

Engineering and Management Institute of India

Diploma in Engineering

INDUSTRIAL & PRODUCTION ENGINEERING SYLLABUS

Second Year		
Subject Code	Subject Name	Page
IPE-2.1	STRENGTH OF MATERIAL	3
IPE-2.2	FLUID MECHANICS	5
IPE-2.3	WORKSHOP TECHNOLOGY	7
IPE-2.4	ENVIRONMENTAL ENGINEERING	9
IPE-2.5	MATERIAL SCIENCE & ENGINEERING	11
IPE-2.6	THEORY OF MACHINE	13
IPE-2.7	THEORY OF ELECTRICAL ENGG	15
IPE-2.8	PRODUCTION PLANING AND CONTROL	17
IPE-2.9	INDUSTRIAL ECONOMY	19
IPE-2.10	PRODUCTION PLANING AND CONTROL	21

Third Year		
Subject code	Subject Name	Page
IPE-2.11	CNC MACHINE	23
IPE-2.12	POWER PLANT ENGG	25
IPE-2.13	QUALITY MANAGEMENT	27
IPE-2.14	OPERATIONS RESEARCH	29
IPE-2.15	SIMULATION OF PRODUCTION SYSTEMS	31
IPE-2.16	ENTREPRENEURSHIP DEVELOPMENT. & MANAGEMENT	33
IPE-2.17	INDUSTRIAL MANAGEMENT	35
IPE-2.18	PROJECT WORK	37

Department of Industrial & Production Engineering

Vision:-

To strengthen the region through imparting superior quality technical education and research; which enables the fulfillment of industrial challenge and establish itself as a Centre of Excellence in the field of Industrial & Production Engineering.

Strength of Material (IPE-2.1)**UNIT-I**

Simple Stresses & Strains : - Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT –II

Shear Force and Bending Moment Diagrams: - Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure.

UNIT – III

Flexural Stresses: - Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, sections. Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T sections.

UNIT – IV

Thin Shells:- Definition – Thin and thick cylindrical shell Failure of thin cylindrical shell subjected to internal pressure Derivation of Hoop and longitudinal stress causes in a thin cylindrical shell subjected to internal pressure simple problems change in dimensions of a thin cylindrical shell subjected to internal pressure -problems Derivation of tensile stress induced in a thin spherical shell subjected to internal pressure simple problems change in diameter and volume of a thin spherical shell due to internal pressure.

UNIT –V

Torsion of Circular Shafts: - Theory of pure torsion, Derivation of torsion equations: $T/J=q/r=N\theta/L$ Assumptions made in theory of pure torsion-Torsional moment of resistance – Polar section modulus – Power transmitted by shafts. Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders.

Reference Book:-

1. Strength of Materials by (R.K. Bansal ,Laxmi Publications 2010).
2. Strength of materials by (Sadhu Singh.Khanna Publications).
3. Strength of Materials by (S.Timshenko)

Fluid Mechanics (IPE-2.2)**UNIT-I**

Fluid statics:- Dimensions and units: physical properties of fluids-specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric gauge and vacuum pressure –measurement of pressure. Manometers- Piezometer, U-tube, inverted and differential manometers. Pascal's law, hydrostatic law. Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

UNIT –II

Fluid kinematics:- Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics:- surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

Closed conduit flow:- Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

UNIT – III

Boundary Layer Theory:- Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

Dimensional Analysis:- Similitude and modelling – Dimensionless numbers.

Performance of hydraulic turbines:- Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systemshydraulicram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

UNIT – IV

Basics of turbo machinery:- hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

of turbo machinery:- hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

UNIT –V

Centrifugal pumps:- classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Hydraulic Turbines:- classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube- theory functions and efficiency.

Reference Book :-

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

Workshop Technology (IPE-2.3)**UNIT-I****Introduction and Demonstration: -**

Introduction to various shops / sections and workshop layouts. Safety norms to be followed in a workshop should be conveyed to students.

Carpentry Shop:-

Introduction of Tools & operations, Types of woods & their applications, Types of Carpentry hardware and their uses, Carpentry Joints, carpentry operations such as marking ,sawing, planing, chiseling, grooving, boring, joining, types of woods and carpentry hardware.

UNIT –II**Fitting Shop:-**

Introduction of Tools & operations, Types of Marking tools & their uses, Types of fitting cutting tool & their uses, fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping.

Smithy Shop:-

Tin Smithy: - Introduction of Tools like hammers, stakes, scissors etc, & operations like shearing , bending ,joining. Types of Sheet metal joints and applications. Black Smithy: Introduction of forging tools and it's operations.

UNIT – III**Metal Joining Shop: -**

Introduction of Tools, Types of welding Joint, Arc welding, Gas welding. Gas Cutting. Soldering, Brazing.

Machine Shop:-

Introduction of machine tools and operations, Demonstrations of basic machine tools like Lathe, Shaper, drilling, Milling machine and CNC with basic operations and uses.

UNIT – IV**Masonry:-**

Different types of Bricks, Different size and part of Bricks, Different types of Bonds, Types of tools used for various masonry works.

Electrical:-

Measure voltage, current, frequency, phase difference, power, power factor for single and three phase supply, Wire fan, tube light, two-way control, Wire MCB, ELCB for a given load circuit.

UNIT – V**Electronics:-**

Introduction to basic electronics components, Controller and its testing: Resistors, Inductors, Capacitor, Diode, BJT, Introduction to testing and Measurement Instruments: Power Supply, Function Generator, Oscilloscope.

Reference Book:-

1. Internal Combustion Engine by V. Ganesan.
2. Internal Combustion Engine by R.K. Rajpoot.

ENVIRONMENTAL ENGINEERING (IPE-2.4)**UNIT-I****INTRODUCTION:-**

Man and Environment :- Overview (socio-economic structure & occupational exposures) – Scope of Environmental Engineering – pollution problems due to urbanization & industrialization.

UNIT –II**AIR POLLUTION :-**

Causes of air pollution :- types & sources of air pollutants- Climatic & Meteorological effect on air pollution concentration- formation of smog and fumigation.

UNIT – III

Analysis of Air Pollutants :- Collection of Gaseous Air Pollutants- Collection of Particulate Pollutants – Analysis of Air Pollutants like : Sulphur dioxide – Nitrogen oxide – Carbon monoxide – Oxidants & Ozone – Hydrocarbons – Particulate Matter.

UNIT – IV

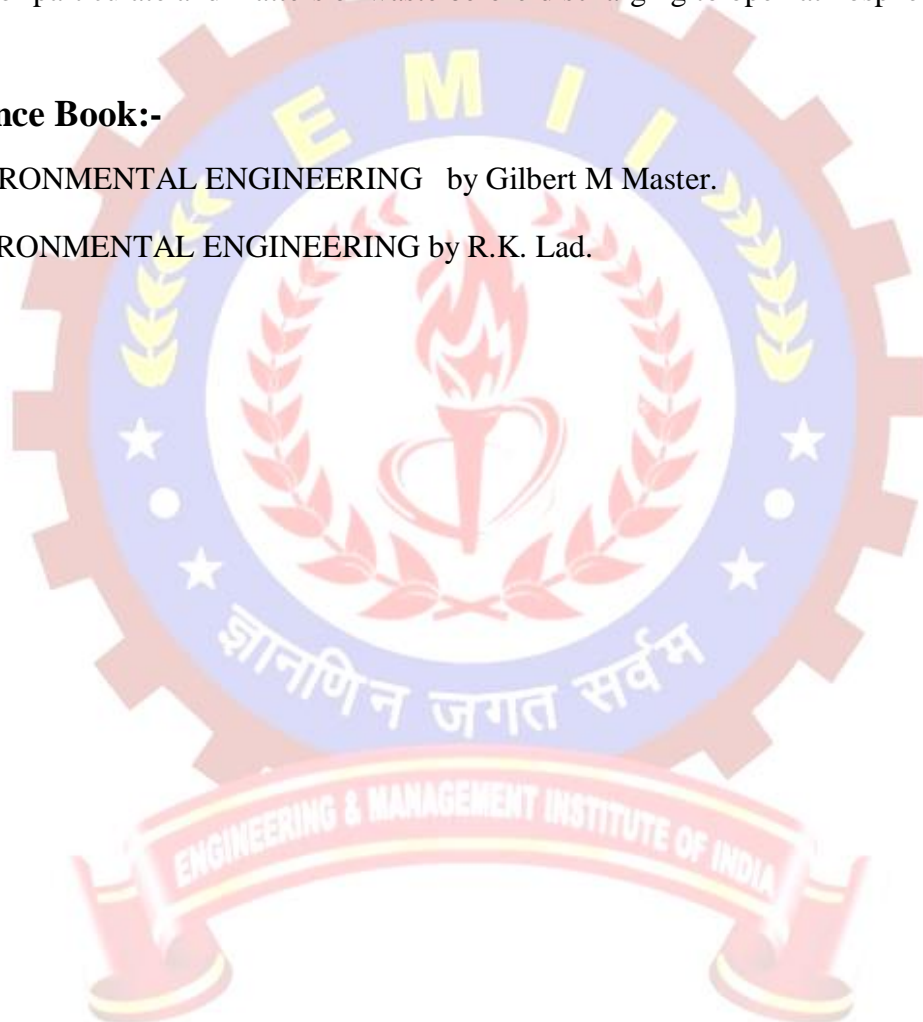
Air Pollution Control Measures & Equipment :- Control of Particulate Emission – Control of Gaseous Emission – Flue Gas Treatment Methods : Stacks Gravitational and Inertial Separation, Settling Chambers, Dynamic Separators, Cyclones, Filtration, Liquid Scrubbing, Spray Chambers, Packed Towers, Orifice and Ventury Scrubbers, Electrostatic Precipitators, Gas/solid Adsorption, Thermal Decomposition.

UNIT –V

Methods & Approach of Air Pollution Control :- Controlling smoke nuisance – Develop air quality criteria and practical emission standards – Creating zones suitable for industry based on micrometeorology of air area – Introducing artificial methods of removal of particulate and matters of waste before discharging to open atmosphere.

Reference Book:-

1. ENVIRONMENTAL ENGINEERING by Gilbert M Master.
2. ENVIRONMENTAL ENGINEERING by R.K. Lad.



MATERIAL SCIENCE & ENGINEERING (IPE-2.5)**UNIT-I**

Introduction and structure of materials:- study properties of materials? Structure of atoms - Quantum states-Atomic bonding in solids-binding energy-inter atomic spacing - variation in bonding characteristics - Single crystals – polycrystalline - Non crystalline solids - Imperfection in solids – Vacancies – Interstitials - Geometry of dislocation - Schmid’s law - Surface imperfection - Importance of defects - Microscopic techniques - grain size distribution.

UNIT –II

Solid solutions and alloys - Phase diagrams - Gibbs phase rule - Single component systems – Eutectic phase diagram – lever rule - Study of properties of phase diagrams - Phase transformation - Nucleation kinetics and growth.

UNIT – III

Band model of semiconductors - carrier concentrations in intrinsic, extrinsic semiconductors – organic semiconductors - Fermi level - variation of conductivity, mobility with temperature – law of mass action - Hall effect - Hall coefficients for intrinsic and extrinsic semiconductors – Hall effect devices. Application of diffusion in sintering, doping of semiconductors and surface hardening of metals.

UNIT – IV

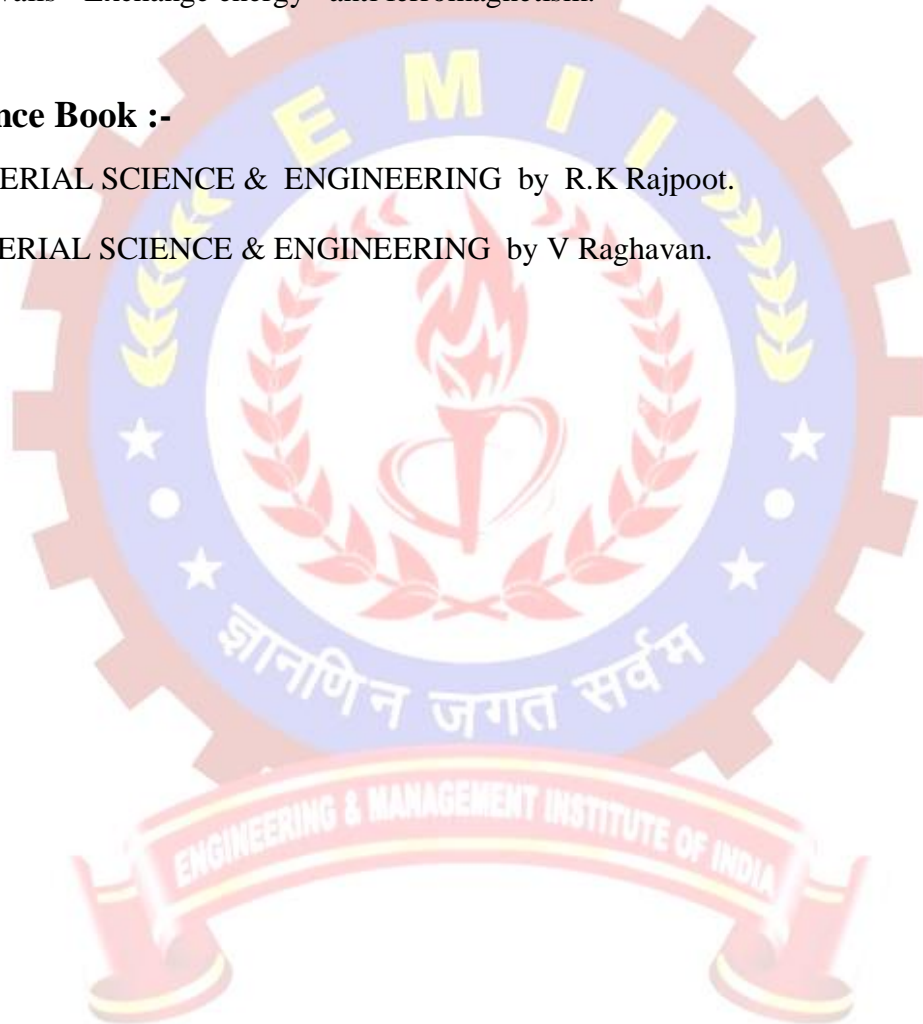
Mechanical properties - Stress, Strain, Elastic properties – Deformation – elasticity – hardness - Optical properties - Light interaction with solids - Atomic, electronic interaction, non – radiative transition - refraction, reflection, Absorption, Transmission, Insulators, luminescence.

UNIT -V

Magnetic properties - paramagnetism - ferromagnetism - domain theory - magnetic hysteresis, Weiss molecular field theory, Heisenberg's theory - magnetic anisotropy - domain walls - Exchange energy - anti ferromagnetism.

Reference Book :-

1. MATERIAL SCIENCE & ENGINEERING by R.K Rajpoot.
2. MATERIAL SCIENCE & ENGINEERING by V Raghavan.



Theory of Machine (IPE-2.6)**UNIT-I**

Transmission of Power :- Flat and V-belt drives Velocity ratio of belt drives, slip in belt, and creep in belt. Length of open and cross belt drives Power transmitted by a belt Ratio of driving tension, centrifugal tension, Condition for the maximum power transmission, initial tension in the belt. Chain drives - types of chain drives roller chain and inverted tooth chain. Gear drives - Types of gear wheels, proportions of gear tooth Gear trains - Simple gear train, compound gear train, reverted gear train and simple epicyclical gear train.

UNIT-II

Balancing :- Static and dynamic balancing Balancing of single rotating mass by a single mass in the same plane, by two masses rotating in different planes. Partial primary balancing of a single cylinder reciprocating engine.

Power Transmission Devices (Belt, Rope and Chain Drive):- Introduction, Belt and rope drives, open and crossed belt drives, actions of belt on pulleys, velocity ratio, Material for belts and ropes, Slip in belts & ropes, Types of V Belt and Flat belt, Types of pulleys – step pulley, flat pulley, Crowning in pulley, Laws of belting and length of belt (open & cross belt), Ratio of tensions, Power transmitted and max power transmitted by belt, Centrifugal effect on belt, Initial tension, Chain drive, classification of chains, Selection of rope based on the load to be lifted.

UNIT - III

Dynamics of Reciprocating Parts :- Analytical method for velocity and acceleration of piston Piston effort, crank pin effort, turning moment diagrams Fluctuation of energy and speed Energy of a flywheel Calculating the weight of flywheel.

Friction :- Friction of collars and pivots Friction clutches-plate clutch and centrifugal clutch Friction in journal bearings Rolling friction Prony brake, Rope brake and Froude's hydraulic dynamometer.

Vibration :- Causes of vibrations in machine, their effects and method of reducing them
Free or natural vibration Forced vibration Damped vibration.

UNIT – IV

Simple Mechanism :- Introduction to link, kinematic pair, kinematic chain, structure, mechanism, machine Slider crank mechanism and its inversion Double slider crank chain Example of mechanism with higher pairs.

Velocity and Acceleration in Mechanism :- Velocity diagrams of four bar and single slider crank mechanisms by relative velocity method and instantaneous centre method Acceleration diagram of four bar chain and reciprocating engine mechanism.

UNIT –V

Fly Wheel:- Functions of fly wheel, Kinetic Energy of rotating masses, turning moment diagram. Types of fly wheels, Co-efficient of energy & speed, Simple problems.

Governor:- Functions of governor; comparison between a fly wheel and governor. Types of governor – Principle, construction and working of Watt governor Porter, governor, Hartnell governor. Simple problems on watt and porter Governor, Terminology used in Governors, Height, equilibrium speed, Hunting, isochronism, stability, sensitiveness (No numerical problem).

Reference Book :-

1. Mechanism and Machine Theory by JS Rao and Dukkipati.
2. Theory of Machine by S.S Rattan.

THEORY OF ELECTRICAL ENGG (IPE-2.7)**UNIT-I**

Introduction -Basic electrical engineering, Faraday's law of electromagnetic induction, D.C. Generator, EMF equation, type of generator, A.C. fundamental, basic idea of alternators (type, equation of emf), power factor, power triangles, method improving p. f. Resistance/ Capacitor/Inductance, RLC circuit, Fundamental of transformer 1- \emptyset ,3- \emptyset emf equation, transformation ratio ($K = \frac{e_2}{e_1} = \frac{n_2}{n_1} = \frac{i_1}{i_2}$) numerical on it. KVA rating and calculation. Open/short circuit test of transformer. Maximum efficiency, Losses in transformer, concept of $\lambda \Delta$, $\Delta \lambda$. Connection of transformer.

UNIT –II

3- \emptyset . Induction motor (sq. cage/slip-ring)., method of starting. $\lambda \Delta$ starter, auto transformer starter, Rotor resistance starter, slip, torque, losses, efficiency. Double revolving theory, Single phase induction motor/working principles Synchronous Motors: Methods of starting, operation of synchronizing motor as a condenser and as a reactor, Application in Industries and Mines.

UNIT – III

Transmission and Distribution of Electrical Power in Mines concept of EHT, HT, LT voltages: Performance of short transmission lines; radial and ring-main distribution systems, line diagram from generation to load centre. Substation arrangements for opencast and underground mines, distribution of electrical power in mines, cables used in mines.

UNIT – IV

Mining type switchgears and protective devices: Types of circuit breakers, Gate end box, Drill panel, and Tran switch, Field Switch. Symmetrical faults and circuit breaker rating calculation. Protective relays: Thermal and induction disc type overload relays; mining type earth fault relay. Signaling and communication: basic concept of underground mine communication, Haulage and Coal face signaling systems for underground coal mines,

UNIT -V

Electrical Safety in Mines: Concept of neutral and earth ,Neutral Grounding and Equipment earthing practice in mines, principles of flameproof enclosure, intrinsic safety, Indian Electricity Rules as applied to mines – mainprovisions. Mine lighting system.

Reference Book:-

1. Electrical Engineering by D.R.Nagpal.
2. Electrical Engineering by J.B.Gupta.



PRODUCTION PLANING AND CONTROL (IPE-2.8)**UNIT-I**

Production Processes: -discrete and process types, mass, batch, unit flexible manufacturing types, manufacturing operations: selection of a process, difference between manufacturing and service operations, classification of manufacturing processes, 5 Ps in the organization.

Process Design: -Systems approach to process planning and design, linkage between product planning and process planning, distinction between process planning and facilities planning, types of process design, product mix, process planning aids, process design procedure.

UNIT –II

Forecasting: -characteristics of demand over time, forecasting qualitative model: Delphi, naïve quantitative models: simple average, simple moving average, weighted moving average, exponential smoothing, smoothing coefficient selection, adaptive exponential smoothing, incorporating trend and seasonal components, linear regression, selection of forecasting models.

UNIT – III

Aggregate Planning: -Concept, strategies for aggregate planning: three pure planning strategies, graphical method for aggregate output planning, master production scheduling (MPS), and procedure for developing MPS.

UNIT – IV

Shop floor planning and control: -Nature, factors determining production planning, factors determining production control, phases in production planning and control, limitations of PPC, measuring effectiveness of PPC, production activity control, operations planning and scheduling, scheduling process-focused production systems, scheduling techniques for job shop, stages in scheduling, load charts and machine loading charts, dynamic sequencing rules, scheduling product –focused systems, scheduling for flexible manufacturing system.

UNIT –V

Resource Requirements Planning: -Nature, resource requirement planning system, MRP-I, MRP-II, MRP Computational procedure, issues in MRP, implementation of MRP, evaluation of MRP, Introduction to ERP.

Manufacturing planning & Control systems: -JIT, CIM and WCM.

Learning curves in services and manufacturing: -Applying the learning curve, arithmetic approach, logarithmic approach, learning - curve coefficient approach; strategic implications & limitations of learning curves.

Reference Book: -

1. Panneer Selvan R, "Production and Operation Management", Prentice Hall India, New Delhi (2002).
2. Buffa, "Modern Production/operations Management", Wiley Eastern, New York (1999).

Industrial Economics (IPE-2.9)**UNIT-I**

Introduction: - Meaning and Scope of Industrial Economics, Need and Significance of The Study of Industrial Economics, Economic & Agricultural Development and Industrialization, Factors Affecting Industrial Development.

UNIT –II

Industrial Location Analysis: - Meaning of Industrial Location. Determinants of Industrial Location. Weber's & Florence's Theories of Industrial Location.

Industrial Decisions, Market Structure: - Competition or Co-Operation, Firm Behavior & Market Outcomes, (I) Cartel, (II) Collusion, (III) Merger.

UNIT – III

Investment, Research, Development & Innovation in Industry: - Investment Decisions The Nature & Types of Investment Decisions, Preparation of the Profile of a Project, Pricing Methods of Project Evaluation iv Risk and Uncertainties in Project Appraisal, Research, Development and Innovation Meaning. R & D Expenditure as an Investment Decision. The Relationship between R & D, Inputs & Outputs Rationalization & Automation. Meaning & Objectives. Benefits, Problems & Policy.

UNIT – IV

Price Competition: - General Situation for Pricing Decisions. Pricing Under Perfect & Imperfect Competition: in theory, Pricing Procedures in Practice, Pricing Methods. Pricing in Public Enterprises 5.6 Price Wars: Theories and Evidence.

UNIT –V

Non Price Competition: - Meaning of Non-Price Competition & Product Differentiation, Horizontal Product Differentiation, Brand Proliferation as an Entry Deterrence Strategy, Vertical Product Differentiation, Price Discrimination: First- Second- & Third Degree Price Discrimination.

Reference Book: -

1. Buffa, “Modern Production/operations Management”, Wiley Eastern, New York (1999).
2. industrial economics by Robert M. Caddel.

PRODUCTION PLANING AND CONTROL (IPE-2.10)**UNIT-I**

Introduction to casting: - Steps involved in casting, advantages, limitations and applications of casting process. Pattern types, allowances for pattern, pattern, materials color coding and storing of patterns.

Moulding methods: - Molding methods and processes-materials, equipment, molding sand ingredients, essential requirements, sand preparation and control, testing, cores and core making. Design considerations in casting, gating and Riser, directional solidification in castings. Sand castings-pressure die casting-permanent mould casting-centrifugal casting-precision investment casting, shell moulding, Co2 moulding, continuous casting-squeeze casting-electro slag casting. Fettling and finishing, defects in Castings.

UNIT –II

Foundry melting furnaces: - Selection of furnace-crucibles oil fired furnaces, electric furnacescupola, calculation of cupola charges, hot blast, cupola-Degasifications, inoculation-pouring equipment, Inspection of castings. Need-Areas for mechanization-Typical layout-sand reclamation techniques-material handling, pollution control in Foundry, Computers in casting process.

UNIT – III

Forming: - Metallurgical aspects of metal forming slip, twinning mechanics of plastic deformationeffectsof temperature, strain rate-microstructure and friction in metal forming, yield criteria and theirsignificanceclassification of metal forming processes. Principle classification equipment, toolingprocesses, parameters and calculation of forces during forging and rolling processes, Ringcompression tests, Post forming heat treatment, Defects (cause and remedy) applications. Classification of extrusion processes, tool, equipment and principle of these processes, influence of friction, Extrusion force calculation, Defects and analysis: Rod/wire drawing-tool, equipment and principle of processes defects, Tube drawing and sinking processes Mannesmann processes of seamless pipe manufacturing.

UNIT – IV

Classification of Forming Processes: - Classification conventional and HERF processes, Pressestypes and selection of presses, formability of sheet metals, Principle, process parameters, equipment and application of the following processes. Deep drawing, spinning, stretch forming, plate bending, press brake forming, Explosive forming, electro hydraulic forming, magnetic pulse forming, Super plastic forming, electro forming-fine blanking, P/M forging-Isothermal forging-high speed, hot forging high velocity extrusion.

UNIT – V

Welding: - Types of welding-gas welding-arc welding-shielded metal arc welding, TAW, GMAW, SAW, ESW-Resistance welding (spot, seam, projection, percussion, flash types)-atomic hydrogen arc welding-thermit welding soldering, brazing and braze welding. Welding symbols-Positions of welding-joint and groove design-weld stress-calculations-design of weld size estimation of weld dilution, heat input, preheat, and post heat temperature-computer applications in weld design. Electron beam and Laser beam welding-plasma arc welding-stud welding-friction welding-explosive welding ultrasonic welding-underwater welding-roll bonding-diffusion bonding-cold welding-welding of plastics, dissimilar metal. Gas welding equipments-welding power sources and characteristics-safety aspects in welding-automation of welding, seam tracking, vision and arc sensing-welding robots. Defects in welding-causes and remedies-destructive testing methods

Reference Book:-

1. Taylor H.F Flemings M.C & Wulff J., Foundry Engineering, Wiley Eastern Limited, 1993.
2. Lindberg R.A, Processes and Materials of Manufacture , Prentice Hall of India (P) Ltd.,1996.

CNC Machine & Automation (IPE-2.11)**UNIT-I****Concept and scope of industrial automation:-**

Automation strategies, devices, drives and control circuits in automation - Semi-automats, Automats and transfer lines. Mechanical, electrical, hydraulic, pneumatic, electronic & hybrid automation system. Comparative evaluation of automation system. Design consideration of NC machine tools - machining centre – MCU functions.

UNIT –II**Controls and System devices:-**

Control loops of NC system – CNC Concepts, reference pulse and sampled data techniques – microprocessor and CNC adaptive control ACO and ACC systems. Graphical Numerical Control - part programming - design of post Processor.

UNIT – III**Automated material handling:-**

Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.

Automated storage systems:-

Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT – IV**Automated flow lines:-**

Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT –V**Assembly system and line balancing:-**

Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

Fundamentals of Industrial controls:-

Review of control theory, logic controls, sensors and actuators, Data communication and LAN in manufacturing. Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE.

Reference Book:-

1. CNC Machine by Mikell P. Groover.
2. CNC Machine by B.S.Pabla.

POWER PLANT ENGINEERING (IPE-2.12)**UNIT-I**

Introduction to the Sources of Energy :- Resources and Development of Power in India. Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

COMBUSTION PROCESS:- Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT –II

INTERNAL COMBUSTION ENGINE PLANT:- Diesel Power Plant- Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.

GAS TURBINE PLANT:- : Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

DIRECT ENERGY CONVERSION:- Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT – III

HYDRO ELECTRIC POWER PLANT:- Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.

HYDRO PROJECTS AND PLANT:- Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

POWER FROM NON-CONVENTIONAL SOURCES:- Utilization of Solar-Collectors Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

UNIT – IV

NUCLEAR POWER STATION:- Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.

TYPES OF REACTORS:- Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT –V

Power Plant Economics and Environmental Considerations:- Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor– related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

Reference Book :-

1. POWER PLANT ENGINEERING by MANOJ KUMAR GUPTA.
2. POWER PLANT ENGINEERING by A. K. RAJA.

QUALITY MANAGEMENT (IPE-2.13)**UNIT-I**

Review of statistical concepts: - Graphical representation of grouped data, continuous & discrete probability distributions, central limit theorem, skewness and kurtosis, tests of normality for a given data, chi-square test.

Introduction: - Process control and product control, difference between SQC and SPC, chance and assignable causes of quality variation, advantages of Shewhart control charts.

Process Control: - Charts for variables; for individuals, \bar{X} bar, R and sigma charts; fixation of control limits; Type I and Type II error; theory of runs; Interpretation of 'out of control' points. Initiation of control charts, trial control limits. Determination of aimed-at value of process setting. Rational method of sub grouping. Control chart parameters. Limitations of \bar{X} bar and R charts.

UNIT –II

Control limits verses specification limits: - natural tolerances limits, relationship of a 'process in control' to upper & lower specification limits. Process capability studies, process capability indices for bilateral specifications & unilateral specification cases, remedial actions for indices less than one.

Control charts for Attributes: - fraction defective chart and number of defectives chart, varying control limits, high defectives and low defectives, seriousness classification of defects, defects chart, U-chart. Quality rating, Average Run Length (ARL), Relative efficiency or sensitivity of control charts.

UNIT – III

Product Inspection: - 100% inspection, no inspection and sampling inspection. Application of hyper geometric, binomial & Poisson distributions in acceptance inspection. Operating Characteristic Curve (O.C.Curve); Effect of sample size and acceptance number, type A and type B O.C. curves. Single, Double and Multiple Sampling Plans

UNIT – IV

Product Inspection (Contd.): - Acceptance/ rejection and acceptance/ rectification plans. Producer's risk and consumer's risk. Indifference quality level, Average Outgoing Quality (AOQ) curve, AOQL. Quality protection offered by a sampling plan. Average Sample Number (ASN) curve, Average Total Inspection (ATI) curve. Design of single sampling plans.

UNIT –V

Economics of Product Inspection: - Use of Break-even analysis in decision for selection of economic acceptance plan option. Dodge - Romig Tables, MIL-STD-105D.

ISO 9000: - introduction, characteristics of quality assurance system. ISO-9000: scope, application, terms & definitions, evolution of ISO-9000 series, process approach, PDCA methodology, commentary on ISO-9000 requirements, guidelines for preparation of Quality Manual. Steps for certification, implementation schedule for certification.

Reference Book :-

1. Zaidi A., "SPC: Concepts, Methodologies and Tools", Prentice Hall of India, First Edition, (2003).
2. Grant E L and Leavenworth R S, "Statistical Quality Control", McGraw Hill, Sixth Edition (2000).

OPERATIONS RESEARCH (IPE-2.14)**UNIT-I**

Nature and development of Operations Research: - some mathematical preliminaries, OR and managerial decision making, OR applications in industrial and non-industrial fields.

Linear Optimization Models: - formulation of linear programming problem, graphical solution, sensitivity analysis in graphical solution, comparison of graphical and simplex algorithm, simplex algorithm, computational procedure in simplex, penalty method, two phase method, degeneracy, duality and its concept, application of LP model to product mix and production scheduling problems.

UNIT –II

The transportation model: - solution methods, balanced and unbalanced problems, Vogel's approximation method, degeneracy in transportation problems. Assignment problem, methods for solving assignment problems. The traveling salesman problem. Numericals on transportation, assignment and traveling salesman method. Computer algorithms for solution to LP problems.

UNIT – III

Dynamic programming problems: - model formulation, computational procedures, solution in different stages. Decision making under conditions of risk, assumed certainty.

UNIT – IV

Waiting line models: - queuing systems and concepts, various types of queuing situations, single server queues with poisson arrivals and exponential service times, finite queue length model, industrial applications of queuing theory.

UNIT –V

Simulation: - advantages and limitations of the simulation technique: generation of random numbers, MonteCarlo simulation, computer-aided simulation, applications in maintenance and inventory management.

Reference Book:-

1. Taha,H A, “Operations Research - An Introduction”, Sixth Edition, Prentice Hall of India Private.
2. Mustafi C K, “Operations Research”, Third Edition, New Age International Pvt. Ltd., New Delhi, 1996.

SIMULATION OF PRODUCTION SYSTEMS (IPE-2.15)**UNIT-I**

Introduction: - Basic concepts of systems, Elements of systems, event driven models, simulation as a decision making tool, types of simulation, system modeling, types of modeling.

Basic factory dynamics: - Basic definitions and Parameters; Simple relationships, Little's Law; Bottleneck Rates and Cycle Times; Labour Constrained Systems.

UNIT –II

Statistical models in Simulation: - Review of terminology and concepts, Probabilistic and statistical models in simulation. Introduction to some discrete and continuous probability distributions including Bernoulli, Poisson, Geometric, Uniform, Exponential, Gamma, Erlang, Normal, and Triangular distributions. Relevance to simulation modelling.

UNIT – III

Random Numbers: - properties of random numbers, pseudo random numbers, techniques for generating random numbers, test for random numbers, techniques for random variate generation.

Analysis of simulation data: - Input data modelling, Data collection, parameter estimation, distributional assumptions and hypothesis testing. Chi-square and Kolmogorov-Smirnov Goodness-of-fit tests.

UNIT – IV

Recent advances and case studies/mini project: - Development of simulation models for systems like queuing systems production, inventory, maintenance, material handling and replacement systems-Investment analysis etc. Introduction to the special purpose simulation language

UNIT –V

Model verification and validation techniques: - Output data analysis of terminating and non terminating Systems. Variance reduction techniques. Introduction to simulation experimental design methods.

Reference Book:-

1. Severance Frank, “System Modelling and Simulation”, John Wiley and Sons, 2005.
2. Banks Jerry and Carson John S., “Discrete event system simulation”, Prentice Hall, 2001.

Entrepreneurship Development & Management (IPE-2.16)**UNIT-I**

Introduction:- Meaning and Importance, Evolution of term 'Entrepreneurship, Factors influencing entrepreneurship, Psychological factors, Social factors, Economic factor, Environmental factors, Characteristics of an entrepreneur, Entrepreneur and Entrepreneur, Barriers to entrepreneurship.

Types of entrepreneur:- According to Type of Business, According to Use of Technology, According to Motivation, According to Growth, According to Stages, New generations of entrepreneurship viz. social entrepreneurship, Edupreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc.

UNIT –II

Entrepreneurial Motivation:- Motivation, Maslow's theory, Herzberg's theory, McGregor's Theory, McClelland's Need – Achievement Theory, Culture & Society , Values / Ethics , Risk taking behavior.

Creativity:- Creativity and entrepreneurship, Steps in Creativity, Innovation and inventions, Using left brain skills to harvest right brain ideas, Legal Protection of innovation, Skills of an entrepreneur, Decision making and Problem Solving (steps indecision making).

UNIT – III

Organisation Assistance:- Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) licence, Environmental Clearance, National Small Industries Corporation (NSIC), Government Stores Purchase scheme (e-tender process), Excise exemptions and concession, Exemption from income tax, Quality Standards with special

reference to ISO, Financial assistance to MSME, Modernisation assistance to small scale unit, The Small Industries Development Bank of India(SIDBI), The State Small Industries Development Corporation(SSIDC), Export oriented units, Incentives and facilities to exports entrepreneurs, Export-Import Bank of India, Export oriented zone.

UNIT – IV

Rules And Legislation:- Applicability of Legislation, Industries Development (Regulations) Act, 1951., Factories Act, 1948, The Industrial Employment (Standing Orders) Act, 1946, Suspension, Stoppage of work, Termination of employment, West Bengal Shops and Establishment Act, 1963, Environment (Protection) Act, 1986, The sale of Goods Act, 1950, Industrial Dispute Act 1947.

Project Report:- Introduction, Idea Selection, Selection of the Product / Service, Aspects of a Project, Phases of a Project, Project Report, Contents of a Project Report, Proforma of a Suggested Project Report for a manufacturing Organization, Suggested Readings.

UNIT –V

Agencies for industrial assistance:- West Bengal Electronics Development Corporation, ICICI West Bengal Infrastructure Development Corporation, West Bengal Industrial Infrastructure Development Corporation, Other Corporations with focus as specific segments, State Industrial Development Corporation (SIDC), State Financial Corporation (SFCs), Directorate General of Supplies and Disposals(DGS & D), Registration with DGS & D, Registration Categories, Registration Procedure, Benefits of DGS & D, Information facilities centre in DGS & D, Khadi and Village Industries Commission (KVIC), Industrial Estate, Financing of Industrial Estates, Shilpabandhu-M Incentives for entrepreneurs 9reference to The West Bengal State Support for Industries Scheme 2008 & 2013.

Reference Book :-

1. Entrepreneurial Development, by S S Khanka.
2. The Entrepreneur, by Mark Casson.

Industrial Management (IPE-2.17)**UNIT-I**

Basic of Management:- Management - Definition – Administration- Definition – Henry-Fayol’s principles of management- Business Organisation-Types- Proprietorship-Partnership- Joint stock- Cooperative Society-Advantages and disadvantages -Functions of Management – Planning-Definition-Functions- Organisation-Definition- types of organisation –Line-Functional-Line &staff- advantages and disadvantages- Leadership -Types –Quality of good leader- Motivation - Maslow’s Theory of Motivation -Hierarchy of needs- Communication - Process of Communication – Barriers for effective communication.

UNIT –II

Production Management:- Concept of project work - Project planning -Market survey- Project capacity-selection of site for project- Plant layout-Types of Plant layout-Product design-Stages in product design-drawing-Specifications-Material requirement-operation-Planning-Production-definition-Job, Batch & Mass production with their advantages and disadvantages-Productivity-definition-factors to improve productivity- Production planning and Control (PPC)-definition-Functions of PPC- planning, routing, scheduling, dispatching and Inspection-Introduction to CPM and PERT –Comparison.

UNIT – III

Material Management:- Material management - definition, functions- Purchase - Objectives, different methods of purchasing -Purchase procedure-Comparative statement-purchase order-Tender-Types of tender- Storekeeping- classification of stores - Functions of store keeper. Store management-Bin Card - Material Issue Requisition- Material Returned Note- Store ledgers -Codification of stores-Inventory Management- Definition - functions of Inventory Control- Advantages of Inventory Control. Material management - definition, functions- Purchase - Objectives, different methods of purchasing -Purchase procedure-Comparative statement-purchase order-Tender-Types of tender- Storekeeping- classification of stores - Functions of store keeper. Store management-Bin Card - Material Issue Requisition- Material Returned Note- Store ledgers -Codification of stores-

Inventory Management- Definition - functions of Inventory Control- Advantages of Inventory Control.

UNIT – IV

Total Quality Management:- Quality–Concept-Quality control- Definition - Factors affecting quality- Advantages of quality control –Inspection-Different types of inspection Total Quality Management-Meaning- Principles of total quality management- PDCA cycles Quality Circles-definition-Function. TQM Tools- Flow charts, Control charts, Histograms, Pareto charts, Cause and effect diagram-5-S- Kaizen, and Six-sigma Quality Certification Systems- ISO 9000 series quality standards, QS14000– ISO 9000, ISO 9001,ISO9002,ISO9003 & ISO 9004- ISO9000 quality certification procedure.

UNIT –V

Plant Maintenance and Industrial Safety:- Plant maintenance-Definition -Types of maintenance-Preventive maintenance- Break down maintenance-Advantages and disadvantages- Total Productive Maintenance-Meaningbenefits of TPM -Tools of TPM-planned maintenance and predictive maintenance. Industrial safety –Meaning - Accident-causes for accident- Direct and indirect losses due to an accident-Personal protective devices for preventions of accidents-Safety department- role of safety officer – safety supervisor -safety committee – Fire prevention and Protection- Fire triangle-principles of fire extinguishing- various classes of fire- A, B,C, D types of fire extinguishers.

Reference Book:-

1. Industrial Engineering and Management by S. C. Sharma, T. R. Banga.
2. Industrial Engineering and Management by Ravi, V.

Final year Project

Project (IPE-2.18)

Select any one topic:-

1. Solar Sea Water Desalination Machine With RO UV Purifier
2. Automatic Wire Cutter And Stripper Machine
3. Dual Side French Fries Maker Machine
4. Automatic Bottle Filling & Capping Machine Using PLC
5. Colour Product Sorting using Pneumatic Conveyor belt
6. Automatic Sugarcane Bud Cutter Machine
7. Auto Motorized Crispy Dosa Maker Machine
8. IoT Industry Automation Using Raspberry Pi
9. Pneumatic Sheet Metal Cutting Machine.