculation.

3. Mould design: parting surface selection, definition of parting surface. Criteria for selection of parting surface. Design of core, and mould cavity layout. Solidification of Casting: Solidification of pure metals & alloys. Solidification time and rate. Feeder types and shapes. Design of feeder using modulus method. Design of feeder neck. Feed aids and their application.

4. Mould filling analysis: Fluidity and turbulence and their impact on mould filling. Types of gating types. Element of gating system. Design of gating system. Casting Process Planning, Cost estimation and product design for castability

5. Foundry Mechanization: Modernization of foundries, Molding machines Material handling equipment's Foundry layout. Heat treatment of castings.

Books & References Recommended :

1. Ravi, B. Metal casting computer aided design and analysis, PHI
2. Rao P. N., Manufacturing Technology.
3. Jain P. L., Principle of Foundry Technology.
4. Campbell J, Metal Casting, Elsevieur

B.E. III (IPE) (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
PE-3352	Quality Control & Reliability Engineering	**4**	**0**	**2**	**04**	**02**	70	30	40	60	**200**

Theory:

1. Basic Concept of Quality Control & Product quality. Inspection & Quality Control. Quality System, Quality cost concept, function of Quality control Deptt.
2. Statistical Quality Control: Statistical concept, Frequency distribution, Process capability, variables and attributes, Theory of control charts, Control charts for variables - X bar and R charts, Applications of control charts for variables.

   Control Charts for Attributes: p, np, C and demerit control charts and their applications.
3. Acceptance Sampling : Fundamental concepts, OC Curve - construction of OC curve, Evaluation of Parameters affecting OC curve, Sampling plans - Single, Double, Multiple & sequential sampling plans, Dodge Roming, MIL-STD-105D, Indian standard sampling tables, selection of sampling plan.
4. Quality Measurement: Quality assurance, Quality Circle, Zero defect concepts, Quality audit, Introduction to ISO 9000, Six Sigma Quality System.
5. Reliability : Definition, Failure pattern of complex product, measurement of reliability, Mean Time between failure and mean repair time, Failure mode and effect analysis, Hazard analysis, system reliability- components in series, parallel & mixed system.

Books Recommended :

1. Grant E. L. & Leave Worth, Statistical Q. C., T.M.H.
2. Balagurusamy, Reliability Engg., T.M.H.
3. Mahajan , Statistical Q.C.

References Recommended :

1. Juran and Grayan, Quality Planning Analysis, T.M.H.

B.E. III (IPE) (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM-3353	Engg. Economics And Financial Management	**4**	**1**	**0**	**04**	-	70	30	-	-	**100**

Theory :

1. Basics of Industrial Economics: Nature and scope, Central Economic Problems Marginalism, Time element, Laws of demand and supply, demand curve and demand function, utility analysis of demand theory, Price consumption curve and Income consumption curve, Elasticity of demand, Introduction to Demand Forecasting, The equilibrium concept.
2. Production and Pricing: Production function, Laws of variable proportions and returns, cost functions and cost analysis, Pricing and equilibrium under various market competitions, Nature and Measurement of Profit.
3. Accountancy and Business Organization: Books and statements of Accounts, Financial and Management Accounting, The manufacturing and trading account, Profit and loss account and balance sheets, Types of Business and Industrial organization, sole proprietary business, HUF, partnership, joint stock companies, private and public limited companies, Co-operative, Joint Sector and Public Sector.
4. Finance Function: Concept, Nature, Scope and functions, Financial analysis and planning, Fund flow analysis, Cash flow analysis, Ratio analysis, Break even analysis, Analysis of operating and financial leverage, Analysis of financial statement, Working capital management, Credit policy.
5. Long term finance: Investment decision, Methods of capital budgeting, Cost of capital, Approach to financing, Capital structuring, and Dividend policy of the firm.

Books Recommended :

1. Dwivedi and Dwivedi: Engineering Economics
2. Kucchal, Financial Management.
3. Pandey I M, Financial Management.
4. Khan & Jain, Financial Management.

References Recommended

1 Dean J., Managerial Economics.

B.E. II (IPE) (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM-23_ _	**Operations Research**	**2**	**1**	**2**	**3**	**1**	70	30	40	60	**200**

Theory :

1. Introduction : History and Development of O.R. present trend& Linear Programming - Simplex method, Big-M-Method, Two-phase method, Degeneracy, Unrestricted variables, Duality in LP, Revised simplex, Sensitivity Analysis.
2. Allocation :
   (i) Assignment Model.
   (ii) Transportation - Optimality Test, Degeneracy Unbalanced Problems, Trans-shipment.
3. Introduction to Integer Programming. Branch and Bound Algorithm. Dynamic Programming : Characteristics of Dynamic optimisation Model Bellman's Principle problem, Salesmen problem, Forward and Backward recursion. Non Linear Programming : Introduction, Computer Application in Operations Research.
4. Waiting Line Models : Introduction, Classification, States in queue, Probability distribution of arrivals and service times, Single server model (M/M/l). Multiple server model (M/M/S). Single server model with finite capacity.
5. Game Theory : Rectangular, Two persons Zero sum games, Maxmin and Minimax Principles, Saddle point, Dominance, Graphical and Algebraic methods of solution, Solution by transforming into Linear Programming Problem. Simulation: Building a simulation model, Monte Carlo simulation as applied to descrete system.

Books Recommended :

1. Taha H. A., Operation Research, Mc Millian.
2. Banerjee B., Operation Research, Business Publicity, Bombay.
3. Hira & Gupta, Operation Research, S. Chand.
4. Chitale A. K., J. Negi, Text Book of Operation Research, Jain Bros., Delhi.
5. Sharma S. D., Kedarnath, Operation Research, Ramnath & Co., Meerut.

References Recommended :

1. Rao S. S., Optimization, Jain Bros., Delhi.

B.E. III YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
		4	**0**	**3**	**04**	**03**	70	30	40	60	**200**

B.E. III YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
PE 3358	**Computer Aided Design**	**4**	**0**	**3**	**04**	**03**	70	30	40	60	**200**

1. Geometric Modeling in CAD: Wire-frame models, parametric representation of Analytical and Synthetic Curves. Surface Models: Parametric Representation of Analytical and Synthetic Surfaces. Solid Modeling : Boundary Representation, Constructive Solid Geometry, Parametric and Variational modeling, Feature Based Modeling**,**
2. Volumetric modeling, Representative techniques: Exhaustive enumeration, Octree. Voxellization of geometric models and rendering of volume data: volume rendering and surface rendering. Applications of volumetric modeling
3. CAD/CAM data exchange standard: DXF, IGES, STEP. Surface representation standards STL, Virtual Reality Markup Language
4. Analysis problems in engineering, Continuous and discrete systems, Solution by differential formulation, Variational formulation, Approximate solution method (Rayleigh-Ritz method), Discretization and piecewise approximation.
5. Concepts of: Shape functions, Element matrices, Global matrix, Assembly, Boundary conditions. Solution of FE equations, Post processing, Convergence requirements, Treatment of distributed loads. Application to structural mechanics problems Longitudinal/Axial bar problem, Beam problem, Plane stress/strain problem, Iso-parametric formulation, Axis symmetric problem, Bending of plates. Weighted residual approach

References

1. Finite element method: Chandrupatla & Belegundu
2. Finite element procedures: K. J. Bathe
3. Volume graphics, Chen M and A E Kaufmann, Yagel R, Springler-Verlag
4. Voulme visualization, A E Kaufmann, IEEE press
5. Computer graphics: Principles and practice, Foley, Van Dam, Feiner and Huges, Pearson
6. Zeid, CAD/CAM Theory & Practice, McGraw-Hill

B.E. IV (IPE) (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING

SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM 4303	**Production Management**	**4**	**0**	**0**	**04**	**-**	70	30	-	-	**100**

Theory :

1. Production Management : Introduction, Systems Concept, Difference between Production & Operations management, Decisions, Organization, Objectives, and Historical review, Types of production system,
2. Facility Planning : Plant location, plant layout and Material Handling and facility design Procedures such as CORELAP, CRAFT etc. PPC, Functions, make buy decision, Forecasting methods.
3. Aggregate Planning : Introduction, Strategies of aggregate planning, Graphic and Charting methods, Transportation and HMMS method master scheduling.

   Scheduling and Sequencing : Factors, Affecting scheduling and its approaches, Grantt Chart, Algorithms for jobshop and flow shop, line balancing, LOB.
4. Materials Management : Purchasing, Stores, Inventory models and selective inventory control and Just – In – Time system of manufacturing, Material requirement, Planning and capacity requirements planning, Introduction to MRP II.
5. Maintenance Management : Types of maintenance strategies, Breakdown and Preventive Maintenance, Predictive and Total Productive Maintenance, Condition monitoring, Individual and Group replacement policies.

Books Recommended :

1. Monks J., Operations Management, McGraw Hill.
2. Charry S. N., Production and Operation Management.
3. Adam Ebert, Production and Operation Management, PHI.
4. A.K. Chitale and R.C. Gupta, Materials Management, PHI
5. G. K. Agrawal, Plant Layout and Material Handling, Jain Pub.

References Recommended :

1. Eilon S., Production Planning and Control, McMillan Pub. .

B.E. IV (IPE) (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM 4304	**Product Management**	**4**	**0**	**2**	**04**	**2**	70	30	60	40	**200**

Theory:

1. Product Design : Product specifications, concept development, configuration design involving synthesis, analysis and optimization, Detailed design, Presentation of design Oral and Visual presentations, various types of models used in product design, Design through creative routes, Adaptive and variant design, Concurrent Engineering.
2. Design for manufacturing and Design for assembly, Role of Aesthetics and Ergonomics in design. Design for Environment. Robust Design using Taguchi methods, Reliability based design. Modular versus integral design.
3. Value analysis-scope techniques and job plan, Standardization, Renard series, Simplification visa - vis Variety in products .Patents, copyright and Intellectual Property Rights.
4. Marketing Management: Philosophies of Marketing, Market and Product strategies, BCG matrix, Portfolio management, New Product development strategy.
5. Marketing channels, Pricing strategies and Promotional strategies, Consumer behavior, Sales Management, Planning of sales, Sales skills, evaluation and promotion, Advertising methods, preparation of advertising briefs.

Books Recommended :

1. Chitale A. K. and Gupta R. C., Product Design and Manufacturing, PHI.
2. Gupta V., Lal G.K. and Reddy ,"Fundamentals of Design and manufacturing" Narosa Publishing.
3. James Garrat, Design & Technology, Cambridge University Press.
4. Kolter, Philip, Marketing Management, PHI.

References Recommended :

1. Dieter, Engineering Design, Marketing Management, PHI.
2. Stanton, Principles of Marketing, Prentice Hall.

B.E. IV YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
		4	**0**	**3**	**04**	**2**	70	30	60	40	**200**

B.E. IV YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
HU23 _ _	**Engineering Economics and Financial Analysis**	**2**	-	-	**2**	-	70	30			**100**

1. Nature and scope of economics, Economic cyclic flow, Central Economic Problems, macro and micro economics, Laws of demand and supply, Demand curve and demand function, Cardinal and ordinal utility analysis of consumer equilibrium, price and income relations of consumer's equilibrium, Demand derivation, Elasticity of demand.
2. Production, Cost and Price: Equilibrium price, Production function, Laws of returns to variable proportions, Laws of returns to scale, Cost concepts, Analysis functions and their inter-relations, break-even point.
3. Pricing and Market: Equilibrium of firms and industry. Price determination under perfect competition, Imperfect competition and monopoly.
4. Accountancy and Business Organization: Book keeping and Accountancy, Trading account, Profit and loss account and balance sheet, Business and Industrial organization- Types, features, merits and demerits.
5. Financial Management and Analysis: Concept, Scope and functions and goals of financial Management, Financial Analysis, Ratio Analysis, Fund Flow Analysis, Break Even Analysis, Time Value of money & capital budgeting.

Books & References:

1. Dwivedi and Dwivedi: Engineering Economics, Vikas Publishing House, New Delhi India.
2. Truett and Truett, Managerial Economics, Weley India, New Delhi, India
3. Ghose, B.N. Managerial Economics and Business decisions, Ane Books Pvt.Ltd., New Delhi, India.
4. Pandey I.M., Financial Management, Vikas Publishing House, New Delhi India.
5. Maheshwary, Maheshwary and Maheshwary: Accounting for Management, Vikas Publishing House, New Delhi, India.
6. James C.Van Horne, FinancialManagement and Policy, Pearson Education Inc., New Delhi, India.

B.E. IV YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'
ELECTIVE -1

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
PE 4326	**Advanced Machining Processes**	**4**	**0**	**0**	**04**	-	70	30	-	-	**100**

1. Modern Machining Process: Introduction and classification. Abrasive Jet Machining: Fundamental principles, process parameters, Metal removal rate, effect of parameters, application & limitations. Ultrasonic Machining: Fundamental principles, process parameters, cutting tool design, tool feed mechanism, transducer, Design of velocity transformers, Mechanics of cutting, Effect of parameters, Economic considerations, application & limitations.
2. Chemical Machining: Chemical milling, chemical engraving, chemical blanking, fundamental principles and process parameters. Electrochemical Machining : Classification, fundamental principles, elements of process, Metal removal rate, electro-chemistry of process, Dynamics and hydrodynamics of process, optimization analysis, choice of electrolytes. Electrochemical Grinding: Fundamental principles, electro-chemical and process parameters, electrochemical deburring and honning.
3. Electrical Discharge Machining: Mechanisms of metal removal, Basic circuitry, Evaluation of metal removal rate, Machining accuracy, Surface finish, Analysis for optimization, tool material, dielectric fluid, application & limitation.
4. Laser Beam Machining: Features, metal removal, thermal analysis, cutting speed and accuracy, application & limitation, Micro-drilling by laser. Electron Beam Machining: Theory, forces in machining, process capability. Plasma Arc Machining: Non-thermal generation of plasma, mechanics of metal removal, various parameters, accuracy and surface finish, applications.
5. Plastics: Composition of plastic materials, Molding methods - Injection molding, compression molding, transfer molding, extrusion molding, Calendaring, Blow molding, Laminating & Reinforcing, Welding of plastics. Dies and Mould Design for Plastics and rubber Parts: Compression molding, transfer molding, blow molding.

Books & References Recommended :

1. Pandey P. C. & Shan H. S., *Modern Machining Process*, Tata McGraw Hill.
2. Dr. Bhattacharya Amitabh, *New Technology*, The Institution of Engineers Publication,
3. William J. Patton, *Plastic Technology Theory, Design & Manufacturing*, Reston Publishing Comp. INC, A P.H. Comp.

B.E. IV YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A' ELECTIVE -1

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
PE4327	**Plastic Engg. & Composites**	**4**	**0**	**0**	**04**	**-**	70	30	**-**	**-**	**100**

1. Introduction : Introduction to polymers classification of polymers – (a) Elastomers, (b) Fibre forming, Rheology of polymeric materials. Chemistry of Polymerization :(i) Chain Polymerization (ii) Step Polymerization (iii) Miscellaneous Polymerisation reactions (iv) Co-Polymerization. Chemical & Geometrical Structure of polymer molecules: (i) General introduction of polymer microstructure (ii) Microstructure based on the chemical structure (iii)Microstructure based on the geometric structure. Properties of Plastics as an Engineering Material : (i) Comparison of metals & plastics (ii) Mechanical properties of plastics (iii) Thermal properties of plastics.

2. Production Processes of Plastics : (a) Press Molding of Plastics – Compression molding, molding of thermostats and thermoplasts :(i) Product design of Press Moulding (ii) Product design of Compression Moulding.

(b) Injection Moulding : (i) Injection moulding process (ii) Influence of material properties on moulding (iii) Design of nozzle, runners & gates (iv) Product design for injection moulding. (c) Extrusion : (i) Extrusion operations (ii) The extruder screw, the banel, profile dies, bareker plate ad screen pach, cooling & take-off equipment (iii) Manufacturing of sheet and film (iv) Wire coating. (d) Blow Moulding :(i)Blow moulding principle, Production of perison, material characteristics in blow moulding (ii) Rotational moulding (iii) Expandable polystyrene moulding. (e) Thermoforming methods : Various types of vacuum forming methods. (f) Powder coating

3. Joining of Plastics :(i) Adhesives, cement and solvent bonding.

(ii) Welding of plastics – by hot gas, hot wire, induction and ultrasonic.

4. Machining, Finishing & Decorating of Plastics : (i) Effect of properties on machining in turning, drilling etc (ii) Abrasive finishing, barrel finishing and Buffing (iii) Decorating : Silk Screen, electroplating and vacuum metalizing.

5. Composites : (i)Introduction to composites (ii) Open and Closed mould processes (iii) Reinforcing fibres, Glass fibres (iv) The influence of reinforcing fibres on strength (v) Yarn designations (vi) Mats and fabrics

Books Recommended :

1.William J.Patton, *Plastic Technology Theory & Design & Manufacturing*,Reston Publishing Comp. INC, A.P.H. Comp.

2.Govazrikar V.R., Vishwanathan N.V., Jayadev Sreedhar, *Polymer Science*, Wiley Eastern Ltd., New Delhi.

3.Akira Kobayashi, *Machining of Plastics*, McGraw Hill Comp.

4.Miles D.C. & Briston J.H., *Polymer Technology*, Chemical Publishing comp.INC, New York.

References Recommended :

1.Sidney Levy & Harry Van J, *Plastic Product Design Engineering*, Nostrand Reinhold Comp.

2.Edward Miller, *Plastics Products Design* Hand Book Part A and B, Marcel Dekker INC, New York.

B.E. IV YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'
ELECTIVE -1

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM4328	**Management Information System and ERP**	**4**	**0**	**0**	**04**	-	70	30	-	-	**100**

1. Introduction to Information, Importance of Information, Characteristics of Information, Taxonomy of Information, Measurement of Information, Integrated Information System, Information Resource Management, search, storage and measurement of information.

2. Introduction to MIS, MIS definitions, Evolutionary Stages of MIS, MIS components, MIS Model, MIS concepts, Management concept of MIS, System concept of MIS, approaches to MIS, System approach, Management approach, subsystem approach, production, marketing, finance and personnel subsystems of MIS, Database Perspective of MIS.

3. Introduction to Computer Based Information Systems (CBIS), Importance and Characteristics of CBIS, Role of C.B.I.S. In Management , Transaction Processing System (TPS), Decision Support System (DSS), Group Decision Support System (GDSS), Executive Support System (ESS), Knowledge Work System (KWS).

4. Evolutionary stages of Enterprise Resource Planning(ERP), Need for ERP, Variety accommodation, Strategic and operational issues in ERP, Integrated and Business model of ERP, Zachmann enterprise architecture, MRP and MRP-II.

5. Introduction to Business Process Re-Engineering, ERP Implementation: Role of consultants, vendors and users, Guidelines and Procedure for ERP implementation, strategic advantage through ERP, ERP Domain.

Books & References Recommended :

1. Chhabra, Ahuja & Jain, Planning Men at Work.
2. Enterprise Resource Planning, Concept and Practice Garg V.K. Venkitkrishnan N.K., PHI
3. Business Process Re-Engineering, Jayaraman, , TMH.
4. ERP by Alexis Leon
5. Kanter, Management Information System, PHI.
6. Murdick & Ross, Management Information System, PHI.
7. James A. O'brion, Management Information Systems, TMH
8. Alan Simpson, D. Base –III

B.E. IV YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A' ELECTIVE -1

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM 4329	**Project Management & Entrepreneurship**	**4**	**0**	**0**	**04**	-	70	30	-	-	**100**

1. Project Management: Definition, characteristics, and life cycle, difference with operations management, Steps in PM, project manager's jobs, Organization for PM. Market Potentiality Analysis: Identification of opportunities of new products, Technical Analysis : Materials and Inputs, Selection of Appropriate Technology , Product mix, Plant capacity

2. Project Analysis & controls: Monitoring and Control: Features of control, Project control, Performance analysis and cost control curves, Line of balance, GERT, Financial Analysis : Estimation of cost of project, means of finance, newer modes of financing. Estimation of working capital, estimation of cost of production working results and profitability, Project cash flows.

3. Introduction to network theory. types of networks, AOA, AON.CPM: optimal time-cost trade offs; the problem of scarce resources; probabilistic activity networks (PERT),Slack, Floats and their applications, generalized activity networks (GERT, GAN): Resource Leveling Introduction to Microsoft PROJECTS &other related softwares

4. Entrepreneurship: introduction and importance of EP in national and world economy, ownerships, Current incentive schemes for SSI in India; problems and solutions. Theories of entrepreneurship. Entrepreneurial Behaviour: traits of an entrepreneur, Transactional analysis, Priorities and management of time, self image, skills and creativity achievement motivation, Entrepreneurial communication, role playing exercises, Analyzing situations and opportunities. Risk creativity trade off.

5. Project Report Preparation : Detailed project report preparations for various agencies., Planning of a new enterprise. Introduction to IPR, Procedures and practices. GATT,

Books Recommended :

1. Prasanna Chandra, Project Preparation, Appraisal and Implementation, Tata McGraw Hill Publishing Co.1, New Delhi.
2. Dennis Lock, Project Management, Galgotia Book Service, New Delhi.
3. Chaudhary S., Project Management, TMH.
4. Pitman K. G., Critical Path Analysis, Lockyer
5. Sudha G.S. Fundamentals of Entrepreneurship, Ramesh Book Depo Jaipur.
6. Khanka S.S. Entrepreneurial Development S. Chand Publishers.
7. Gupta C.B. and Srinivasan S. Entrepreneurial Development SultanChand and Sons Publishers.

B.E. IV YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A' ELECTIVE -1

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
ME 4330	**Automobile Engineering**	**4**	**0**	**0**	**04**	-	70	30	-	-	**100**

1. Vehicle Structure: Fine frame, integral body structure, engine, transmission and body structure mountings, subframes collision safety, type of rubber flexible mounting. Vehicle ride characteristics: human response, vehicle ride.

   Handling System and Steering System: Study state handling characteristics and response to input .Steering gear box fundamental design. Need for power steering, steering linkages ball and socket joints.

   Suspension: Suspension geometry camber, Swivel & Castor angle. Suspension roll centres body roll stability. Antirol stiffness. Rubber Spring pump or limiting stop. Axle location, front wheel drive, independent suspension, McPherson stut & rear wheel. Hotch kiss drive springs & shock absorber.

2. Pneumatic Tyre: Mechanics of type forces, rolling resistance, tractive effort & step. Cornering properties & stiffness, Performance on roads. Tyre material & construction, Thread design & its marking identification brakes,

   Braking fundamentals, Brake shoe & pad fundamentals brake & shoe expander & adjuster disc brakes. Dual brake system, anti locking brakes air operated power brakes.

3. Friction Clutch: Clutch fundamentals, Angular driven plate, Cushioning & tortional damping, Friction material, clutch alignment, types of clutch – diaphragm, multi-plate etc., hydraulically operated automatic transmission clutch.

4. Transmission : The necessity for a Gear box, five speed and reverse synchromesh, Gear box synchronization & engagement, remote controlled gear selection & engagement, splitter & range change gear box, over drive considerations setting gear ratios, Hydrokinetic fluid coupling & torque converter, final drive transmission, crown wheel & pinion axle adjustment, differential locks, skid reducing universal joint, four wheel drive & two wheel drive.

5. Performance Characteristics of Road Vehicles: Tractive effort weight & axle loads, aerodynamics forces, vehicle power plant & transmission characteristics & its prediction operating fuel economy. Electrical System: Self starting mechanism & battery charging system, Lighting & wiring system for horn, lamp indicators etc. General: Air conditioning, auto-inspection motor vehicle acts, emission standard & its control.

Books & References Recommended :

1. Hinz, *Advanced automobile*.
2. Wrong, Theory *of ground vehicle*.
3. Newton steeds Garret, *The motor vehicle*.
4. Crouse/ Anglin, *Automotive mechanics*, TMH Edition .
5. *The series of judge*, The modern motor Engg.

B.E. IV YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
PE 4358	**Tool Engineering & Design of Cutting Tools**	**4**	**0**	**2**	**04**	**2**	70	30	60	40	**200**

1. Tooling classification, material, properties and application, General design considerations. Design of single point cutting tool for strength & rigidity, Design for optimum geometry, Design strategies for H.S.S. Carbide and Ceramic, Chip Breakers, Design of form tool. Design of drill, and milling cutters

2. Design of Metal Working Tools: Design of elements of press working tool dies and die set, concept of center of pressure, compound dies, progressive dies, Combination dies, bending, forming dies, press tonnage and its calculations.

3. Tooling for forging and rolling – Design principles for forging dies, drop forging, upset forging, Design principles and practice for rolling, roll pass design.

4. Design of Jig and Fixtures : Economics of jigs and fixture, principle of location and clamping, Drilling Bushes, Design of various jigs and fixtures, such as Drilling jig, milling fixture, Assembly fixture, Welding fixtures.

5. Dies and Mould Design for Plastics and rubber Parts: Compression moulding, transfer moulding, blow moulding.

Books & References Recommended :

1. Wilson, Fundamentals of Tools Design, ASTME.
2. Parron, Tooling for Production.
3. Donaldson, Tool Design, T.M.H.
4. Paqwin J.R., Dies Design Handbook, The Industrial Press NY.
5. Archinow, Metal Cutting & Tool Design, MIR Publishers, Moscow,
6. Kempster M.H.A., Introduction to Jig and Tool Design, ElBS.
7. Joshi, Jigs and Fixture.

B.E. II (IPE) (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'A'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM 23_ _	**Principles And Practice Of Management**	**2**	**-**	**-**	**2**	**-**	70	30			**100**

Theory :

1. Introduction: Origin of management concept, Management process. Principles related to organization: Organization, its role and importance, Theories of organization, Departmentation, Delegation, Span of control, line and staff relationship, Shaping overall structure.
2. Personnel Management : Role and functions of personnel management, Organization of personnel dept., Personnel problems and their solution welfare techniques. Manpower Selection and Development: Sources of recruitment, Selection methods, Interviewing and testing, Training methods, Performance appraisal and its methods.
3. Motivation and Leadership: Need analysis, theories of motivation, Integrating pay, need and organization, Wage curve, Salary structure and number of grades, Merit Rating.
4. Job Evaluations: Purpose, Various types of job evaluation systems and their applications, Job classification, Wage curve, Salary structure and number of grades, Merit Rating.
5. Employee – Employer Relations and Labour Legislation: Employee – Employer relations, Industrial conflicts, conciliation, Arbitration, Adjudication, collective bargaining, strikes and lockouts, Grievances, Procedures, Trade Unions and their functions. Principle and practice of labour legislation.

Books Recommended :

1. Koontz & O'Donnel, Essential of Management, McGraw-Hill.
2. Robbins, Organizational Behaviour, PHI.
3. Agrawal R.D., Organization and Management, TMH.
4. Chhabra, Ahuja & Jain, Planning Men at Work.
5. Chhabra, Human Resource Management.

References Recommended :

1. Terry & Francklin, Principles of Management, Richard – Erwin.

B.E. IV YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM 4360	**Supply Chain Management**	**4**	**0**	**0**	**04**	-	70	30	-	-	**100**

1. Introduction to SCM: Definition, elements of supply chain, building blocks of supply chain network, drivers of supply chain, Decision making in supply chain, Decision making models, supply chain performance measurement.

2. Demand management in supply chain: Demand planning and forecasting, types of demand, Forecasting methods, Aggregate planning , Economic Order Quantity models and Reorder Point models, Inventory optimization in supply chain.

3. Mathematical foundations of Supply chain Solutions: Stochastic models and Optimization techniques in Supply Chain Planning, Facility layout, capacity planning, routing and scheduling in supply chain, determining optimal levels of product availability.

4. Logistic Management: Definition, Elements of logistics management, Organization for logistics function, Logistics function integration, logistic function performance measurement, distribution and distribution strategies, integrated logistics and business logistics, customer orientation and relationship management.

5. Transportation, Network design and Information Technology: Transportation fundamentals, Decisions in transportation, Network design in supply chain, Information Technology for supply chain management, Coordination, E-business, E-procurement, E-logistics, E-markets, Internet auctions, E-business process optimization.

Name of Books/ Authors/ Publisher

1. "Business Logistics Management", Ronald H. Bolau
2. "Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies", D. S. Levi, P. Kaminsky, and E. S. Levi, Irwin McGrawHill,2000
3. "Introduction to Supply Chain Management", R.B. Handfield and E.L. Nochols, Jr., Prentice Hall (ISBN 0-13-621616-1),1999
4. "Logistical Management", Bowersox D.J.,ClossD.J. & Helferich O.K.
5. "Materials Management", A.K. Chitale and R.C. Gupta, PHI, 2006
6. "Modeling the Supply Chain", J. F. Shapiro, Duxbury Thomson Learning,2001
7. "Strategic Logistics Management", Lambert D.M.& Stock J.R.
8. "Supply Chain Management: Strategy, Planning, and Operation", Sunil Chopra and Peter Meindel, Prentice Hall of India,2002
9. Quantitative Models for Supply Chain Management", Sridhar Tayur, Ram Ganeshan, Michael Magazine (editors), Kluwer Academic Publishers,1999

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SEMESTER 'B'

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
PE-4361	**Computer Integrated Manufacturing**	**4**	**0**	**3**	**04**	**2**	70	30	60	40	**200**

1. Rapid Prototyping Technologies : Sterelithography, Selective Photocuring, Selective sintering, Fused Deposition Modeling, Laminated Object Manufacturing, 3D Printing, Applications of RP techniques, Emerging Techniques in RP, RP Methodology, Rapid Tooling. Process capability of RP and RT methods
2. Group Technology: Concept, Part family formation, Part Classification and Coding Systems types, OPITZ system, Production Flow Analysis, Composite Part Manufacturing and Machine Cell formation. Process planning, Computer Aided Process Planning and its Types.
3. Industrial Robotics : Robot Anatomy, Robot Classification, Essential Features and characteristics, Common configuration, Robot Application. Introductions to Robot kinematics. Introduction to Robot programming
4. Flexible Manufacturing Systems : Concept, Components and Types. Automated Storage and Retrieval Systems, AGVs and their types, Adoption Strategies of FMS, Flexibility Analysis. FMS Scheduling.
5. Computers Integrated Manufacturing Definition, CIM wheel concept, Evolution of CIM, CIM and systems view of manufacturing, and CIM IT & concurrent engineering, Economic Impact of CIM and Scale Dynamics.

Reference

1. Ramamurthy, Computer Graphics & CAD, T.M.H.
2. Groover, Production System & CIM, P.H.I.
3. Grieves Michael, Product Life Cycle Management, McGraw Hill
4. John Stark, Product Life Cycle Management: Paradigm for 21st Century, Springer-Verlag
5. Burns Automated Fabrication
6. Groover & Zimmers, CAD/CAM, P.H.I.
7. Besant & Lui, CAD/CAM, E.W.P.
8. Surendra Kumar, Industrial Robotics & CIM, I.B.H.
9. Zeid, CAD/CAM Theory & Practice.

B.E. IV (IPE) (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B' ELECTIVE – II

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM 4376	Ergonomics	4	0	0	04	-	70	30	-	-	100

1) Introduction: Definition, History of Development, Characteristics of Man Machine Systems, Relative capabilities of Human beings and Machines,
2) Information Input and Processing :
   a) Introduction to information theory, Factors affecting information reception and processing. Coding and Selection of sensory inputs.
   b) Human Sensory Process: Vision, Hearing, Cutaneous, Kinesthitics, and orientation senses.
3) Display:
   a) Visual Display: Quantitative and qualitative types of visual display, Visual indicators and warning signals, pictorial and Graphic displays, Alphanumeric Characteristics, Symbolic Codes.
   b) Auditory and Textual Display: General Principles, Characteristics and Selection of Auditory and Textual display.
4) Human Motor Activities :
   a) Biomechanisms of motion, Measurement of Physiological Functions, Energy Expenditure in Physical Activities.
   b) Human Control of Systems: Human input and output channels. Compatibility, Tracking Operations, Design of Control.
   c) Anthropometry: Anthropometrics Data and their uses, Work Space Dimensions. Design of seats and seating Arrangement, Location of components, Design of work place.
5) Environment and Safety: Introduction to Environmental stresses and their impacts on human work. Industrial Safety: Analysis of cost of accidents, Hazards in various fields like Fire, Electrical shocks. Chemicals, Material Handling, Radiation Machine and Machine Tools and Methods of eliminating them, Personnel Protective equipments, Government legislation about occupational safety, organization for safety, plant safety.

Books Recommended :

1. McCormick, Human Factors in Engineering and design.
2. Singalton, Introduction to Ergonomics.

References Recommended :

1. Grandjean, fitting task to the men, TMH

B.E. IV (IPE) (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING

SEMESTER 'B' ELECTIVE – II

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM 4377	**Total Quality Management**	**4**	**0**	**0**	**04**	-	70	30	-	-	**100**

Theory :

1. Evolution of Total Quality Management, Historical perspective. People involvement, Teamwork, Discipline, Supplier involvement, Defining the immediate customer, Quality at source.
2. Elements of TQM : Total employee involvement, Elimination of Waste and problem exposure, Total Quality Control Systems, SPC and ISO 9000, Demings wheel, Deming 14 points-Pros and Cons in Industrial Engineering context. Philip Crosby Philosophy, Ishikawa Diagram. Just-in-time philosophy, Design and Development strategy in TQM, Quality function development.
3. Just-in-time Management : Problems of queues, Tenets of JIT. Load smoothing, Push vs pull method of production, Set up time reduction.
4. Total Productive maintenance (TPM), Kaizen and continual improvement, Cost benefit analysis, Life cycle costing.
5. Application of TQM to service type organizations, Service guarantees, Case studies on application of TQM to service type organization, Various quality awards, Cost benefit analysis, Life cycle costing.

Books Recommended :

1. D. D. Sharma, TQM, Sultanchand
2. Chitale and Jain, TQM & ISO – 9000.

References Recommended :

1. Juran J. M., Quality Planning and Analysis.

B.E. IV YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B' ELECTIVE – II

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
PE 4378	**Rapid Prototyping Rapid Tooling and Reverse Engg.**	**4**	**0**	**0**	**04**	**-**	70	30	-	-	**100**

1. Phases of Product Development, Problems in Product Development. Need for Rapid product development. Virtual Reality (VR), Introduction, Features used in VR, Technologies used in VR.
2. Rapid Prototyping. Methods of Rapid prototyping. CAD to Rapid prototyping Process, STL format, Support structures, Classification of RP methods. Laminated Object Manufacturing (LOM), Approaches to LOM, Steps in LOM, LOM machine and process capability, Applications, Kira's LOM. Fused Deposition Modeling (FDM), principles, steps, machines and applications. Selective Laser Sintering (SLS), Principles, Operations, Machines, Materials and Applications. 3D Printing. Principles, Operations, Machines, Materials and Applications
3. Selective Photocuring technologies: Selective Laser Scanning, Stereo Lithography Apparatus (SLA). Principle, Steps and post processing. SLA machines and process capability, Applications. Photocuring through Mask, Solid Ground Curing (SGC), Principle, Steps, Application and machines. SLA Quick CAST and its applications.
4. Emerging Techniques in RP: Shape Deposition Modeling, Contour Crafting, Droplet Deposition Method. Reverse Engineering, Approaches, CMM and its applications, Principle of Non-contact Measurement: Laser Scanner, Introduction to Photogrammetry.
5. Rapid Tooling: Indirect methods, Silicon Rubber Molding, Epoxy Tooling, Electroforming, Spray Metal Tooling, Cast Kirksite Tooling, 3D Keltool, Direct methods: 3D printing, SLS, Laminated Tooling, Hybrid Layer Manufacturing.

References

1. Integrated Product Management, Andreasen MM, Hein L, IFS publication
2. Automated Fabrication: Burns
3. Peter D. Hilton and Paul F. Jacobs (Ed.), 2000, *Rapid Tooling: Technologies and Industrial Applications*, Marcel Dekker
4. Rapid Prototyping, Principles and Applications, 2nd Edition, C K Chua, K F Leong & C S Lim

B.E. IV YEAR (4YDC) INDUSTRIAL & PRODUCTION ENGINEERING
SEMESTER 'B' ELECTIVE – II

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
IM 4379	**Product Life Cycle Engineering and Management**	**4**	**0**	**0**	**04**	-	70	30	-	-	**100**

1. Product specifications, concept development, configuration design involving synthesis, analysis and optimization, Detailed design, Presentation of design Adaptive and variant design, Concurrent Engineering

2. Product data management, Pre-requisites for PLM. PLM benefits. PLM implementation methods. Product Life Cycle Engineering: Design for X, Components of DFX.

3. Design for manufacturing and Design for assembly, Role of Aesthetics and Ergonomics in design.. Robust Design using Taguchi methods, Reliability based design. Modular versus integral design. Design for environment (DFE), Life cycle assessment (LCA), Steps of LCA. Determining system boundaries, Life Cycle Inventory compilation, Common LCA methods and their impact categories.

4. Value analysis-scope techniques and job plan, Standardization, Renard series, Simplification visa - vis Variety in products .Patents, copyright and Intellectual Property Rights.

5. Marketing Management: Philosophies of Marketing, Market and Product strategies, BCG matrix, Portfolio management, New Product development strategy. Marketing channels, Pricing strategies and Promotional strategies, Consumer behavior, Sales Management, Planning of sales, Sales skills, evaluation and promotion, Advertising methods, preparation of advertising briefs.

Books & References Recommended :

1. Chitale A. K. and Gupta R. C., Product Design and Manufacturing, PHI.
2. Gupta V., Lal G.K. and Reddy ,"Fundamentals of Design and manufacturing" Narosa Publishing.
3. James Garrat, Design & Technology, Cambridge University Press.
4. Dieter, Engineering Design, Marketing Management, PHI.
5. Kolter, Philip, Marketing Management, PHI.
6. Stanton, Principles of Marketing, Prentice Hall. Grieves Michael, Product Life Cycle Management, McGraw Hill
7. John Stark, Product Life Cycle Management: Paradigm for 21st Century, Springer-Verlag
8. Product Life Cycle Engineering and Management, CEP Lecture notes, Prof B Ravi, IIT Bombay

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SEMESTER 'B' ELECTIVE II

Subject Code	Subject Name	L	T	P	Th. Credit	Pr. Credit	Maximum Marks				
							TH	CW	SW	Pr	Total
CO 4380	**Robotics and Robot Applications**	**4**	**0**	**0**	**04**	-	70	30	-	-	**100**

1. Introduction : Need and importance – basic concepts – structure and classification of industrial robots – terminology of robot motion – motion characteristics – resolution, accuracy, repeatability – robot applications.

2. End Effectors and Drive systems: Drive systems for robots – salient features and comparison – different types of end effectors – deswign – applications.

3. Sensors: Sensor evaluation and selection – Piezoelectric sensors – linear position and displacement sensing – resolvers, encoders – velocity measurement – proximity, tactile, compliance and range sensing.
Image Processing and object recognition.

4. Robot Programming: Teaching of robots – manual – walk through – teach pendant – off line programming concepts and languages – applications.

5. Safety and Economy of Robots: Work cycle time analysis – economics and effectiveness of robots – safety systems and devices – concepts of testing methods and acceptance rule for industrial robots.

References:

1. Yu KOzyhev, Industrial Robots Handbook, MIR Publ, 1985
2. Groover M.P., CAM and Automation, Prentice Hall, 1985.
3. Shimon, K., Handbook of Industrial Robots, John Wiley & sons, 1985.
4. Janakiraman P.A., Robotics and Image Processing – Tata McGraw Hill Publ Co.Ltd., 1995.
5. Yoram Koren, Robotics for Engines, McGraw Hill Book Co., 1987.
6. Fu, Lee & Gonzalez, ROBOTICS, Prentice Hall.

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