

## 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 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 the production of gears; 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, analogues; Application of servo mechanisms in mechanical system, hydraulics, serve control pneumatic, electro-mechanical control.

#### IPE 6104: Principles of Industrial Management (3 Credits)

Development of modern management thought; Motivation incentives and moral; 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 multiobjective location problem; Storage systems layout: different types of storage location policy; Planar multifacility 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 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; Multiechelon 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; Multiechelon 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.