Department of Industrial & Production Engineering Dhaka University of Engineering & Technology

Course Structure for Bachelor of Science in Industrial & Production Engineering

1 st year 1 st Semester (Exempted)					
Subject	t Code	Subject Name	Contact Hours	Credits	
Math	1701	Mathematics -I	3.00	3.00	
Ph	1701	Physics-I	3.00	3.00	
Ch	1701	Chemistry-I	3.00	3.00	
HSS	1701	Economics	3.00	3.00	
		Sub Total=	12.00	12.00	
IPE	1710	Machine Shop Practice- I	3.00	1.50	
IPE	1720	Engineering Drawing- I	3.00	1.50	
Ph	1702	Physics-I Sessional	3/2	0.75	
Ch	1702	Chemistry I Sessional	3/2	0.75	
		Sub Total=	9.00	4.50	
	Total= 21.00 16.50				
		1 st year 2 nd Semester			
Subject	t Code	Subject Name	Contact Hours	Credits	
IPE	1701	Introduction to Industrial & Production Engineering	3.00	3.00	
Math	1703	Mathematics -II	4.00	4.00	
Ph	1703	Physics -II	4.00	4.00	
Ch	1703	Chemistry -II	4.00	4.00	
HSS	1703	Sociology and Accounting	3.00	3.00	
		Sub Total=	18.00	18.00	
IPE	1730	Machine Shop Practice-II	3.00	1.50	
IPE	1740	Engineering Drawing- II	3.00	1.50	
Ph	1704	Physics -II Sessional	3/2	0.75	
Ch	1704	Chemistry- II Sessional	3/2	0.75	
		Sub Total=	9.00	4.50	
		Total=	27.00	22.50	

2 nd year 1 st Semester					
Subje	ct Code	Subject Name	Contact Hours	Credits	
ME	2303	Engineering Mechanics	4.00	4.00	
IPE	2701	Engineering Materials and Processing	3.00	3.00	
EEE	2201	Electrical Machines and Electronics	3.00	3.00	
Math	2701	Mathematics -III	4.00	4.00	
HSS	2701	English Language	3.00	3.00	
		Sub Total=	17.00	17.00	
IPE	2702	Engineering Materials and Processing Sessional	3/2	0.75	
EEE	2202	Electrical Machines and Electronics Sessional	3/2	0.75	
CSE	2410	Computer Programming Sessional	3.00	1.50	
HSS	2720	English Language Practice	3.00	1.50	
		Sub Total=	9.00	4.50	
	Total= 26.00 21.50				

2 nd year 2 nd Semester					
Subje	ct Code	Subject Name		Contact Hours	Credits
IPE	2703	Manufacturing Processes-I		3.00	3.00
IPE	2705	Engineering Economy		3.00	3.00
ME	2305	Mechanics of Materials		3.00	3.00
ME	2307	Thermodynamics and Heat Transfer		4.00	4.00
Math	2703	Mathematics –IV		4.00	4.00
			Sub Total=	17.00	17.00
IPE	2704	Manufacturing Processes-I Sessional		3.00	1.50
IPE	2706	Professional Ethics in Engineering		1.50	0.75
ME	2308	Thermodynamics and Heat Transfer Sessional		1.50	0.75
			Sub Total=	6.00	3.00
			Total=	23.00	20.00

	3 rd year 1 st Semester				
Subj	ect Code	Subject Name	Contact Hours	Credits	
IPE	3701	Manufacturing Process-II	3.00	3.00	
IPE	3703	Measurement, Instrumentation and Control	3.00	3.00	
IPE	3705	Probability and Statistics	3.00	3.00	
IPE	3707	Numerical Analysis	3.00	3.00	
ME	3309	Fluid Mechanics and Machinery	3.00	3.00	
		Sub Total=	15.00	15.00	
IPE	3702	Manufacturing Processes-II Sessional	3.00	1.50	
IPE	3704	Measurement, Instrumentation and Control Sessional	3/2	0.75	
ME	3310	Fluid Mechanics and Machinery Sessional	3/2	0.75	
IPE	3720	Business Communication Seminar-I	3.00	1.50	
		Sub Total=	9.00	4.50	
		Total=	24.00	19.50	
		3 rd year 2 nd Semester			
Subj	ect Code	Subject Name	Contact Hours	Credits	
IPE	3709	Computer Integrated Manufacturing	3.00	3.00	
IPE	3711	Material Handling	3.00	3.00	
IPE	3713	Quality Management	3.00	3.00	
IPE	3715	Operations Research	4.00	4.00	
IPE	3717	Product Design and Development	3.00	3.00	
		Sub Total=	16.00	16.00	
IPE	3710	Computer Integrated Manufacturing Sessional	3/2	0.75	
IPE	3712	Material Handling Sessional	3/2	0.75	
IPE	3714	Quality Management Sessional	3/2	0.75	
IPE	3718	Product Design and Development Sessional	3.00	1.50	
		Sub Total=	7.50	3.75	
		Total=	23.50	19.75	

	4 th year 1 st Semester			
Subje	ect Code	Subject Name	Contact Hours	Credits
IPE	4701	Ergonomics and Safety Engineering	3.00	3.00
IPE	4703	Machine Tools and Tool Engineering	3.00	3.00
IPE	4705	Logistics and Supply Chain Management	3.00	3.00
IPE	4707	CAD/CAM	3.00	3.00
IPE	4761	Operations Management	3.00	3.00
		Sub Total=	15.00	15.00
IPE	4702	Ergonomics and Safety Engineering Sessional	3/2	0.75
IPE	4704	Machine Tools and Tool Engineering Sessional	3.00	1.50
IPE	4708	CAD/CAM Sessional	3/2	0.75
IPE	4000	Project and Thesis	3.00	*1.50
		Sub Total=	9.00	4.50
Indu	strial Atta	chment ** (After the completion of final examination of	4 th year 1 st seme	ster and
	the re	esult of it will be published along with the result of 4 th yea	ar 2 nd semester)	
		Total=	24.00	19.50
		4 th year 2 nd Semester		1
Subje	ect Code	Subject Name	Contact Hours	Credits
IPE	4709	Robotics and Industrial Automation	3.00	3.00
IPE	4711	Industrial and System Simulation	3.00	3.00
IPE	4713	Marketing Management	3.00	3.00
IPE	47XX	Optional Subject I	3.00	3.00
IPE	47XX	Optional Subject II	3.00	3.00
		Sub Total=	15.00	15.00
IPE	4712	Industrial and System Simulation Sessional	3/2	0.75
IPE	4730	Business Communication Seminar-II	3.00	1.50
IPE	4000	Project and Thesis	3[*1.5+1.5]	1.50
IPE	4720 **	Industrial Attachment	3.00	1.50
		Sub Total=	10.50	5.25
		Total=	25.50	20.25
		Total Credit =		159.50

	Optional Courses				
Subj	ect Code	Subject Name	Contact Hours	Credits	
IPE	4731	Emerging Trends in Manufacturing Technology	3.00	3.00	
IPE	4733	Intelligent Manufacturing	3.00	3.00	
IPE	4735	Process Dynamics and Adaptive Control	3.00	3.00	
IPE	4737	Energy and Environment Management	3.00	3.00	
IPE	4739	Technology Management	3.00	3.00	
IPE	4741	Human Factors Engineering	3.00	3.00	
IPE	4743	Total Quality Management	3.00	3.00	
IPE	4745	Management Information System	3.00	3.00	
IPE	4747	Engineering Systems Safety Design and Control	3.00	3.00	
IPE	4749	Management and Productivity	3.00	3.00	
IPE	4751	System Dynamics and Policy Planning	3.00	3.00	
IPE	4753	Entrepreneurship Development and Micro Industries	3.00	3.00	
IPE	4755	Environmental Management	3.00	3.00	
IPE	4757	IT in Manufacturing	3.00	3.00	

IPE	4759	Digital Logic and Micro-Processor Technology	3.00	3.00
IPE	4763	Project and Environmental Management	3.00	3.00
IPE	4765	Industrial and Business Management	3.00	3.00
IPE	4767	Industrial Law and Safety Management	3.00	3.00
IPE	4769	Optimization and Heuristic Methods	3.00	3.00
IPE	4771	Maintenance Management	3.00	3.00

Course Contents for Undergraduate Program of Industrial & Production Engineering

Math 1701 Mathematics- I

Algebra: Complex quantities, Binomial theorem, Positive integral index, Negative or fractional index, Exponential series, Logarithmic series, Partial fraction, Denominator having a non-repeated liner factor, Repeated liner factor, Non-repeated quadratic factors, Determinant-properties and product of determinants, Euler exponential values, Hyperbolic function, Logarithm of complex quantity.

Coordinate Geometry: Coordinates, Distance between two points, Straight line, The equation of straight line in different forms, Intersection of straight lines, Angle between two straight lines, Parallel and Perpendicular lines, Circle-equation, tangent, normal, Length of tangent, Chord of contract, Equation of parabola and ellipse.

Statics: Concurrent forces, Composition of forces, Resolution of forces, Equilibrium of concurrent forces, Parallel forces, Moments, Couples, Center of gravity.

Dynamics: Acceleration, Laws of motion, Motion of two connected bodies, Projectile, Impulsive force, Work, Power and Energy.

Ph 1701 Physics- I

Properties of Matter: Viscosity; Co-efficient of viscosity; Reynold's number; Stoke's formula; Poiseuille's formula; problems involving these topics. Fluid dynamics; streamline & turbulent motion' equation of continuity; Bernoulli's equation; practical application; Torricellis theorem; problems involving these topics.

Gravitation: Kepler's Laws of motion, Gravitational Potential and field due to (a) spherical shell (b) solid sphere and (c) hollow sphere, Escape velocity, Velocity of satellite; Elasticity: Elastic constants, Relation between elastic constants; Surface tension: Molecular theory of surface tension, Surface energy, Excess pressure of curved surface, capillarity, Determination of surface tension of water by capillary tube method;

Sound: Audible, ultrasonic and infrasonic waves; Newton's assumption on propagation and speed of sound thought medium; Laplace's correction; factors the velocity of sound' transverse and longitudinal waves' laws of transverse vibration of stretched string; sonometer.

Light: Reflection and refraction of light through spherical surfaces and lenses; magnification; equivalent focal length of combined lenses; Achromatic combined of lenses; refraction through a prism; dispersion; dispersive power; problems involving these topics.

Thermal Physics: Kinetic theory of gases: Kinetic calculation of pressure, Temperature and energy, Ratio of specific heats, Atomicity of gas molecules, Mean free path; Equation of state: Van der Waal's equation of state, Critical constants, Van der Waals constant; Thermal conductivity: Rectilinear, cylindrical and spherical flow of heat, Heat flow through compound walls; Thermodynamics: Zeroth law and first law of thermodynamics and their applications, Thermodynamic processes, Isothermal and adiabatic gas equation and work done, Reversible and irreversible processes; Second law of thermodynamics: The Carnot cycle; Entropy: Entropy of a perfect gas.

Circuit theorem: Ohms law; laws of resistance; Kirchhoff's laws; combination of resistance; shunt; post-office box; heating and chemical effect of current; problems involving these topics.

Heat: Concept of heat and temperature; low and light temperature; constant volume thermometer; resistant thermometer; thermal conductivity of solids; heat flow through compound walls; rectilinear; cylindrical and spherical flow of heat; problems involving these topics.

Credit: 3.00

Ch 1701 Chemistry-I

Inorganic Chemistry: Types of chemical reactions, atomic structure, modern periodic table; Group, period & their general characteristics, classification of elements, chemistry of Ozone, hydrogen peroxide, Phosphorus & Phosphine, types of solution, solubility and factors that affect solubility.

Organic Chemistry: Definition, classification & nomenclature of organic compounds, functional group, homologous series, isomerism, hydrocarbons; alkanes, cycloalkanes, alkenes & alkynes, alcohols; classification, carbonyl compounds, aromatic hydrocarbons, and heterocyclic compounds.

HSS 1701 Economics

Economics: Definition & scope of economics; its utility importance to engineering definition of engineering economics; basic concepts of economics; utility of goods; wealth; value; price & want; theory of utility & demand the law of diminishing marginal and its measurement; consumer's surplus; production; factors or production; division of labor; localization of industries; specialization; small & large scale production; distribution the marginal productivity theory; economics of development & planning basic concepts of saving; investment; GNP; per capita income; growth rate; policy instruments of developments fiscal policy; momentary policy their relative applicability in Bangladesh; some planning tools capital output ratio; input-output analysis; planning in Bangladesh five year plan. Development problems related to agriculture; industry and population of Bangladesh; role of state & engineers in economic development; natural resources in Bangladesh; trade & commerce; banking system.

IPE 1710 Machine Shop Practice-I

Lathe, Milling, Shaper, Drilling and Grinding. Foundry shop, Pattern making, Joining of metals

IPE 1720 Engineering Drawing-I

Introduction; Instruments and their uses; First and third angle projections; Orthographic drawings; Isometric views; Missing lines and views, Sectional views and conventional practices; Auxiliary views.

Ph 1702 Physics-I Sessional

Experiments based on Phy-1701

Ch 1702 Chemistry-I Sessional

Experiments based on Chem-1701

IPE 1701 Introduction to Industrial & Production Engineering

Evolution of industrialization; Involvement of Industrial and Production Engineering in the entire life cycle of a product, Design of product; Basic processes for product manufacturing; Machineries for manufacturing; Computer in manufacturing; Managing manufacturing system; Improvement of systems-optimization, quality management, ergonomics, safety, Basic of Probability and Statistics, Concept of reliability, organizational behavior etc.

Math 1703 Mathematics-II

Differential Calculus: Limit, Continuity and differentiability, differentiation of explicit and implicit function, significance of derivatives, differential coefficient, Successive differentiation of various types of functions, Leibnitz's theorem, Rolle's theorem, Mean value theorems, Taylor's theorem, Maclaurin's theorem, Lagrange's remainder theorem, Partial differentiation, Euler's theorem on homogeneous function, maxima and minima, Tangent and normal, Curvature, Asymptotes, Curve tracing, Indeterminate forms,

Credit: 3.00

Credit: 3.00

Credits: 1.50

Credits: 1.50

Credits: 0.75

Credits: 0.75

Credit: 3.00

Credit: 4.00

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L'Hospital's rule.

Integral Calculus: Definitions of integration, Integration by method of substitution, integration by parts, Standard integrals, Integration by the method of successive reduction, Definite integrals, Beta and Gamma functions, Jacobian, Length of curves, Area of bounded by plane curves volume and surface area of solid of revolution, Multiple integration and application.

Ph 1703 Physics-II

Credit: 4.00

Optics: *Interference*: Huygen's principle, Young's experiment, Coherent sources and it's production methods, Analytical treatment of Interference, Interference due to thin films, Newton's rings. Diffraction, Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction by single and double slit, Plane diffraction grating, Resolving and dispersive power of a grating. *Polarization*: Polarization by reflection, Refraction, Double refraction, Brewster's law and Malus law, Elliptical and circular polarization of light.

Atomic Physics: *Atomic Structure*: Atom models, Electron orbits, Energy levels and spectral series of hydrogen atom, Bohr's correspondence principle; *Nuclear Structure and Decay*: nuclear compositions, Mass defect, Binding energy, Radioactive decay, Laws of Radioactive decay, Half life and Mean Life, Radioactive series, Nuclear fission and fusion, Q-value of nuclear reaction.

Waves and Oscillations: *Wave motion:* Types of wave motion, Expression for plane progressive wave, Energy calculation of stationary and progressive wave, Interference of sound wave, Beats, Doppler effect; *Oscillations:* The simple harmonic wave equation and its solution, Composition of simple harmonic motion-Lissajou's figures, Damped harmonic motion and its solution, Forced oscillation and resonance.

Electricity and Magnetism: *Electrostatics:* Coulomb's law, Gauss' law, Electric potential and their applications due to continuous charge distribution, electric dipole and quadruple, Capacitance and capacitors; *Magnetism:* The magnetic field and flux, Magnetic force on a current carring conductor, Hall effect, Biot-Savart law and Ampere's law and their applications, Induction, Faraday's law, Lenz law, self induction and mutual induction.

Ch 1703 Chemistry-II

Inorganic Chemistry: Atomic structure, quantum numbers, chemical bond; their formation, conditions & properties, modern concept of covalent bond, hybridization, oxidation-reduction reaction & oxidation number .

Physical Chemistry: Chemical equilibrium; Le Chatelier 's principle & applications, thermo-chemistry; laws of thermo-chemistry, Henry's law, properties of dilute solution; chemical kinetics; rate, order & molecularity of reaction, factors affecting rate & rate expressions.

Non-metallic Engineering materials : Polymers; definition, classification, physical & mechanical properties and effect of temperature on them, some important plastics, their uses etc., natural & synthetic rubber, raw materials & manufacturing processes of glass & refractory.

Corrosion: Corrosion principles: Definition, Importance, Classification, corrosion rate expressions, Corrosion Prevention: Corrosion control by materials selection, alternation of environment, coatings, cathodic and anodic protection.

HSS 1703 Sociology and Accounting

Sociology: Definition; Scope & its importance from Engineering point of view. Basic concepts; Family; Society; Groups; Association; State; Government; Nation; Nationality; Community; Culture & Civilization. Oriental & occidental societies; Population & world resources; Contribution of biology; Geography; Group life & culture to develop-personality; Living habits; Working habits in Bangladesh, Social evaluation; Techniques of production and transportation in Bangladesh, Social systems; Social Problems; Technology and social changes of Bangladesh.

Accounting: Accounting and its uses in business decisions. *Financial Accounting:* Recording processes of accounts; The Journal, The Ledger, Financial statement, Depreciation techniques. *Financial Management:*

Credit: 4.00

Financial statement analysis; Ratio analysis, liquidity ratio, leverage ratio, profitability ratio, activity ratio; capital budgeting; Discounted cash flow, NPV, IRR, ARR, payback period method, working capital management; Definition, nature of WC, sources of finance. Cost ccounting: Definition, Need for cost accounting, scope, definition cost and cost center. Classification of costs; direct and indirect material, direct and indirect labor, overhead costs, preparation of cost sheet.

Machine Shop Practice-II IPE 1730

Lathe: Straight and Step Turning of a cylindrical block, Taper turning of a cylindrical block Milling- Making a Hexagonal nut using Vertical/Horizontal milling machine Drilling- Making a stepped hole on a cylindrical block using Drilling machine Grinding- Surface grinding of a cylindrical/rectangular block using grinding machine Shaping- Shaping of a rectangular block

Foundry shop- Permeability test of a sample of sand, Pattern making for sand casting Welding Shop- joining of metals using Arc and Gas welding

IPE 1740 Engineering Drawing-II

Introduction; Instruments and their uses; Review of first and third angle projections; Orthographic drawings; Isometric views; Missing lines and views, Sectional views and conventional practices; Auxiliary views, Fasteners and gears, working drawing of machine elements with sectional views; details drawing; subassembly drawing.

Equipment and basic drafting procedures, Lettering and Symbols, Drafting geometry and single-view drawing, Orthographic projection, Dimensions, Pictorial drawing (isometric and perspective drawing), Threads Developments, Introduction to descriptive geometry, Introduction to computer drafting, Architectural working drawings (planes, sections, and elevations)

Product graphics: drafting codes as per ISO, tolerances and dimensioning, ensuring co-axiality, perpendicularly and parallelism compatible to manufacturing and assembly requirements, schematic product symbols for welding and piping systems.

System graphics: working drawings of cumulative and non-cumulative assemblies, dimensioning of assembled parts, use of standard parts threads, fasteners and springs, detailing of assembled parts.

Ph 1704 **Physics-II Sessional**

Experiments based on Phy-1703.

Ch 1704 **Chemistry-II Sessional**

Experiments based on Chem-1703.

ME 2303 Engineering Mechanics

Statics: Introduction and basic concepts; Resultant and components of forces; Rectangular components of two and three dimensional forces; Moment of forces; Couples; Equilibrium of co-planar forces; Concept of free body diagrams; Equilibrium of particle and rigid bodies in two and three dimension; Centroids and center of gravity of lines, areas and bodies; Moment of inertia of area and masses; Forces in cables, trusses and frames: Friction: surface friction, roller friction and belt friction.

Dynamics: Introduction to linear motions: displacement, velocity, acceleration; Concepts of absolute and relative velocity and acceleration and their graphical solution; Newton's laws of motion; Conservation of momentum; Concept of dynamic equilibrium and inertia force; Motion under a central force; Application to space mechanics; Potential and kinetic energy; General plane motions: translation and rotation; Concept of instantaneous center; absolute and relative velocity and acceleration and equation of motion in plane motion; Constrained plane motion.

Credit: 1.50

Credit: 4.00

Credit: 1.50

Credit: 0.75

Credit: 0.75

Work, power and energy: Work, power and energy of particle and rigid body of a force, spring force and gravitational force; Power and efficiency; Conservation of energy; Principle of work and energy and its application; Principle of impulse and momentum; Impulsive force and impact; Principle of work and energy, Impulse and momentum for plane motion of a rigid body; Impulsive motion and eccentric impact.

IPE-2701 Engineering Materials and Processing

Credit: 3.00

Credit: 3.00

Introduction: Definition of metal and metallurgy, Concept of malleability, ductility, toughness, fatigue, creep and other mechanical properties of metals. Engineering materials, Structure, properties, processing, fabrication and application of – metals and alloys, ceramics, rubber, plastics, semiconductors, and composites. Materials cycle, application and selection criteria of materials. Atomic structure & bonding: Elementary particles, electronic distribution and atomic size/structure, bonding-primary and secondary, effect of bonding on material properties. Structure of solids: Crystallinity in metals, ceramics, semiconductors and polymers; crystal system/lattice/structure, crystallographic indexing of planes & directions, atomic aggregates and their structure, significance of microstructure; crystalline defects: dimensions, origin and their effect on properties; amorphous structure.

Phase diagrams: Origin, construction, interpretation and application of binary phase diagrams with reference to a few important metallic and ceramic systems. Properties of materials: physical, mechanical, chemical, electrical, semi/super conducting, magnetic, optical, thermal properties of solids; units and testing.

Iron-Iron Carbide Equilibrium Diagram: Introduction, the Iron-Iron Carbide Diagram, definition of structures, slow cooling steel, the critical-temperature lines.

Heat treatment: Introduction, Classification of heat treatment and four principal transformations in steelformation of austenite, decomposition of austenite, martensitic and bainitic transformation, transformation of tempering. Practice of different types of heat treatment: surface hardening; full annealing, spheroidizing, stress-relief annealing, process annealing, normalizing, hardening, tempering; case hardening; carburizing, nitriding, cyaniding or carbonitriding, flame hardening, induction hardening.

Cast iron: Its classification; composition, micro- structure, characteristics and application of different types of cast iron. Alloy cast iron.

Production of steel: Construction, chemistry and relative advantage & disadvantage, different steel making processes.

EEE 2201 Electrical Machines and Electronics

DC generator: principle, types, performances and characteristics.

DC motor: principles, types of motor and its application, performances, speed control, starters and characteristics.

AC machines: three phase induction motor principles, equivalent circuit, Introduction to synchronous machines and fractional horse power motors, speed control of AC Machine.

Transformer: Introduction to single-phase transformer, single-phase transformer equivalent circuit and laboratory testing, introduction to three-phase transformer.

Industrial Electronics: Semiconductor diode, transistor characteristics, equivalent circuits, self-biasing circuits, emitter-follower amplifiers, push-pull amplifier. Introduction to silicon controlled rectifier and its application, Oscilloscope. Transducers: strain, temperature, pressure, speed and torque measurements, Introduction to PLC, microcontrollers.

Digital electronics: Digital and analog systems, digital circuits/logic circuits; Logic gates and Boolean algebra; Introduction to counters and registers; Introduction to integrated-circuit logic families, MOS, CMOS, MOSFET etc; Interfacing with analog world; Timing circuits, Introduction to PLC and microcomputer controllers.

Math 2701 Mathematics-III

Vectors: Definition of vectors, Equality of Vectors addition, Subtraction & Multiplication of vectors, Scalar & vector products of two vectors and their geometrical interpretation, Triple product and multiple products and their application in geometry & mechanics, Linear dependence & independence of vectors, Differentiation and integration of vectors together with elementary applications; line, surface and volume integrals; Gradient of a scalar function, Divergence and curl of a vector functions, Physical significance of gradient, Divergence & curl, Green's theorem, Stoke's theorem and Gauss's theorem and their applications.

Matrices: Definition of matrices, Matrix Algebra, Transpose, Inverse and ranks of matrices, Solution of simultaneous equation by matrix method.

Coordinate geometry: Transformation of coordinates and identification of conics, Three dimensional System of coordinates, Projection, Direction cosines, Equations of planes and lines, Angle between lines and planes, Distance from a point to a plane, Co-planar lines, Shortest distance between two given straight lines, Standard equations of sphere, ellipsoid, hyperboloid of one sheet, hyperboloid of two sheets, Tangent planes, Normal lines, condition of Tangency.

HSS 2701 English Language

Basic sentence pattern, contrastive analysis in Semantics, Syntax, Error analysis & correction, Nominal, Verb phrases, Verb modifiers (Adv. of Time, Place & Manner etc.), Report writing skill, Conversational practice, Vocabulary & its contextual usage, appropriate use of preposition, Communicative Grammar Practice, Dialogue writing, Clauses, Notion & Function, Letter writing as a separate skill (Business correspondence), Free writing and Reading comprehension, American and British English Different, phonetic and spoken English.

IPE 2702 Engineering Materials and Processing Sessional Credit: 0.75

Experiments based on IPE-2701

EEE 2202 Electrical Machines and Electronics Sessional

Experiments based on EEE-2201.

CSE 2410 Computer Programming Sessional

Historical development; Basics of computer: hardware and software; Number systems: binary, octal, hexadecimal arithmetic; Introduction to high level and low level languages; Flow diagrams; Micro-computer operating systems; Programming with FORTRAN language; Application of computer to solve mechanical engineering problems.

HSS 2720 English Language Practice

Lab session for the improvement of the learners' fluency in speaking and listening skill

IPE 2703 Manufacturing Processes-I

Foundry & Casting: Patterns & allowance; Moulding tools & operation; Classification of manufacturing processes, casting processes for ferrous and non-ferrous metals; sand, die, centrifugal, permanent mould casting, slush, plaster mold, loam mold, precision investment casting etc. Casting defects, design of moulds, riser, gate, sprue and core, cost analysis.

Welding: Fundamentals of welding, Electrodes and its desired characteristics; Arc welding with consumable electrode- Shielded metal arc welding, GMAW, Flux cored arc welding, Electro gas welding, Submerged arc welding; Arc welding with non consumable electrode- GTAW, Plasma arc welding, Resistance welding;

Credit: 3.00

Credit: 0.75

Credit: 1.50

Credit: 1.50

Money management: Engineering economic decisions; Time value of money; Market and effective Engineering Economy: Investment appraisal criteria for economic decisions, Present worth, annual equivalence and rate of return analysis; Resolution of multiple rates of return.

Development of project cash flow: Accounting for depreciation, inflation and income taxes; project cash flow analysis and basic concepts of discounting; Handling project uncertainty, Replacement decisions; Benefit cost analysis, sensitivity analysis.

oxy-fuel gas welding and different flames; Solid state welding- Ultrasonic welding and friction welding; Other fusion welding- EBW, LBW, Electro-slag welding, Thermit welding; Different types of welded joints-Lap, Butt, corner, edge joints etc; Testing and inspection of welded joints. Other joining Processes-

Bulk deformation manufacturing processes: All kinds of forging operations, All kinds of extrusion

Sheet metal working- Shearing, blanking, punching, slotting, perforating, notching; Bending- V bending, Edge bending, Flanging, Seaming, Curling; Drawing- Deep drawing, Re drawing. Other sheet metal

ME 2305 Mechanics of Materials

Soldering and Brazing.

operations.

IPE 2705

Introduction and analysis of axially loaded members: Indeterminate members: Thermal stress and centrifugal stress; Stresses in thin walled cylinder, Shear force and bending moment: their equations, diagrams and relation. Various types of stresses in beams; Flexure equation; Deflection in beams: Double integration method, area moment method, conjugate-Beam method and method of superposition for finding slopes & deflections; Curved beams. Torsion; Relation between shear stress and torque; hp and torque; Angle of twist; Helical springs; Modulus of rupture; Combined stress: Combined axial and flexural stresses, Kern of a section, variation of stresses with inclination, stress analysis; Principal stress and planes; Mohr's circle' Strain energy and theories of failure; Columns; types of column failures; Euler's equation; Column Secant's formula. Criteria load of column. Joints: Riveted and welded joints.

ME 2307 Thermodynamics and Heat Transfer

operations- Lancing, Twisting, Embossing, Coining, Ironing etc.

Engineering Economy

interest rates; Equivalence calculation under inflation.

Basic concepts and definitions; Sources of energy: conventional and renewable;

Thermodynamics: Specific heat of solids; first law of thermodynamics; isothermal; adiabatic; isochoric and isobaric processes; work done by expanding gases; adiabatic gas equation; reversible and irreversible processes; second law of thermodynamics; the Carnot cycle; Carnot theorem; Clapeyron latent heat equation; entropy of perfect gas; change of entropy in reversible & irreversible processes; entropy and disorder; problems involving these topics.

Fundamental concepts and laws, non-flow and flow processes; thermodynamic cycles; Introduction to: steam generating units, internal combustion engines, steam turbines, gas turbines, refrigeration and air conditioning systems.

Introduction to heat transfer; Modes of heat transfer, Steady and unsteady state heat conduction and radiation heat transfer, Convection heat transfer, Natural and forced convection, Heat exchangers.

Ordinary Differential Equations: Formation of differential equation, Differential equation, where variables are separable, First order homogeneous equation, Equation reducible to homogeneous form, First order linear equation, Clairaut's form; one variable absent; Exact differential equation, General linear equation of second and higher order with constant coefficients, Solution of homogeneous linear equations; applications, Differential equations with variable coefficients in which either dependent or independent variables are

Math 2703 Mathematics-IV

Credit: 3.00

Credit: 4.00

absent. Factorizing the operator, Euler's equation.

Partial Differential Equation (PDE): Particular solution with boundary and initial conditions, linear and non-linear equation, Charpit's methods.

Mathematical Methods: Bessel's function, Laplace transformation and its use in evaluating integrals, Harmonic analysis, Laplace equation in Cartesian, cylindrical and spherical coordinates, Cylindrical harmonics, Spherical harmonics, Potential of a ring, Potential about a spherical surface, general properties of harmonic functions.

IPE 2704 Manufacturing Processes-I Sessional

Experiments based on IPE-2703

IPE 2706 Professional Ethics in Engineering

The course will be an interactive course having presentation on engineering ethics, professional and ethical engineering codes and case studies. Students' evaluation can be done through assignments on ethical case studies, group presentation and quiz.

ME 2308 Thermodynamics and Heat Transfer Sessional

Experiments based on ME-2307

IPE 3701 Manufacturing Processes-II

Theory and Mechanics of metal cutting: Tool geometry, mechanism of chip formation, types of chips and effect of different factors on. Shear plane and shear angle, cutting ratio, friction between cutting tool and chips, built-up-edge, chip formation and tool design, chip breakers. Cutting force, Metal cutting dynamometers, Economics of metal cutting, tool life, Mechanisms and geometry of tool wear, selection of optimum tool geometry, economics of metal cutting, wear and life of cutting tools. Cutting tool materials, Heating aspects of metal cutting, effects of different factors on temperature of cutting fluid and its action, estimation, measurement and control. Cutting fluid applications. Failure modes. Role of geometrical and process parameters and cutting fluid on machinability. Mechanics of grinding. Economy of machining and grinding. Special techniques and advanced technology of machining and grinding.

Conventional Machining Processes: Study and analysis of turning, drilling, shaping, planning, milling, grinding, broaching.

Nontraditional Machining processes: ECM, EDM, LBM, EBM, Ultrasonic Machining, Water jet machining, AJM.

Plastics: Plastic product manufacturing processes: compounding, extrusion, injection molding, compression molding, blow molding, vacuum forming and hand lay up.

Selection of manufacturing processes on the basis of product characteristics and manufacturing economy.

IPE 3703 Measurement, Instrumentation and Control

Introduction to fundamentals of engineering measurements; study and use of instrumentation and control systems. Linear measuring system, Instruments Limits, fits and gauges: ISO system of limits and Fits. Precision dimensional measurement of length and angles, roundness profiles and flatness, surface roughness and texture, Wear; Taylor's principles on limit gauges; abbey's principle, Measuring threads, gears; measurement; ultrasonic measurement, measurement by light-wave interference; Electrical and electronic measurement, Digital recording by LASER and LASER beam dimension measuring system. Opto-electronic dimensional gauging, Non-destructive testing methods (NDT methods); Inspection and kinds of inspection; Testing and calibration testing of gauges dynamic measurement.

The characteristics and use of analogue and digital instrumentation applicable to industrial engineering

Credit: 3.00

Credit: 3.00

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Credit: 1.50

Credit: 0.75

Credit: 0.75

problems, Statistical methods for developing system specifications; Basic concepts of modern instrumentation. Sensors for measuring stress, strain, pressure, temperature, position, velocity etc.; Signal conditioning techniques using Wheatstone bridge, Operational amplifiers, digital-to-analog converter, analog-to-digital converter etc.; Actuators-hydraulic, pneumatic, electrical etc.; Programmable Logic Controller-components, inputs, outputs and programming with Ladder Diagram; Generalized measurement systems; Modeling of systems; Dynamic characteristics of open and closed loop systems.

IPE 3705 Probability and Statistics

Basic laws of Probability, Conditional Probability, Baye's Theorem, Random variables; Frequency distribution, Measures of central tendency and dispersion, Mathematical expectation; Probability distribution, transformation of variables' Moments and moment generating functions; Sampling; Central limit theorem; Chi-Square distribution, t-distribution, F-distribution; Estimation and confidence interval; Statistical, hypothesis and testing; Goodness-of-fit tests; Correlation and regression analysis of variance; Experimental designs; Randomized block design, Factorial design, Introduction to stochastic problems in engineering.

IPE 3707 Numerical Analysis

Solution of algebraic equations, Graphical method, Iterative method, Newton's method, Gauss reduction formula, Method of dominating diagonal, Interpolation: Forward and backward difference table, Newton's formula for forward and backward interpolation, Divided difference, Lagrange's interpolation formula. Curve fitting: Method of least square, numerical differentiation: Use of Newton's interpolation formula, Douglas- Avakian method, Graphical differentiation maxima-minima, Raphson's methods. Numerical integration: Trapezoidal rule, Simpson's rule, Weddle's rule, Use of Lagrange's interpolation formula, Graphical integration, Solution of differential equations, Adam's method for first- order equation, Picard's method, Runge-Kutta's method, Finite difference method.

ME 3309 Fluid Mechanics and Machinery

Fluid statics; basic hydrostatic equation, pressure variation in static incompressible and compressible fluids; forces on plain and curved surfaces, Continuity, momentum and energy equation; Introduction to inviscid incompressible flow to include two dimensional basic flows, dimensional analysis and similitude; Fundamental relations of compressible flow, real fluid flow; Frictional losses in pipes and fittings; Introduction to boundary layer theory, Introduction to open channel flow.

Types of Fluid machinery, Rotodynamic and positive displacement machinery, Impulse and Reaction turbines; Centrifugal and axial flow pumps, Dimensional analysis applied to Fluid machinery, Specific speed, Unit power, Unit speed, Unit discharge, Performance and Characteristic of turbines and pumps. Cavitations and surging, Reciprocating pumps, Gear and screw pumps, Fans, blowers and compressors, Hydraulic transmission.

IPE 3702	Manufacturing Processes-II Sessional	Credit: 1.50
Experiments	based on IPE 3701	
IPE 3704	Measurement, Instrumentation and Control Sessional	Credit: 0.75
Sessional wo	ork compatible to course no. IPE 3703	
ME 3310	Fluid Mechanics and Machinery Sessional	Credit: 0.75
Sessional ba	sed on ME 3309	
IPE 3720	Business Communication Seminar I	Credit: 1.50

Each student enrolled in the course is to participate in the seminars organized by the Industrial & Production Engineering Department. Every topics of the seminars are to be approved by the Industrial & Production

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Credit: 3.00

Credit: 3.00

Credit-3.00

IPE 3709 Computer Integrated Manufacturing

Introduction: The meaning and origin of CIM–The changing manufacturing and management scene– External communication–Islands of automation and software–Dedicated and open systems – Manufacturing automation protocol–Product related activities of a company–Marketing engineering–Production planning– Plant operations–Physical distribution– Business and financial management.

Group technology: History of group technology– Role of GT in CAD/CAM integration– Part families– Classification and coding– DCLASS and MICLASS and OPITZ coding systems – Facility design using GT– Benefits of GT–Cellular manufacturing

Computer aided process planning: Process planning–Role of process planning in CAD/CAM integration– Approaches to computer aided process planning–Variant approach and generative approaches – CAPP and CMPP process planning systems.

Shop floor control: Shop floor control–Phases–Factory data collection system–Automatic identification methods–Bar code technology–Automated data collection system

Introduction of FMS: FMS–Components of FMS–Types–FMS workstation–Material handling and storage systems–FMS layout–Computer control systems–Application and benefits

Automated manufacturing systems: Automated production line – system configurations, work part transfer mechanisms–Fundamentals of Automated assembly system–System configuration, Part delivery at workstations – Design for automated assembly

AGV and ASRS: Automated Guided Vehicle system–Types of vehicles and AGVs applications–Vehicle guidance technology–Vehicle management and safety. Storage system performance – storage location strategies – Conventional storage methods and equipments – Automated storage/Retrieval system and Carousel storage system. Deadlocks in Automated manufacturing systems – Petrinet models – Applications in dead lock avoidance.

CIM implementation and DATA communication: CIM and company strategy–System modeling tools– DEF models– Activity cycle diagram – CIM Open System Architecture (CIMOSA) – Manufacturing enterprise wheel – CIM architecture – Product data management – CIM implementation software – Communication fundamentals – Local area networks – topology – LAN implementations – Network management and installations.

IPE 3711 Material Handling

Credit: 3.00

Issues and importance of handling of materials: Overview of material handling equipments, Consideration in material handling system design, The 10 principles of material handling. Analysis of material handling problems, Classification of materials, unit load, bulk loads, Study of material handling systems and their efficiency, Selection and classification of material conveying equipment.

Product handling: Design system configuration conforming to various kinds of product features and layout characteristics.

Designing concepts common handling and transfer equipment: Different types of conveyors such as belt, screw, chain, flight, bucket elevators, pneumatic, hydraulic, cranes, and forklifts, Design of ware house facilities appropriate for relevant handling and transfer device.

Automatic packaging devices: Testing procedure of packages, vibration test, drop test, performance limits and testing machines. Algorithms to design and analyze discrete parts material storage and flow system such as Automated Storage/Retrieval System (ASRS), order picking, automated guided vehicle system (AGVS).

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IPE 3713 Quality Management

Emergence of modern concept of quality and its management, quality redefined, identification of quality characteristics; quality of design, conformance and performance; Deming's principle on quality and productivity, Quality costs and their interpretation.

Control and measurement concept of quality: Elementary SPC tools; PDCA cycle, Pareto's law, cause and effect (fishbone), control charts-attribute control charts and variable control charts, Measurement of variation and process capability analysis, Design of experiments- identification of key variables for major variations.

Acceptance sampling plans: QC curves, single and double sampling plans, sequential and rectifying inspection plans, AOQ, AOQL.

Quality and Reliability: Failure and survival probability; hazard rate, component and system reliability and its prediction; failure mode and fault tree analysis, reliability testing. Quality standards and their compliance, ISO 9000 and ISO 14000, DOE, Taguchi methods.

Foundations of quality: Total Quality Management (TQM), Application of TQM philosophy, Frontiers of quality.

IPE 3715 Operations Research

Introduction and scope of Operations Research, Introduction to Mathematical Modeling: Different kinds of modeling and their characteristics.

Classical optimization techniques involving single variable and multiple variables with and without constraints.

Linear models: Simplex algorithm, Duality, Sensitivity analysis; Transportation and Assignment algorithm, Game theory. Integer programming; Dynamic Programming; Queuing models; Introduction to simulation.

Application: Engineering, business and other sectors of economy.

IPE 3717 Product Design and Development

The design process, House of quality, Different types of customer requirements (Kano model), Types of design and redesign, Source of idea generation, Breaking down barriers, DFM, Product development stages, Customers' requirements, Mechanical design processes. Quality Function Deployment (QFD), House of Quality.

Concurrent Engineering (CE): Basic principles of CE, Traditional Engineering Vs. CE, Building block for CE, Important factors in CE practice, Product design methods, Road blocks to CE, Product development team, Applications of CE, Tools for CE.

Value engineering; Identification of customer needs; Establishing product functions; Specification development; Concept generation and evaluation.

Reverse Engineering (RE): Reverse Engineering (RE), Scope and Tasks of Reverse Engineering, Different Approaches, RE tools, Design for assembly, disassembly, reliability and environment; Standardization. Design of gears, bearings, springs, welded joints and screwed joints.

Designing machine parts for strength, deflection, stiffness, fatigue, impact etc.; Design of shafts, keys, power screw, couplings, clutches and brakes.

Alternative solutions and their evaluation, product life cycle, cost analysis, use of standard parts, application of CAD software.

Factors of safety, Predictions of static failure, Phenomenon of fatigue failure, Avoiding fatigue failure, Bearing selection, Nuts, bolts and joints, Design of tension and Compression members, Mechanics of plastic

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Credit: 3.00

Credit: 4.00

materials.

IPE 3710Computer Integrated Manufacturing Sessional

Software Packages and Recent Technology; Commercial solid modeling packages; Salient features - Technical comparison - Modules and tools - Brief outline of data exchange standards. Brief outline of feature technology: Classification of features - Design by features - Applications of features - Advantages and limitations.

FEM Fundamentals: Introduction - Steps involved in FEA; Nodes - Elements and their types, shape function, constraints, forces and nodal displacements - Stiffness matrix - Solution techniques. Analysis of spring element. Simple problems involving stepped bar subject to axial loading and simple structural members with triangular element.

Analysis: Stages of FEA in CAD environment - Preprocessor - Solver and postprocessor. Demonstration of the above using any one commercial packages. Brief outline of kinematic analysis - Manufacturability analysis and simulation.

IPE 3712	Material Handling Sessional	Credit: 0.75
Sessional wo	ork compatible to course no. IPE 3711	
IPE 3714	Quality Management Sessional	Credit: 0.75
Experiments	based on IPE 3713	
IPE 3718	Product Design and Development Sessional	Credit: 1.50
Sessional wo	orks Compatible to IPE 3717	

IPE 4701 Ergonomics and Safety Engineering

Ergonomics fundamentals: History of ergonomics, Modern ergonomics, Simple and complex work systems, Ergonomic aspects in workstation design and analysis. Anthropometric principles and postural analysis in workspace design; Anthropometry and its uses, principles of applied anthropometry, applications of anthropometry in design, postures and body mechanics, musculoskeletal problems in sitting and standing.

Man-machine-material interfaces in manufacturing: physical and cognitive aspects, comparative advantages of man and machine, physical work and human muscular effort, bio-mechanics and bio-engineering.

Design of Manual Handling Tasks: Anatomy and biomechanics of manual handling, design of manual handling tasks; lifting and carrying, NIOSH approach, EC guidelines.

Physiology, Workload, and Work Capacity: Physical work capacity, factors affecting work capacity, measurement of physiological cost of work, fitness for work.

Design of Physical Environment: Human thermoregulation, measuring thermal environment, measurement of light, lighting design considerations, measurement of sound, industrial noise control, vibration, principles for the design of visual displays

Work Measurement: It's Purposes and Uses, Stop-watch time study, Predetermined time standards

Evolution of modern safety concepts, Industrial hazard, safety and risk management, productivity, worker health and safety, proactive management techniques for safety management, safety standards and regulations for engineering works.

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Credit: 0.75

IPE 4703 Machine Tools and Tool Engineering

Machine Tools: Concept and definition of machining and machine tools. Classification and specification of machine tools. History of developments of machine tools, Installation of machine tools, acceptance test of machine tools, types of vibration in the machine tools, effects of vibration and its minimization.

Tool Engineering: Introduction, general considerations in the tool design, Degrees of freedom, location and clamping methods, different types of jigs and fixtures.

Concept of producing geometrical surfaces by generatrix and directrix. Kinematic systems and structures of conventional machine tools. Drive system of machine tools, Electromechanical and hydraulic drives, design of mechanical drive, speed gear boxes, feed gear boxes, infinitely variable drives, PIV and other mechanical stepless drives, hydraulic drives, electrical drives, Bearings, spindles, slide ways of machine tools, machine tool structure, Machine tool automation.

Machine tool control: Functions, requirements and classification, basic elements of machine tools control, mechanical, electrical and hydraulic control, adaptive and automatic control system, mechanical automatic control system.

Working principle and application of various semi-automatic and automatic lathes. Study of milling machine, Unconventional machine, Transfer lines. Flexible automation need, principle and advantages. Basic constructional features, working principle and application of CNC machine tools, machining center and FMS.

IPE 4705 Logistics and Supply Chain Management

Credit: 3.00

Credit: 3.00

Nature and scope of logistics, Logistics environment, Logistic decisions: facility location, transportation, storage and material handling, Logistics information systems, Logistics audit and control. Introduction to SCM- Principles and issues, forward and backward linkage, Inbound and outbound logistics: Supply chain as a source of competitive advantage, Supply chain coordination- procurement, vendor development, reduced sourcing and supplier partnership, Managing inventory in SCM and Risk pooling, coordinated inventory decision, Coordinated pricing decision, coordinated product and process design, Distribution strategies-customer service, physical distribution planning, Material handling, Facility and warehousing decision, Strategic considerations for supply chain: Porters industry analysis and value chain models, the concept of total cost of ownership, Supply chain management strategies, Logistics strategies and global supply chain management, Measuring effectiveness of supply chain management, Value of information sharing in supply chain management, The Bullwhip effect and supply chain management game. E-supply chain and its performance. Case Studies in supply chain management.

Inventory systems management: Different types of product structures for materials planning, management of raw materials, Work-in-Process (WIP), finished good and spare parts inventories, lead time management, cycle time reduction.

Stores management: Stores layout planning, addressing systems, codification systems, traceability, physical verification and counting, surplus and waste management.

Physical distribution: Network planning, packaging, materials handling, carrier systems, distribution inventory, legal aspects and common rules of transportation.

IPE 4707 CAD/CAM

CAD: Fundamental concepts, application, hardware and software, types of CAD systems, common 2D CAD software features, basic 3D CAD features.

CAM: Fundamental concepts, trend of development of NC, principles of NC, types of NC systems and machines, NC manual part programming, CNC part programming using APT language, interfacing CAM software with CNC machines, implementing the CAD/CAM system Principles of FMS.

Robotics: Industrial Robots, robot anatomy (structure) and robot configuration, robot drive and control systems, robot sensors, robot applications.

IPE 4761 Operations Management

Concepts of production systems; Forecasting; Capacity planning; Probabilistic Inventory models, Aggregate planning; Master production scheduling, forecasting models, bill of materials, material and inventory management: Inventory models, ABC analysis, coding and standardization, Aggregate planning, MPS, MRP, capacity planning, operation scheduling.

Push and pull production systems: Material requirements planning-inputs, outputs, procedure, lot sizing etc., MRPII, ERP; Just-in-time (JIT) production system-goals, implementation, Kanban; The push-pull interface; Comparison of push and pull systems.

Parameters and performance of production systems; Efficiencies of performance; Line balancing. Production scheduling; Shop floor control; Facility location; Facility layout. Project planning and control; CPM and PERT; Project organization; Scheduling; Resource allocation.

IPE 4702	Ergonomics and Safety Engineering Sessional	Credit: 0.75
Sessional wo	ork compatible to course no. IPE 4701	
IPE 4704	Machine Tools and Tool Engineering Sessional	Credit: 1.50
Sessional wo	ork compatible to course no. IPE 4703	
IPE 4708	CAD/CAM Sessional	Credit: 0.75
Sessional wo	ork compatible to course no. IPE 4707	
IPE 4000	Project and Thesis	Credit: 1.50

Experimental and theoretical investigation of various topics in Industrial & Production Engineering. The topic should provide an opportunity for the student to develop initiative, creative ability and Engineering judgment. The work may be done individually or in a group (Preferably not more than three in a group). Towards the end of the final semester; the students will have to submit thesis to the department.

IPE 4720 Industrial Attachment

Three weeks (40 hours per week) industrial engagement of the students at different or private organizations for problem identification, formulate the solution of that problem, reporting to the authority of the industry as well as the department and presentation of the entire attachment programme in front of the board.

IPE 4709 Robotics and Industrial Automation

Robot: Robot anatomy, Drive systems of robots, Electrical and hydraulic systems, AC and DC drives, Servo drives using voltage control, current control and direct torque control, PID control systems and performance issues. Feedback systems. Single loop and multi-loop, DSP based motion control systems, Sensors for industrial robots, encoders, resolvers, hall-effect sensors, acoustic sensors, ultrasonic and optical/infrared sensors, Elements of robot vision, Integration using PLCs. Digital motion planning systems.

Industrial Automation: Introduction, basics of PLC, programmable automation controller, relay timer, control system security, sequential control system, direct and reverse action on controller

Credit: 1.50

Credit: 3.00

Credit: 1.50

Credit: 1.50

Credit: 3.00

Credit: 3.00

Credit: 3.00

Credit: 0.75

Discrete system simulation, Generation of pseudo-random numbers, Generation of random deviates. Continuous system simulation, Numerical integration schemes such as, Euler and Runge Kutta. Simulation languages such as EXTEND and STELLA. Design of simulation experiments, Variance prediction techniques, Statistical analysis of outputs, Optimization of parameters, Verification and validation aspects of simulation models. Simulators for training skill, Principles, Learning theory, Examples. Simulation games, Principles, Types, Studies on effectiveness.

IPE 4713 Marketing Management

Marketing concepts: market orientation, relationship marketing, market segmentation and measurement, buyer behavior; Marketing planning and budgeting.

Implementing Business and Marketing Strategies: Business and marketing strategies implementation. Business and marketing strategies implementation issues, Strategy, structure and process, Marketing actions. Monitoring and Controlling Marketing Programs: Control process and Marketing audit Concept of marketing mix: product, price, place and promotion; Strategic and tactical decisions; New product planning processes; Global marketing; Case studies.

IPE 47XX Optional Subject I

Any one course from the optional subjects

IPE 47XX Optional Subject II

Any one course from the optional subjects

IPE 4712 Industrial and System Simulation Sessional

Introduction to Simulation Systems, Models & Simulation, Discrete-Event System Simulation, Simulation of Oueuing Systems, Simulation of Inventory System, Simulation of Reliability Problem, Introduction to Computer Simulation, Problem solving with Computer simulation, Computer Simulation Practice, Problem solving on each topic.

IPE 4730 Business Communication Seminar II

Each student enrolled in the course is to participate in the seminars organized by the Industrial & Production Engineering Department. Every topics of the seminars are to be approved by the Industrial & Production Engineering Department.

IPE 4000 Project and Thesis

Experimental and theoretical investigation of various topics in Industrial & Production Engineering. The topic should provide an opportunity for the student to develop initiative, creative ability and Engineering judgment. The work may be done individually or in a group (Preferably not more than three in a group). Towards the end of the final semester; the students will have to submit thesis to the department.

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Optional Courses of IPE Department

IPE 4731 Emerging Trends in Manufacturing Technology

Surface engineering and High speed grinding; Application of advanced coatings in high performance cutting tools and high performance super-abrasive grinding wheels. Application of surface coating in metal-ceramic joining. Ultra high speed grinding with monolayer CBN grinding wheel. Machining and grinding under cryogenic environment. Micro and nano machining of glasses and ceramics in ductile regime using diamond cutting tool and diamond grinding wheel.

Rapid prototyping: Need for Rapid Prototyping, Basic Principles and advantages of RP, Classifications of different RP techniques with examples, Introduction to three Representative RP techniques: Fused deposition modeling, Laminated Object Manufacturing and Stereo-lithography

MEMS: Introduction, history, development and need of micro-electro-mechanical systems. IC fabrication processes used for MEMS; MEMS sensors and actuators; Mechanical process techniques and process models for micro-machining; Fabrication processes and design of the process sequences; Agile prototyping; Reliability and process control of micro manufacturing processes; Introduction to nano-technology processes.

IPE 4733 Intelligent Manufacturing

AI Technologies and expert system: components and features, knowledge system, knowledge engineer, domain expert, knowledge engineering languages. Artificial neural network and fuzzy logic Expert manufacturing systems: CIM, manufacturing communication system and intelligent manufacturing, flexible manufacturing system, case study of EMS.

IPE 4735 Process Dynamics and Adaptive Control

State space approach to control systems. State transition equations. Linear Time invarient and nonlinear systems. Controllability and Observability of systems. Pole placement design. Design of control systems. Elements of optimal control. Digital control and time delay control systems. Basic concepts of estimation and identification in automatic control systems. Adaptive control of complex process control systems as in automated machining and welding processes, energy based systems and processes. Nonlinear control and related topics using neuro, fuzzy or genetic algorithms. Case studies and descriptions for automated industrial process control applications inclusive of advanced topics in processes for the high tech industry.

IPE 4737 **Energy and Environment Management**

Energy Systems: commercial-noncommercial, rural-urban, renewable-non-renewable energy; Energy planning, Energy generation and distribution systems management; generation mix, dispatch system; Energy policy: national energy policy and tariff policy.

Environmental impact assessment of projects. Source of degradation of earth's eco-system technological development, green-house gases, ozone layer depletion, toxic gases and industrial wastes, Montreal protocol, remedies Noxout China-sun refrigerant technologies and use of catalysts, Environmental economics and accounting system.

IPE 4739 Technology Management

Introduction to technology; Growth of technology; Types and components of technology; Technology and environment; Technology forecasting; Technology assessment, Transfer of technology; Technological development and planning

IPE 4741 Human Factors Engineering

Introduction to Simple and Complex Work systems and Relevance of Human Factors or Ergonomics;

Credit: 3.00

Credit: 3.00

Credit: 3.00

Credit: 3.00

History and Recent Trend in Human Factors; Anatomy, Posture, and Body Mechanics; Anthropometric Principles in Work system Design; Design of Manual Handling Tasks and Hand Tools; Workload, Work Capacity and Fitness for Work; Measuring Work by Physiological Methods; Choice of Work Posture; Fatigue Measurement and Evaluation; Physical Work and Heat Stress, Noise Exposure and Hearing Loss, Design of Thermal, Auditory, and Lighting in Physical Environment; Industrial Product Design; Illumination at Work; Whole Body Vibration; Design of VDT Work Station.

IPE 4743 Total Quality Management

TQM definition; Origins and growth of TQM; Benefits of TQM; Philosophies of TQM: quality circle approach, Deming's approach, Juran's approach, Philip Crosby's approach. Planned implementation of TQM: Planning and commitment, participation, continuous improvement

IPE 4745 Management Information System

Strategic Role of Information System, Organizations, and Business Processes; Information Management, and Decision Making; Computers and Information Processing; Information Systems Software; Telecommunications, Networks and Wireless Technology; The Internet; Electronic Business and E-Commerce, digital markets, digital goods Developing Information systems; function-oriented design; object-oriented design; database management systems Enterprise Resource Planning: Basic issues; Approach; Implementation, and the modules of ERP Project management: establishing the business value of systems and managing change, Managing Knowledge: Knowledge Work and Artificial Intelligence; Enhancing Management Decision Making. Redesigning the Organization with IS Information Systems Security and Control; Ethical and Social Impact of Information Systems.

IPE 4747 Engineering Systems Safety Design and Control

Introduction: Key concepts and terminologies, Engineering systems safety and management, system safety, accident prevention, loss control, risk assessment, energy control model, hazard control hierarchy; Know your worksystem: Identify the elements of a worksystem, divide the worksystem into sub-systems, sub-subsystems to component levels based on hardware approach and functional approach. Represent a worksystem through process flow diagram and P & I diagram; possible safety issues in process plants, repetitive manufacturing, and job shops; Safety issues in material handling, machine tools, and operations. Safety mathematics: Basic probability and statistics, Boolean algebra, probability distributions, reliability tools - FTA, ETA, decision making tools - AHP and PROMETHE, Monte Carlo Simulation, Bayesian decision models, numerical problems, and case examples. Hazard Analysis: HAZAN, HAZOP, PHA, FMEA, and Root cause analysis, numerical problems, and case examples. Risk assessment: Qualitative and quantitative risk, risk assessment process, loss calculation, probabilistic risk assessment (PRA), uncertainty modeling in risk assessment, numerical problems, and case examples. Safety function deployment: Link to quality, QFD, design for safety, prevention through design, Haddon's energy model, and integrated approach for safety functions deployment (SFD), numerical problems, and case examples. Standards, rules and regulations for safety: OSHA 18001, industrial safety rules and regulations in Bangladesh.

IPE 4749 Management and Productivity

Basic concepts of management, Evolution of management thought, Management factors: Planning, Organizing, Leadership, Motivation and Control. Organization and management of business and industry; Evolution, long and short term perspective for growth, Diversification in the context of changing environment: Social, economic, technological, etc. Productivity; Definitions, Scope and measurement, Productivity improvement methods for organizations in Bangladesh.

IPE 4751 System Dynamics and Policy Planning

Systems Concept and System Dynamics, Evolution of System Dynamics as a System Enquiry Methodology. Strategy modeling: Approaches and procedures, techniques - a comparative study.

Credit: 3.00

Credit: 3.00

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Credit: 3.00

Credit: 3.00

Conceptual models, Suitability of System Dynamics for Policy analysis, Qualitative System Dynamics, Physical resources conversion modules, Causal Loop diagramming, Qualitative Study of model behavior and policy recommendation. Case presentation on qualitative analysis. Quantitative System Dynamics. Flow diagramming, model formulation, Software Packages: STELLA, IGRASP, VENSIM. Practice sessions in computer with standard examples. Model validation, Policy design, Algorithms for resource allocation and dynamic policy option selection. Optimization with SD models. Parameter and substructure optimization. Policy design through optimization.

IPE 4753 **Entrepreneurship Development and Micro Industries**

Entrepreneurship: definition and importance and its role; Characteristics and skills of entrepreneurs; Entrepreneurial process; Self assessment; Managers, leader, innovators and entrepreneurs.

Small Business: nature and importance, methods for generating ideas, creativity process, product planning and development process; Merger, acquisition & joint venture; Business plan; Marketing plan; Market research; Financial plan; Organizational and human resource plan; Production plan; Financing the business, Managing early operations and growth.

IPE 4755 Environmental Management

The nature, scope and components of environmental management. Environmental Impact Analysisneed and importance, steps involved, methods of EIA, Public participation and communication. Environmental policy analysis- Macro level and micro level, methods of policy analysis, steps involved. Environmental Management Plan (EMP), Components of EMP, Preparation of EMP, Case Study. Organization for environmental management example, organizational design. Environmental Legislation Acts, Statutes and Regulations in Bangladesh and case studies of litigations and implications. Environmental Audit, Components of Audit, Preparation of Audit Report-Case Study. Institutionalization of Environmental management in Bangladesh, Ministry of Environment and Forest, Central Pollution Control Boards, State Pollution Control Boards, Local Bodies- their scopes, organizational and functional issues. Environmental Information Systems- Global, National, Unitlevel Systems, DSS and Expert Systems, Applications. Environmental Economics Estimation of Costs and Benefits- Cost-Benefit Analysis. Interpretation of Environmental Protection into Business Goals and Plans.

IPE 4757 IT in Manufacturing

Introduction of IT in Manufacturing, Development of Corporate IT, Engineering Applications of Computer Technology in Manufacturing, Computer-Integrated Manufacturing, Relation between Engineering and IT, Emergence of Personal Computers and Networks, Rise of ERP, Dot-Com Boom and Bust, Current state of IT in Manufacturing, ERP in the Plant, Reasons behind ERPs Shortcomings, Legacy of the relations between Corporate IT and Plant Engineering, Ways to cut cost and add capabilities, Value of Focusing on the Supply Chain, Manufacturing's Place in the Supply Chain, Reducing Waste and Loss, Waste Streams, Informed Decision Making, Reducing Waste through Supplier Integration, Reducing Waste through Management of Quality, Providing New Capabilities, Building a Bridge between ERP and the Plant, Guidelines for Technology Evaluation and Selection, Seven Habits of Highly Effective Manufacturers.

IPE 4759 Digital Logic and Micro-Processor Technology

Logic gates, flip-flops, counters, Registers, Memory systems, A/D and D/A Converters, Multiplexers and Demultiplexers, Address Memory, Control Unit. Digital System Design. Introduction to different types of microprocessors, Microprocessor Architecture, Instruction Set, I/O Operations, Interrupt structure, Interfacing & Interfacing ICs, Micro-processor based system design.

IPE 4763 Project and Environment Management

Project: identification, planning, appraisal, project implementation, project organization, budgeting, scheduling, using bar diagram, CPM, PERT, resource allocation, information system and project control, project termination, matrix organization, project manager, contract negotiation and conflict

Credit: 3.00

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resolution, Case study: planning and evaluation of an investment project.

Environmental impact assessment of projects; Source of degradation of earth's ecosystem; technological development, greenhouse gases, ozone layer depletion, toxic gases and industrial wastes, Montreal protocol, remedies Noxout China-sun refrigerant technologies and use of catalysts, Environmental economics and accounting system.

IPE 4765 Industrial and Business Management

Business and Management process, managerial function of business and their relative importance, managerial skills and development.

Emergence of management thought and the patterns of management analysis scientific management and Taylor's Principle, Modern operational-management theory, emergence of the behavioral sciences, recent contributors to management thought.

Management and Society: the external environment, social responsibility and ethics. Organization and management: system approach to organization, organization theory and organizing practices, basics of organizing.

Personnel and human resource management in business; human factors and motivation, leadership, group decision making and communication, Job gradation, process of performance appraisal and reward systems

Managing information for decisions and management information systems

Management in operations and business: systems approach to operation management and business, managing the marketing of goods and service, total marketing activity, marketing mix, some selected topics of marketing such as, Industrial and consumer selling, advertising, new product strategy and decisions.

Management in the international selling, management revisited and challenges for management in the twenty first century.

IPE 4767 Industrial Law and Safety Management

Principles of law of contract; Company law: Law regarding formation, incorporation, management and winding up of companies; Labor law: Law in relation to wage hours, health, safety and other work conditions; The trade union legislation arbitration; The policy of the state in relation to labor; The Factory Act; Law of compensation.

Safety Management: Evolution of modern safety concepts; Industrial hazard, safety and risk management; Worker health and safety; Proactive techniques for safety management; Safety standard and regulation for engineering works.

IPE 4769 Optimization and Heuristic Methods

Genetic Algorithm: Mechanism, Appraisal of GA performance, Data structure, Procedures, Operations and techniques in genetic search, Computer implementation, Applications. Neural Networks: Introduction, multi-layer networks, recurrent networks, learning paradigms. Data Envelopment Analysis (DEA): Definitions, Relative efficiency measurement, Solutions to the DEA Model, Dual DEA Model, DEA issues. Fuzzy optimization: Soft constraints, Approximate reasoning, Multi-criteria soft decision modeling, Interactive approach, and Developing expert systems using fuzzy logic. Simulated Annealing: Metropolis algorithm, Heat Bath Algorithm, Fast simulated annealing, Very fast simulated annealing, Mean field annealing. Chaos: complexity and simplicity, evolution of possibilities, simple models of chaos, strange attractors, deterministic chaos, selforganization, synergistic. Evolutionary computing: hybrid intelligent system, evolutionary dynamics, evolutionary engineering and its application.

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Credit: 3.00

Credit: 3.00

IPE 4771 Maintenance Management

Organization and Management of the Maintenance Function: Introduction to the theory and practice of maintenance, Maintenance and Reliability engineering, Effective maintenance organizations, Operating policies of effective maintenance, Six sigma safety: Application of quality management principles for a Zero-injury safety culture;

The horizons of maintenance management: Condition monitoring of the machine components and condition based maintenance, Corrective maintenance, Reliability based preventive maintenance, predictive maintenance, Reliability centered maintenance, Total productive maintenance, Maintenance repair and operations – storeroom excellence, Computerized planning and scheduling, Computer based maintenance management systems;

Engineering and analysis tools: Economics of reliability, Work measurement, Rating and Evaluating maintenance workers, Work simplification in maintenance, Estimating repair and maintenance cost, Key performance indicators. Maintenance engineer's toolbox, Root cause analysis; Maintenance of plant facilities; Maintenance of Mechanical and electrical equipment; Instruments and reliability tools; Lubrication; chemical corrosion control and cleaning; Maintenance welding.