

### **Third Year First Semester**

#### **Prod/T/311 TECHNOLOGY OF MACHINING SYSTEMS**

(A) Manufacturing system as an input-output model; Survey of products; Machining accuracy and algebra of dimensions, surface finish and sub-surface properties of products. (B) Selection processes, tooling and machines for producing: i) External surface of revolution; ii) Internal surface of revolution; iii) Regular and irregular profiles; iv) Threads and gears. (C) Selection of cutting variables compatible to machines and processes. (D) Finishing processes, viz. grinding, honing lapping etc. (E) Estimation of machining time. (F) Stereometry of cutting tools, Mechanics of metal cutting action (G) Computations of cutting forces (H) Failure of cutting tools materials (I) Economics of machinings

#### **Prod/T/312 INSPECTION AND PRODUCT CONTROL**

(A) Standards of measurements; Concepts of interchangeability, Taylor's principles; Design of limit gauge; Selective assembly. (B) Mechanical, pneumatic, electrical, electronic and optical measuring systems for in-processes and post-processes features inspection of products; Principles of light wave interferometry and interferometers; Ultrasonic gauging. (C) Co-ordinate measurement principles, Co-ordinate measuring machines (CMM); Product feature recognition and image processing. (D) Surface finish measurement and analysis; Metrology of screw threads, gear metrology, machine tool metrology; Quality and reliability; Basic principles of statistical quality control; General theory of control charts for variable and attributes; Concept of acceptance sampling; Computer applications in inspection and quality control, ISO 9000 requirements.

#### **Prod/T/313 ENERGY PRODUCTION SYSTEMS**

(A) Energy Management; (B) Elementary study of combustion; Power developing and power absorbing reciprocating engine; Internal Combustion Engine; Reciprocating compressor; (C) Principles of turbo-machines: Steam and Gas turbine; Gas Turbine power plant Cycle; (D) Utilization of Nuclear energy and nuclear power plants; Principles of Direct Energy Conversion: Fuel cells, MHD generators; Solar energy Conversion Systems; Bio-energy conversion Systems; Wind, Tidal, Geothermal and Ocean Thermal energy Conversion systems.

#### **Prod/T/314 PLANT LAYOUT & PRODUCT HANDLING**

Objective of Facility Design: Types of layout problems, the layout function, organization of layout. Analysis and Design of Material Flow: Systems approach to flow cycle, flow possibilities, facility layout, process charts, string diagram, flow process charts, Quantitative analysis of material flow; optimal material flow configuration. Space and

Area Allocation for Production and Physical Plant Services; Computerized handling of layout algorithms; Algorithms for computerized Layout Planning, Construction and Development type of computerized Layout Planning Techniques i.e. CRAFT, ALDEP, CORELAP etc.; Product handling; Design of system configurations conforming to various kinds of product features and layout characteristics; Design concepts of common handling and transfer equipment; Different types of conveyors, crane, elevator, fork lifters; Design concept of warehouse facilities commensurate with adopted kind of handling and transfer devices; Automated packaging devices. Application of pneumatic and hydraulic system in

transportation and handling of products. Design of integrated plant layout for product handling systems.

### **Prod/T/315 DESIGN OF ENGINEERING SYSTEMS - I**

Interrelatedness of product design and production processes. Introduction of engineering design processes; Conceptual design, configurational design, detail design; Design Methods; Design to Standards. Design of Simple Systems involving fasteners, pins, cotters, welds, rivets, pressure vessels, etc. Use of general design rules, rational sections for strength, rigidity, weight reduction, choice of materials. Modelling, simulation and optimization in design; Economic considerations; Systems Engineering using the concepts of concurrent engineering/DFM/DFA/QFD/robust design (Taguchi methods)

### **Prod/T/316 PRODUCTION MANAGEMENT**

Management approaches to planning, analysis and control, Functions involved in a production system; Production cycles, Planning functions; Types of industry: Job, batch, continuous, mass and flow productions; Organization and policies in respect of production planning and control; Forecasting techniques; Resources economics and scheduling, Sequencing and plant loading for optimal utilization; Queueing models and line balancing; Materials planning and control; Inventory management: MRP, MRP- II, JIT, Value analysis; Productivity analysis; Mechanics of production control.

### **Prod/S/311 METROLOGY AND PRODUCT CONTROL LABORATORY**

(A) Laboratory experiments for the measurement and inspection of various product features using:- i) Mechanical, pneumatic, optical, electrical and electronic instruments, ii) Co-ordinate measuring machine (CMM) iii) Interferometer; iv) Colour image processing system for product feature recognition, edge detection, etc; v) Ultrasonic ecograph; vi) Surface roughness measuring system, and vii) Gear inspection modules. (B) Laboratory experiments and exercises involving hardware and software modular based off-line product gauging and inspection analysis, inspection information recording and processing - signal channel and multi-channel; on-line and off-line computer aided quality control analyses.

### **Prod/S/312 MANUFACTURING SYSTEMS LABORATORY - IV**

(A) Experiments to demonstrate: i) Layout of die and die making practices, ii) Wire drawing. iii) Extrusion processes, v) Friction and lubrication in forming processes. vi) Use of computer for die design/die layout, etc. (B) Machining operations related to: i) Relieving, and profiling ii) Contouring, iii) Finishing processes and iv) Grinding of tools and cutters

### **Prod/S/313 PRODUCTION MANAGEMENT LABORATORY**

Experiments and computational work involving: i) Production planning and scheduling ii) Processes planning iii) Resources allocation, machine loading and optimization, iv) Plant facility layout models; v) Mechanical, electro-analogue and computer aided analogue space models for optimal plant facility location analysis; vi) Time study & Motion study.

### **Prod/S/314 PROJECT AND TERM PAPER**

An individualized project will be assigned either for analysis or for manufacture or both to be completed within the semester and submitted for evaluation along with the Report.

Alternatively, students will be required to submit a term paper for evaluation based on an assignment of thematic area of development in Engineering and Technology.

### **Third Year Second Semester**

#### **Prod/T/321 MACHINE TOOL SYSTEMS**

Basic concepts and general requirements of machine tools; Conformable kinematic synthesis for tracing, forming, enveloping and generation; Pseudo-Boolean approach for kinematic order; Fuzzy-cluster grouping for size range evaluation; Determination of power for optimal utilization; Designing discrete step drives for machine tools speeds and feeds; Stepless drives; Hydraulic drives and control; Functional analysis of machine tool spindles, guides and slideways; Compliance of machine tools; Automation and control features; Selection and acceptance testing of machine tools.

#### **Prod/T/322 ERGONOMICS AND WORK DESIGN**

Human factors in a production system: characteristics features of man-machine system: quantitative and qualitative visual displays; Human factors associated with speech communication; Introduction to kinesiology; Biomechanics and bioengineering aspects of human motor activity; performance analysis of body members in making specific types of movements; and conceptual relationships of stimuli and responses; Design of control function. Tools and related control devices and control systems. Design of work place and work-components; Applied anthropometry, activity analysis: concepts of productivity and its improvement strategies; Design of individual work place; Human performance under heat, cold, illumination, vibration, noise, pollution. Static and dynamic conditions. Application of results from human factors data and analysis in work

study; work design; Method study and work measurement techniques; performance rating and time standards.

#### **Prod/T/323 MATERIAL FORMING**

Nature and purpose of materials forming theory: Octahedral stresses and yielding. Yield criteria, determination of working load in homogeneous deformation, stress evaluation using slip lines: Significance of Velocity diagrams (hydrograph), Visco-plasticity: Upper and lower bound techniques of load estimation for metal; forming. Drawing of round bars, flat strips, extrusion of bars and flat strips, rolling of flat slabs and strips: Roll-pass design principles, Forming, Deep Drawing, Bending, Miscellaneous forming processes Mould flow plastics. Non-Traditional forming methods. Principle design features of different forming dies, Design of extrusion, drawing and forging dies; Design of moulds, gating and riser systems for plastics and die design for plastic components. Use of computers in solving problems in forming of materials.

#### **Prod/T/324 MASS PRODUCTION TECHNOLOGY AND AUTOMATION**

Types of production systems; Role of interchangeability and standardization; Economics of mass production; Factors of production; Planning for optimal production. Comparative Study of various production processes for making (a) Flat surfaces, (b) Housing, (c) Shafts and

spindles, (d) Screw threads, (e) Gears, (f) Assembled products. Holding devices for tools and workpieces; Collets and chucks; jigs and fixtures; Locating and clamping and clamping elements; Locating rules. Alternative processes for polymer products; Moulding, extrusion and machining of thermoplastics and thermosetting plastics; Mass production processes by precision castings; Investment casting, loam moulding, die casting, etc. Press tools and punch-die working shears, drawing and forming dies and punches. Economics of tooling. Basic principles of automation; Extending the capabilities of conventional machines through improved devices; Automatic machines; Hydro copying lathe; copy milling; single spindle Auto screw machine; Swiss type Automats.

### **Prod/T/325 INFORMATION TECHNOLOGY**

Information concepts & processing: Evolution of information processing, data and communication. Parallel and Serial Communication, Standard interface, Simplex, half-duplex, full duplex, Synchronous and Asynchronous Communication. Need for computer Networks, network protocols, Transmission Media, OSI Model and network architecture for shop floor integration, Single user, multi-user, Client/Server systems. Concepts of LAN, WAN, Internet, its utility & securities, Levels of Decision making in Manufacturing and Design industry. Introduction to DBMS and its Applications in Manufacturing and Management.

### **Prod/T/326 DESIGN OF ENGINEERING SYSTEMS-II**

Problems of rational design: Fundamental concepts in design of engineering systems. Static and dynamic analysis of engineering systems involving shafts. Linkages, couplers, transmission devices, toothed elements, etc. Tribological analysis of support systems. Computer solution of design problems.

### **Prod/S/321 ERGONOMICS LABORATORY**

Experiments involving: A) Anthropometry B) Kinesiology C) Comfort analysis D)

Fatigue, and E) bio-engineering, etc. are to be done.

### **Prod/S/322 COMPUTER GRAPHICS AND MODELLING**

Laboratory exposure on: Use of graphics package for (A) Interactive graphics for Generation of polyhedron, cylinder, sphere, cone etc. (B) 3D viewing and transformation, hidden surface removal. (C) Generation of curves and surfaces; Geometric modelling;

### **Prod/S/323 DESIGN SESSIONAL**

Design problems related to simple engineering systems, involving fasteners, pins, cotters, welds, rivets, pressure vessels, etc. Problems related to static and dynamic analysis of engineering systems involving shafts, linkages, couplers, transmission devices, toothed elements etc. Tribological analysis of support systems Computer solutions of design problems.

### **Prod/S/324 VACATIONAL PRACTICAL TRAINING AND VIVA-VOCE II - 200 hrs.**

In-plant training involving study of: a) Complex machining operation b) Plant layout c) Organizational hierarchy d) Degree of automation e) Product handling features. f) Specialized tooling, set-ups Students will be required to submit a report on the in-plant training and appear for a viva-voce test of the said training.