

Courses offered for Postgraduate Program in IPE

Course No	Course Title	Credit Hours
IPE 6001	Metal Fabrication	3
IPE 6002	Principles of Metal Cutting	3
IPE 6003	Advanced Machine Tools	3
IPE 6004	Production Materials	3
IPE 6005	Statistical Quality Control	3
IPE 6006	Designing for Production	3
IPE 6007	Production System Analysis	3
IPE 6008	Advanced Manufacturing Process	3
IPE 6009	Advanced Quality Control	3
IPE 6101	Tool Engineering	3
IPE 6102	Managerial Economics:	3
IPE 6103	Introduction to Control Engineering	3
IPE 6104	Principles of Industrial Management	3
IPE 6105	Modern Marketing Management	3
IPE 6106	Plastics Process Engineering	3
IPE 6107	Special Study	3
IPE 6111	Materials Management	3
IPE 6112	Probabilistic Methods in Engineering Design	3
IPE 6113	Engineering Data Analysis	3
IPE 6114	Micro-manufacturing	3
IPE 6115	Facility Location and Layout	3
IPE 6116	Operations Scheduling and Sequencing	3
IPE 6119	Composite Materials	3
IPE 6201	Quantitative Analysis I	3
IPE 6202	Control Engineering	3
IPE 6203	Applied Plasticity	3
IPE 6204	Linear Programming	3
IPE 6205	Quantitative Analysis II	3
IPE 6206	Computer Methods in Industrial Engineering	3
IPE 6207	Growth and Management of Technology	3
IPE 6209	Quantitative Techniques	3
IPE 6210	Computer Integrated Manufacturing (CIM)	3
IPE 6211	Inventory Management	3
IPE 6212	Production Management	3
IPE 6213	Decision Analysis	3
-	One PG course from other Engineering disciplines	-

Course Detail

IPE 6001: Metal Fabrication (3 Credits)

Casting and powder metallurgy; Metal forming; Unconventional metal forming process; Fusion, pressure and thermit welding; Cutting, brazing and adhesive bonding techniques; Unconventional Welding technique; Design, preparation and testing of welded constructions.

IPE 6002: Principle of Metal Cutting (3 Credits)

Single and multiple edge cutting tools; Mechanism of chip formation; Mechanics of metal cutting; Cutting force and the factors which influence it; Determination of cutting forces; Causes of failure of cutting tools; Cutting tools without definite tool geometry; Superfinishing processes; Unconventional machining process.

IPE 6003: Advanced Machine Tools (3 Credits)

Review of Structural and functional characteristics of machine tools; Machine tools for gear production; Precision Machine tools; Automatic machines and transfer lines; Design of machine tools for static and dynamic rigidity; Economics in the design and the selection of machine tool; NC machine tools.

IPE 6004: Production Materials (3 Credits)

Atomic arrangement and imperfections in microstructure; Ferrous and non-ferrous metals and alloys; Influence on physical and chemical properties of metals by alloying materials; Electrical, magnetic, thermal and mechanical properties; Composite materials; Surface & heat treatment; Non-metallic materials and their uses; Inspection of metals.

IPE 6005: Statistical Quality Control (3 Credits)

Economics of quality control; Probability; Acceptance sampling by attributes and by variables; Control charts: average, range, standard deviation and fraction defective.

IPE 6006: Designing for Production (3 Credits)

Creative decision making in developing products; Design criteria, alternative solutions and their evaluation; Design morphology; Graphical presentation of design concepts; Product analysis and product development including sales considerations; Economics of product development and standardization; Group technology; CAD; Technological and product substitution; Materials in design; Case study on product design with emphasis on import substitution.

IPE 6007: Production System Analysis (3 Credits)

Man machine materials system in production; Environmental and human factors affecting productions; Work measurement; Modern organizational and plant layout techniques such as

matrix organization; Group technology; Machine lines; OR techniques for management and PPC: graphs and network, linear programming, decision making, etc.

IPE 6008: Advanced Manufacturing Process (3 Credits)

Theory of metal forming: drawing, rolling, extrusion, forging, etc.; Modern metal forming processes; Theory of metal cutting: mechanics of chip formation; Chip-tool-job contact process and heat phenomenon; Generating processes for gear manufacture; Modern machining processes.

IPE 6009: Advanced Quality Control (3 Credits)

Basic concepts: optimum cost of conformance; Quality improvement: management controllable defects and operator controllable defects; Designing for quality: failure model/failure defect and fault tree analysis, maintainability, safety in new product design and reliability; Measurements: mechanical, electrical, electronic, pneumatic and optical; Process control: concepts and techniques; Acceptance sampling; Quality assurance; Croanization for quality.

IPE 6101: Tool Engineering (3 Credits)

Functions and organization; Fits and tolerance; Locating principles and clamping methods; Clamping force; Various types of locators; Tool guides; Jigs and fixtures; Open and closed die design; Design and production of jigs and fixtures; Cutting tool materials: heat treatment of tools; Production of tools: carbide, threading and gear cutting tools, milling cutter etc.; Economic factors in tooling; Discriminant analysis; Classification of tools inventory.

IPE 6102: Managerial Economics (3 Credits)

Introduction to managerial economics: definition and scope; Review of optimization techniques; Comparing investment alternatives; Cost of capital: capital budgeting, capital rationing problems; Demand theory; Production theory: production function; Marginal rate of substitution of input factors; Cost theory: cost curves of a firm in short-run and long-run; Market structure and the theory of price; Firm's price output decision under (i) pure competition, (ii) Monopoly, and (iii) Oligopoly; Price leadership; Forecasting: analysis of time series; Risk analysis and decision theory; Replacement, Renewal and Reliability: case studies.

IPE 6103: Introduction to Control Engineering (3 Credits)

Introduction to theory of control systems (mechanical, hydraulic, thermal, pneumatic); Study of frequency: stop function and system responses, transfer functions, characteristic function; Analysis of systems, system compensation, analogs; Application of servo mechanisms in mechanical system, hydraulics, servo control pneumatic, electro-mechanical control.

IPE 6104: Principles of Industrial Management (3 Credits)

Development of modern management thought; Motivation incentives and morals; Economic analysis in business decisions: quantitative methods in business decisions; Information systems.

IPE 6105: Modern Marketing Management (3 Credits)

Conceptualizing marketing management: the concept of marketing and the marketing system; Analyzing marketing opportunities: marketing environment, consumer markets and buyer behavior; Market segmentation, market measurement and forecasting; Organizing for marketing: marketing organization and planning; Planning the marketing: program-product- policy decision, new product decisions, price decision, channel decisions, physical distribution; Advertising, sales decisions; Controlling the marketing effort: marketing control, sales, cost and profit analysis, profitable share of market.

IPE 6106: Plastics Process Engineering (3 Credits)

Different types of polymerization; Molecular weight and its distribution; Mechanical, electrical, thermal and optical properties; Processing properties: thermal and rheological, die swell, melt fracture; Mathematical models of flow in cannels; Testing of properties and different standards including I.S.O.; Degradation; Stabilization; Common industrial materials; Fabrication processes: mixing-batch and continuous types; Extrusion: principles, design calculations and flow theory, graphical representation, constructional features; Materials for extrusion; Extrusion dies; Coating of wires; Film extrusion: techniques of manufacture; Injunction molding: construction operation, effects of different processing variables.

IPE 6107: Special Study (3 Credits)

IPE 6111: Materials Management (3 Credits)

Fundamentals of materials management; Different types and configurations of product structures, materials planning; Materials evaluation and inventory classification; Materials codification; Stores accounting and physical verification; Surplus and waste management; Value engineering; Variety reduction and standardization; Lead time management; Distribution requirements planning (DRP); Purchasing, material sourcing, source development, vendor rating and selection; Warehouse design; Optimization techniques in facility location and layout; Cost minimization in materials handling; Materials handling equipment selection.

IPE 6112: Probabilistic Methods in Engineering Design (3 Credits)

Review of basic probability concepts, random variables and distributions; Probabilistic methods and their applications in analysis and synthesis of engineering systems; Modeling and quantification of uncertainty; Model validation; Regression and correlation analyses; Monte Carlo simulation; Reliability analysis and reliability-based design optimization.

IPE 6113: Engineering Data Analysis (3 Credits)

Statistical estimation; Simple comparative experiments: inferences about the differences in means for randomized and paired comparison designs; Experiments with a single factor: the analysis of variance, fixed effect model, model adequacy checking, the regression approach to the analysis of

variance, nonparametric methods in the analysis of variance; Randomized blocks, latin squares, and related designs; Introduction to factorial designs: blocking and confounding, two-level fractional factorial designs, three-level and mixed-level factorial and fractional factorial designs; Fitting regression models; Response surface methods; Steepest ascent; Robust design; Data envelopment analysis; Multivariate analysis.

IPE 6114: Micro-manufacturing (3 Credits)

Fundamentals of micro-manufacturing; Moore's law; Materials: silicon, gallium arsenide; Processes: pattern generation, optical lithography, etching, doping, oxidation, diffusion, ion implantation; Deposition techniques: PVD, CVD; Equipment design; Structures: plasma- etched and wet-etched structures, fabrication of structures by controlling deposition parameters; Micro-metrology and materials characterization; Process integration; CMOS transistor fabrication; Packaging: surface mount technology, flip chip technology; Tools for microfabrication; Cleanroom design; Contamination control; Factory systems.

IPE 6115: Facility Location and Layout (3 Credits)

Fundamentals of facility location and layout; Layout procedures; Computerized layout planning; Planar single-facility location: minisum and multi-objective location problem; Storage systems layout: different types of storage location policy; Planar multi-facility location: rectilinear and Euclidean distance minisum location selection; Network location: tree network, n-center problem; Cyclic network location: covering, n-center, n-median and warehouse location problems.

IPE 6116: Operations Scheduling and Sequencing (3 Credits)

Introduction to operations scheduling; Scheduling algorithms, search process, classification of scheduling problems; Performance measures; Problems without due dates and with due dates; Single-machine scheduling, sequencing; Heuristic procedures; General purpose methodologies in scheduling, Branch and Bound algorithm, Integer programming, Dynamic programming, Neighborhood search algorithms; Non-simultaneous arrival of jobs, dependent jobs, sequence dependent setup times; Parallel machine models; Flow shop scheduling; Job shop scheduling.

IPE 6119: Composite Materials (3 Credits)

Introduction: general characteristics, application, selection of composite materials; Properties and morphology of different types of fibers and matrixes; Fiber surface treatments, fillers and other additives, incorporation of fiber into matrix, fiber content, density, void content and fiber architecture. Characteristics and mechanics of different types of lamina. Laminated structure, inter-laminar stresses. Mechanical properties: static mechanical, fatigue, impact, environment effect, creep, fracture behavior and other properties. Manufacturing: Fundamental issues in composite manufacturing, bag molding, compression molding, pultrusion, filament winding, resin transfer molding, injection molding and other manufacturing processes. Design: Failure prediction, laminate design consideration, joint design, examples of design and application.

Polymer Nanocomposite: Carbon nanotubes (CNT), its structure and properties; CNT based composite and its properties.

IPE 6201: Quantitative Analysis I (3 Credits)

Probability distribution, characteristic function; Regression models and statistical design; Stochastic process; Differential equations, linear algebra; Convex combination and convex set; Kuhn Tucker condition for optimization: maximum and minimum applied to multivariable; Nonlinear programming algorithms; Lagrange multiplier; Z-transformation and Laplace transformation.

IPE 6202: Control Engineering (3 Credits)

Introduction to automatic controls; Representation of control components: mechanical, electrical, thermal and fluid system; Series and parallel laws analysis; Comparators and integrators; Representation of control systems: block diagram algebra, system such as hydraulic servomotor, temperature control system; Steady-state operation: P-I, PI-D-, PID- control systems, Laplace transforms; The characteristic function: transient and impulse response, stability criteria, the root locus method; Analogue computers; Frequency response method; Improving system performance; Study of control systems such as adaptive hydraulic, pneumatic and electrical systems.

IPE 6203: Applied Plasticity (3 Credits)

Study of plastic behavior of common engineering metals; Plasticity conditions, deformation equations, buckling, necking; Methods of solving forming problems; Design of extrusion: drawing and other forming tools and dies including recent developments.

IPE 6204: Linear Programming (3 Credits)

Linear algebra related to linear programming; An overview of simplex algorithms; Theoretical fundamentals: duality, dual simplex and post optimality analysis; Transportation: primal and dual algorithms; Revised Simplex; Decomposition principle; Network flow; An introduction to MPSX program.

IPE 6205: Quantitative Analysis II (3 Credits)

(Prerequisite IPE 6201)

Mathematical tools; Cost-volume-profit analysis; Decision making with an uncertain future; Linear programming; Games and strategies; Inventory and production; Forecasting; Markov analysis; Waiting lines; PERT, CPM.

IPE 6206: Computer Methods in Industrial Engineering (3 Credits)

Computers and modes of storage memory; Access time for different data storage system; Software of a computer: executive, macros, library system, monitoring and editing of a program; Batch processing, time sharing, paging; Computer languages: FORTRAN, GPSS, DYNAMO; Use of

computers in production planning and control: information system, inventory management, simulation etc.

IPE 6207: Growth and Management of Technology (3 Credits)

Concept and technology: technology and engineers; Technology: its role and influence in the modern economy; Multiplier model; Hardware and software technologies; Growth of technology: innovation and substitution; Transfer to technology: absorption, adaptation and dissemination; Import of technology: its costs and policies; Scale of economy; Ancillary industry and linkage.

IPE 6209: Quantitative Techniques (3 Credits)

Convex combination and convex set; Maximum and minimum applied to multivariable; Unconstrained and constrained optimization; Linear programming; Inventory models; Scheduling techniques; Markov analysis; Waiting lines; Dynamic programming; Nonlinear Algorithms.

IPE 6210: Computer Integrated Manufacturing (CIM) (3 Credits)

Types of manufacturing systems and introduction to computer integrated manufacturing (CIM); CIM Components; Parts design: CAD, use of graphics, AutoCAD; Numerical control (NC), NC system, CNC, DNC; NC Part programming: APT language, macro in APT; CAM; Computer aided process planning (CAPP), group technology; Manufacturing support system; Computer monitoring; Supervisory computer control; Computer quality control; Material handling systems in CIM: AGVs, transfer line; Robotics: industrial robots and their function in CIM; Production planning and control in CIM; Operation scheduling; Data collection system; Flexible manufacturing system (FMS), mathematical models and algorithms to solve FMS problems.

IPE 6211: Inventory Management (3 Credits)

Deterministic case: order quantity for constant demand rate; Quantity discount; Finite capacity; Inflation; Time varying demand; Coordinated replenishment with or without group discount; Multi-echelon inventory situation; Probabilistic case: continuous review, periodic review, order point, order quantity; Control system; Exchange curves; Safety stocks; Decision rules for and C items and perishable items; Coordinated replenishment; Multi-echelon inventory system; Inventory problem with budget, store, transportation etc., limitation.

IPE 6212: Production Management (3 Credits)

Strategic, tactical and operational decisions; Anthony's framework; Production planning system; Aggregate production planning: relevant costs, linear cost models, lot sizing models, general cost models; Operations scheduling: single machine, parallel machine, flow shop, job shop; Project management; Line balancing; Hierarchical production planning: single-stage system, two-stage system; Factors effecting HPP, MRP; Comparing MRP with HPP.

IPE 6213: Decision Analysis (3 Credits)

Introduction: pay off and regret tables decision criteria; Expected value of perfect information; Decision trees and probability trees; Bayesian revision of probabilities; Risk aversion and utility; Decision-making with utility; Markovian decision process; Game theory; OR in decision making; Case study.