# FACULTY OF ENGINEERING


## Syllabus for the

## T. E. (Production Engineering-Sandwich)

## (w. e. f. 2010-2011)


## UNIVERSITY OF PUNE

# UNIVERSITY OF PUNE
# COURSE STRUCTURE FOR
## TE (Production- Sandwich) (2008 Course)

### Semester- I

| Subject Code | Subject | Teaching Scheme (Hrs) | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Lecture | Pr/Dw | Th | Tw | Or | Pr | Total |
| 311121 | Industrial In-plant Training for 6 months (2 contact hrs. per student per week)@ | - | - | - | 150 | 100* | - | 250 |
| 311122 | Manufacturing. Technology ( self study)$ | - | - | 100 | 50 | - | - | 150 |
| 311123 | Seminar @ | - | - | | 50 | 50 | | 100 |
| | **Total** | **-** | **-** | **100** | **250** | **150** | | **500** |

\* - Oral based on TW by one internal guide & one external examiner from industry.

$ - Students should study this subject during training & contact supervisor for guidance.

@- The contact hours are provided for supervision of students under training and for giving guidance regarding the seminar/theory subject to be studied during the training.

### Semester II

| Subject Code | Subject | Teaching Scheme (Hrs) | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Lecture | Pr/Dw | Th | Tw | Or | Pr | Total |
| 311124 | Kinematics Design of Machines | 4 | 2 | 100 | - | 50 | - | 150 |
| 311125 | Material forming & Mould design | 4 | 2 | 100 | - | 50 | - | 150 |
| 311126 | Production & Industrial Management II | 4 | - | 100 | - | - | - | 100 |
| 311090 | Numerical Techniques and Database. # | 4 | 2 | 100 | 50 | - | - | 150 |
| 311091 | Production Metallurgy. # | 4 | 2 | 100 | 50 | - | - | 150 |
| 311127 | Production System Design | - | 2 | - | 50 | | - | 50 |
| | **Total** | **20** | **10** | **500** | **150** | **100** | | **750** |

#- Common to TE (Production).

Th- Theory          Pr- Practical          Dw- Drawing          Tw- Term Work

# 311121 Industrial Inplant Training

| Teaching Scheme | Examination Scheme |
|---|---|
| **2 hrs/week/student** | **TW: 150 Marks** |
| **Duration of Training in industry: 6 Months** | **Oral: 100 Marks** |

**General guidelines to the institutions running Production - Sandwich degree course and to the students opting for sandwich course.**

Students are expected to learn following things during the Industrial Inplant Training of 6 months:

He shall be given training in large or medium size manufacturing unit in various departments.

1. Orientation/Rotational Training: Organizational structure of the company, scale and type of production, types of products, functional departments like manufacturing, process planning and control, quality assurance, assembly, testing, maintenance, stores, purchase, marketing, human resources department, design and drawing department, general administration, packing and dispatching, tool engineering, materials and material handling etc.

2. Industrial Design and Drawing Practice: Design and Drawing standards, study of Mechanical components and introduction to machine design element design such as gears, gear boxes, chain and belt drives, electric motor selection, couplings, shafts, keys, bearings, brackets, bolted and welded connections, sub-assembly and assembly design and drawings, various ISO/BIS/TS standards for design, simple assignments based on the above items, selection of materials, material specifications, heat treatment, and properties of materials.

3. Study of Manufacturing Processes: Study of Processes such as casting, forging, sheet metal working, plastic moulding, extrusion, rolling and machining operations on various machines, study of finishing processes like grinding, lapping, honing, burnishing, buffing, etc. Chipless Manufacturing Processes.

4. Study of Various Manufacturing Machine Tools:
   Lathe, Capstan and Turret Lathe, Planer, Shaper and Milling, Mechanical and Hydraulic Presses, Gear Hobbing, Shaping and Grinding Machines. I

5. Study of special purpose machines, jig boring machines, NC/CNC machines, work centers, transfer lines and automatic machines.

6. Study of single point cutting tools and multipoint tools, form tools, jig and fixtures, special purpose machine tools and press tools, Tool Material and Tool Selection, Study of Cutting Parameters.

7. Study of Material Handling Methods and Equipment.

8. Introduction to Quality and Quality Policy, Need for quality control, National and Intemational Standards on Quality and Reliability, Introduction to Total Quality Management (TQM), Kaizen Practice, 5' S, Study of various inspection gauges, selection of gauges, comparators, calibration of gauges, standards room etc. Product Performance Test Procedures.

9. Study of various Production Planning and Control functions. Process and Operations planning, yearly and Monthly Planning, Forecasting, Machine Loading, Exposure to Interdepartmental coordination planning.

10. Study of various Industrial Engineering Functions, Work Study (Motion Study and Time Analysis), Economic considerations, Plant Layout, Safety aspects of working, safety gadgets used on machines and personal safety,

Students shall be asked to do simple assignments in various departments where he is undergoing training. Industries shall be requested to prepare training program before hand, covering as much as possible from above mentioned topics depending upon the type of industry. Students shall be encouraged to give monthly reports and presentation (preferably power point presentation) to the college of his/her work in the industry. Students are also should be encouraged for paper presentation at National/International Level based upon the applied knowledge gained during the Inplant Training.

**Term Work**
Term work will consist of a comprehensive report based on his observation, training received and assignments completed during 6 months of training. The report shall also include good drawing figure, process sheets, machine and product specifications.

**Examination**
Oral Examination shall be conducted after training by appointing one internal examiner and one external examiner from industry.

# 311122 Manufacturing Technology (Self Study)

| Teaching Scheme | Examination Scheme |
|---|---|
| Self Study | Theory: 100 Marks |
| | TW: 50 Marks |

## Unit I: Non Conventional Machining processes
Detail study with respect to principal, processes parameter, comparative assessment of abrasive jet machining, ultrasonic machining, chemical machining, electrochemical machining, electrodischarge machining, electron beam machining, laser beam machining, plasma arc machining, ion beam machining, wire cut EDM, merits, limitations and applications of each.

## Unit II: Plastic Processing
Introduction, types of plastics, elastomers, material for processing plastics, processing plastics, molding processes, calendaring, thermoforming, casting, laminating and reinforcing, foam plastics, fastening and machining plastics, design considerations. Recycling of plastics.

## Unit III: Advanced Manufacturing Processes
Introduction to Micro Electro Mechanical Systems(MEMS), Introduction to fabrication of micro electronic devices – semiconductor and silicon, crystal growing and wafer preparation, film deposition, oxidation, lithography, etching, diffusion and ion implantation, bonding and packaging, yield and reliability, printed circuit boards, Introduction to Nanotechnology, Nanofabrication, Top Down and Bottom Up manufacturing.

## Unit IV
## Metrology I

**Comparators:** Definition, Types, Characteristics, Applications, Construction and Working of Different Mechanical, Electrical, Optical, and Pneumatic Comparators.

**Measurements by light wave interference:** Basic Principle, Optical Flats, Fringe Patterns and Their Interpretation, Testing Of Flat Concave, Convex and Irregular Surfaces, and Checking Of Slip Gauges, Michelson Interferometer, NPL Flatness Interferometer.

## Unit V: Metrology II
**Angular Measurement:** principle and applications of measuring instruments like protractor (optical and bevel), sine bar, angle gauges, spirit level, clinometer, autocollimator, angle dekkor, constant deviation prism, and miscellaneous  measurement of angle,  Methods of measuring surface finish.

## Unit VI: Mechanical Estimating and Costing
**Fundamentals of Estimating:** Objectives and functions of cost estimating, organization of estimating departments, principle factors in estimating, estimating procedure
**Estimation of Weights and materials:** Introduction, need for scrap, provision for scrap, minimizing manufacturing time, estimation of volume and weight of material, volume and surface area of solids, densities of metals
**Depreciation:** Concept, need and classification, methods of depreciation. Replacement Techniques, Time Value of Money.

**Reference Books:**
1. TTTI Madras, Kannappan D. and Augustine A. G., "Mechanical Estimating and Costing".
2. T. R. Banga and S.C. Sharma, "Mechanical Estimating and Costing", Khanna Publisher, 1985.;,
3. Hajara Choudhary, "Workshop Technology", Media Promoters & Publishers Pvt Ltd
4. R. K. Jain, "Engineering Metrology", Khanna Publication.
5. Kalpakjian and Schmid, "Manufacturing Engineering and Technology", 4$^{th}$ edition, Pearson Education India ISBN 81-7808-157-1.
6. R K Jain, Production Technology, 11$^{th}$ edition, Khanna Publication.
7. Sharma P.C., "A Text Book of Production Technology- Manufacturing Processes", S. Chand & Co., 2008, ISBN 81-219-111-4-1.
8. Amitabh Ghosh & Ashok Kumar Mallik, "Manufacturing Science", Affiliated East-West Press Pvt. Ltd., ISBN 81-85095-85-X.

## 311123 Seminar

| Teaching Scheme: | Examination Scheme |
|---|---|
| Self Study | Term work: 50 Marks |
| | Oral: 50 Marks |

Seminar is in the form of Technical Paper Presentation which is expected to be on a state-of-the-art technical topic, related to Production Engineering discipline but beyond syllabus. The seminar report and its presentation is to be based on material, mainly collected and analyzed from the latest papers in technical journals. The report is expected to be about 15 A4 size pages, including figures and tables, in addition to certificate, synopsis and reference pages. The presentation is expected to be in front of the audience which must include at least two internal examiners one of them being a guide and both being university approved teachers and one external examiner. The marks distribution is equally divided between the report and presentation/oral examination

## 311124  Kinematic Design of Machines

**Teaching Scheme:**                                   **Examination Scheme:**
**Lectures: 4Hrs *I* Week**                            **Theory: 100 Marks**
**Practical: 2Hrs *I* Week**                           **Oral: 50 Marks**

**Unit I: Analysis and Synthesis of mechanisms and kinematics structure of machine tools:** Analysis for four bar mechanism and slider crank mechanism, dimensional synthesis of mechanisms, three position synthesis of slider crank mechanism, Overlay method

Machine tool motion and their transmissions, Kinematic balancing equation for motion transmitting elements, Kinematic analysis of machine tool structure: gear hobbling, gear shaping, bevel gear generator.                                                      **(10)**

**Unit II: Design for fluctuating loads**
Stress Concentration and remedies, S.N .Diagram, Endurance limit, Factors affecting Endurance Strength, Design for Finite and Infinite life under reverse stresses, Cumulative damage, Sodberg's and Goodman's Diagram, Design of  shaft subjected to variable loading.                                                                                   **(8)**

**Unit III: Spur Gears**
Various design considerations, Beam Strength, tangential loading, module Calculations, width calculations, types of gear tooth failures, Estimation of dynamic load by velocity factor and Spott's equation.

**Helical Gears:** Normal Module, Virtual no. of teeth, force analysis, Beam and wear. Strength, Design of Helical Gears.                                                             **(8)**

**Unit IV: Rolling Contact Bearings**
Types, Static and Dynamic load Capacity, Stribeck's Equation, Concept of equivalent load, Load life Relationship, Selection of bearing from Manufacturer's Catalogue, Design for variable loads and Speeds, Bearings with Probability of Survival other than 90%, Lubrication and Mounting of bearing.

**Sliding Contact Bearings:** Introduction, Classification of bearings, Hydrodynamic Lubricated Bearings, Wedge film Journal Bearings, Squeeze film Journal Bearings, Materials used for Sliding Contact Bearings, Lubricants. (No Numerical on sliding contact bearing).                                                                           **(8)**

**Unit V: Flywheel**
Introduction, Coefficient of fluctuation of speed, Fluctuation of energy, Maximum fluctuation of energy, Energy stored in flywheel, Stresses in flywheel rim & Arms, Detail Design and construction of flywheel.                                                       **(8)**

**Unit VI: Statistical considerations in design and Optimum Design**
**Statistical Considerations in Design:** Analysis of Tolerances, Design and Natural Tolerances, Factor of safety and reliability in engineering design, Probabilistic design using safety margin.

**Optimum Design:** Objectives of Johnson's Method of optimum design, normal specification, redundant and incompatible specification, design for normal specification only. **(8)**

**Term Work:**
1. Assignments, one each on Units I, II, IV, V& VI.
2. Design Project: - One design project on gear box design, consisting detail design report & Two Full Imperial size sheets one showing the manufacturing drawing of assembly of Gear box and second showing details for the same.
3. Study of Kinematics of Machine Tool Gear Box.
 Oral is based on above Term work

**Text Books**
1. Shigley J. E. and Mischke C. R., "Mechanical Engineering Design", 1$^{st}$ edition, McGraw- Hill      Publication Co. Ltd., 1989, ISBN 0-07-049462-2.
2. Spotts M. F. and Shoup T. E., "Design of Machine Elements", 8$^{th}$ edition, Pearson Education Pvt. Ltd., 2008, ISBN 81 -7758- 4219.
3. Bhandari V.B., "Design of Machine Elements", Tata McGraw-Hill Publishing, 1984, ISBN 0-07-0611416.
4. Kannaiah P., "Machine Design", Scitech publications Pvt. Ltd., 2003, ISBN 81-88429-10.

**Reference Books:**
1. William C. OrthweinOrtewein, "Machine Component Design", West Pub. Co. and Jaico Publication House, ISBN 81-7224-773-7.
2. Robert C. Juvinall and Marshek K. M., "Fundamentals of Machine Component Design", 1999, John Wiley & Sons, ISBN 0-471-24448-1.
3. "PSG Design data", M/S DPV printers, Coimbatore, 2000.
4. Black Paul H.and Adams O. Eugene, "Machine Design", 3$^{rd}$ edition, McGraw-hill Book Company, 1999, ISBN 0–07-085037-2.
5. Hall Allens, Holowenko Alfred R., Laughlin Herman G., "Theory & Problems of Machine Design", McGraw-Hill Book Company, New Delhi Ed.2002, ISBN : 0-07-048333-7
5. G. C. Sen & A. Bhattacharyya, "Principles of Machine Tools", New Central Book Agency (P) Ltd. Kolkata. ISBN: 81-7381-155-5
6. R. S .Khurmi & J. K. Gupta, "Theory of Machine", Eurasia Publishing House Pvt. Ltd.
7. S.S.  Rattan," Theory of Machine", Tata McGraw Hill Publication. New Delhi, ISBN: 0-07-460320-5

# 311125 Material Forming & Mould Design

**Teaching Scheme:**
**Lectures: 4Hrs** *I* **Week**
**Practical: 2Hrs / Week**

**Examination Scheme:**
**Theory: 100 Marks**
**Oral: 50 Marks**

## Unit I: Fundamental of Material Forming
Introduction of forming process, Deformation under complex stresses, Maximum shear stress, Principle stresses and principle planes, Theory of plasticity, Mohr's circle diagram, Slip line theory, Upper and lower bound theory, Yield criteria for ductile material – Von Mises criteria, Tresca criteria. Effect of temperature, strain rate, chemical composition and mechanical properties. Friction and lubrication in metal working, concept of flow stress and flow stress determination. Classification of material forming process on forces and material movement, Concept of formability, formability limit and formability diagram, Concept of redundant work and its impact on metal working operations. **(8)**

## Unit II: Forging
Introduction, Forgability tests, design of forging as a product. Friction in forging. New technologies: Liquid metal forging, Isothermal forging, No draft forging, P/M forging, Rotary swaging.
**Extrusion:** Introduction, Dies for Extrusion, stock penetration, Extrusion ratio, Force requirement, metal flow in extrusion, defects. Role of friction and lubrication, Extrusion plant layout and accessories, Manufacture of seam-less tubes. **(8)**

## Unit III: Wire Drawing
Introduction, Rod and Wire drawing machines- construction and working. Preparation for stock for wire drawing, wire drawing dies, material and design. Variables in wire drawing, maximum reduction in one pass, forces required in drawing, multiple drawing, Lubrication in wire drawing. Force calculation in tube drawing.
**Advance Metal forming Processes:** High velocity forming- principles, Comparison of high velocity and conventional forming processes. Explosive forming, Magnetic pulse forming, Electro Hydraulic forming. **(8)**

## Unit IV: Rolling of metals
Scope and importance of rolling, Types of rolling mills - construction and working, Deformation in rolling and determination force required, Process variable, redundant deformation, Roll flattening, Roll bite, Roll Camber and its effect on rolling process, Mill spring, Rolling Mill plant and accessories, Automatic gauge control – concept, need and methods, Roll pass classification. **(8)**

## Unit V: Design of Casting
Metal pouring, Gating system- design of gating system, solidification time, riser design, Principles of gating, risering and their design methods. Progressive and directional solidification, casting design consideration, Chvornov's rule, numericals on casting, defects in casting.
**Design of Die casting dies:** Design of simple die for die casting. Detail calculation of cavity, core, shrinkage and other allowances, heat transfer consideration, directional solidification, design of cooling system, feed and flow system and ejection system. Role of computers in casting die design. **(8)**

**Unit VI**

**Design of simple Die for Forging:** Open and Closed die, detailed calculations of cavity shapes, shrinkage and other allowances. Heat transfer consideration, Inter cooling system. Design of simple spring/Cam operated ejectors.

**Design of Mould:** Mould materials used for construction, consideration of plastic material parameters- shrinkage, density, bulk factor etc. Design of simple two plate injection moulds. Design of simple blow moulds for articles like bottle, cans etc. Study of type of ejectors, gate, runner's c/s; Study of cooling systems and heat transfer consideration. Introduction to Injection molding of thermosetting plastic materials. **(8)**

**Term Work:**
1. Assignments on Unit I, II, III & IV.
2. Study of Roll pass Design for structural shapes. ( At least Two )
3. A Report on Factory Visit comprising of Product range, Processes, Plant layout, Auxillary equipment, Process parameter etc.
4. Detail design and drawing of die for forging operation. ( Use of CAD desirable )
5. Detail design and working drawing of plastic moulds for plastic components for manual and automatic machines. ( Use of CAD desirable )

**Text Books**
1. Dieter George E., "Mechanical Metallurgy", McGraw Hill, ISBN 0-07-100406-8.
2. P. H. Joshi, "Press Tool Design & Construction", 1st edition, Wheeler Publication, ISBN 81-85814-46-5.
3. P. N. Rao, "Manufacturing Technology: Foundry, Forming & Welding", Tata McGraw Hill Publication, ISBN 0-07-451863-1.
4. Donaldson Cyril, Lecain Gilt and Goold V. C., "Tool Design", 3rd edition, Tata McGraw Hill Publication, ISBN 0-07-099274-6.
5. B. Ravi Metal Casting, "Computer Aided Design & Analysis", Prentice Hall of India, ISBN 81-203-2726-8.
6. A. Kumar, Fundamental of Tool Design, Danpat Rai & Sons.
7. R. Sharam, S.N. Parsad, N.P. Saxena, Forging die design and practice by; S. Chand and Company. New Delhi.

**Reference Books:**
1. J N Harris, "Mechanical Working of Metals", Pergmon Press
2. Avitzer, "Fundamental of Metal Working", McGraw Hill Publication
3. Dr. R. Narayanswamy, "Metal Forming Technology", Ahuja Book Company
4. ASME, "Metal Hand Book", Vol II and Vol III.
5. Slotten, "The Die Casting Hand Book".
6. Surendra Kumar, "Technology of Forming Processes", Prentice Hall of India.

**311126 Production Industrial Management II**

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lectures: 4 Hrs/Week | Theory: 100 Marks |

**Unit I: A) Elementary Economics**
Basic economics concepts- Law of demand and supply, Law of diminishing marginal utility, Forms and functions of money. Money market and Capital Market.
**B) Materials Management**: Objective, functions of materials management, material planning analysis (MRP I and MRP II), organization of materials management, ABC Analysis, EOQ Concept, ERP, Industrial Purchasing Producer.
**C) Marketing Management** : Marketing Function, Marketing Planning, Market Survey and Market Research, Marketing and Selling Concept.                                **(8)**

**Unit II: Process Planning**
Introduction- Production Engineering, Role of Product Engineering department, process engineering functions, coordination of process engineering department with other department, process planning organization
Phases of process planning, process planning principles and process sheet design, factors affecting process design, general considerations in selecting machining methods, study of the machined parts and initial data required for process design from the point of manufacturer, planning the sequence of machining operations, selection of stock preparations and blank material, time estimate and time standard.                        **(8)**

**Unit III: Process Engineering**
Basic Manufacturing processes, supporting operations, study of the functions of the part in the assembly and corresponding finishing operations, study of tooling standard and special tooling, Special of tooling - Conventional tooling methods for commonly machined surfaces, tooling ideas for typical features on job, multi-tooling set up, new tools and tooling methods economics of tooling, make or buy decision, Tolerance chart, Geometric control, Dimensional Tolerances analysis.                              **(8)**

**Unit IV: Quality Control**
Definition of Quality, Quality Characteristics, Introduction to Quality Control, Study of control chart -control chart for variables, control chart for attributes. Acceptance Sampling - Sampling inspection v/s 100 percent inspection, Basic concepts, operating characteristics curves, conflicting interests of consumer and producers, producer's and consumer's risks, AQL, LTPD, AOQL, Single and Double Sampling Plans, Standard Sampling tables. Theory of Work Sampling.                                        **(8)**

**Unit V: World Class Manufacturing-I**
Deming's and Juran's Approach, Deming's PDCA, PDSA cycle, 7 QC Tools, 5'S, TPM, Kaizen, Quality Circle, Concurrent Engineering, JIT, Kanban, Quality Function Deployment, House of Quality, Six Sigma, Poka Yoke.                            **(8)**

**Unit VI: World Class Manufacturing-II**
ISO, QS and CMM Standards, Introduction to Reliability, FMEA, FTA.
Introduction to, taguchi method, Design of Experiments & Hypothesis Testing.      **(6)**

**Text Books:**
1. Zaidi, "SPC, Concepts, Methodologies & Tools", Prentice Hall of India.
2. Panneerselvam, "Engineering Economics", Prentice Hall of India
3. Mukherjee & Kachwala, "Operations Management & Productivity Tech", Prentice Hall of India.
4. M. Mahajan, "Industrial Engineering & Production Management", Dhanpat Rai & Company
5. P. Rama Murthy, "Production & Operation Management", New Age Internation (P) Ltd.

**Reference Books:**
1. Francis R. L. and White S. A., "Facility Layout & Location: An analytical Approach", Prentice Hall of India
2. Datta A. K., "Material Management: Procedure, Text & Cases", Prentice Hall of India.
3. Mahapatra P. B., Computer Aided Production Management, Prentice Hall of India, ISBN 81-203-1742-4.

## 311090: Numerical Techniques and Database

| Teaching scheme: | Examination Scheme: |
|---|---|
| Lectures :04 Hrs/Week . | Paper: 100 Marks. |
| Practical: 02 Hrs/Week. | Term Work: 50 Marks. |

### Unit I: Introduction to Databases

Introduction, Organization & component of database management system(DBMS), data models, entity relationship model, advantages & disadvantages in database processing, hierarchical & network databases.

Introduction to oracle, SQL, Database creation, database retrieval, use of compound conditions like AND, OR, Joining and updating tables. **(8)**

### Unit II: Database Management:

Database design- dependencies and normalization($1^{rst}$ & $2^{nd}$ order), database storage and querying, aggregate functions. – Group by, having order by, sub-queries and various SQL operators. **(6)**

### Unit III: Information technology for competitive Advantages

Introduction to information technology, Inter-organizational and global information systems, Electronic Data Interchange(EDI) and Electronic Fund Transfer(EFT).

Functional and Enterprise system- Production & operation systems, human resource management systems, marketing and sales systems, human resource management systems, marketing and sales systems.

Intelligent systems in Business- Artificial intelligence and intelligent systems, expert systems, intelligent agents.

Electronic Commerce(E-Commerce)- foundations, business-to-consumer and business-to-business applications. **(8)**

### Unit IV: Numerical methods-I

Revision of 'C' syntax. Errors & approximations: types of errors, error propagation.

Numerical solution of algebraic and transcendental equations by bisection method, Newton-Raphson Method.

Numerical solution of Linear Simultaneous Equations by Gauss Elimination Method, Gauss-Siedel Method, methods of moments of curve fitting. **(8)**

### Unit V: Numerical methods -II

Curve Fitting: Least square criterion- $1^{rst}$ and $2^{nd}$ order

Interpolation: Lagrange's formula, Newton forward difference method. **(8)**

### Unit VI: Numerical methods -III

Manufacturing Optimization- Method of Lagrange multipliers, Generalised reduced gradient Method. Ordinary Differential Equations.- Runge-Kutta Method. Partial Differential Equations -Finite difference method **(8)**

### Term Work:

1. A database related language such as Oracle/VB/V FoxPro should be covered.
2. Creation of database using SQL.
3. Addition/Deletion Modification of existing Database using VB/FoxPro.

4. Creation of Database format for Purchase/Manufacturing/Logistics and its report generation.
5. Solution of Algebraic/ Transcendental Equation using C
6. Solution of Linear simultaneous equations using C.
7. Solution of Curve Fitting using C.
8. Solution of Numerical Interpolation using C.
9. Study on any two of the following:

   a)Inter-organizational and global information systems

   b)Functional and enterprise system

   c)Intelligent systems in Business.

   d)electronic Commerce(E-Commerce).

**Text Books:**
1. Silberschatz, Korth H F, Sudarshan, "Database System Concepts", McGraw Hill Intl., 4th Edition, 2002, ISBN 0 07 100529 3.
2. A.M. Muzumdar and P. Bhattacharya, "Database management System", Tata McGraw Hill Publication, New Delhi,ISBN 0 07 462 239 0.
3. Turban, Rainer & Potter-John, "Introduction to Information Technology", Wiley & Sons, 2000,ISBN 81 265 0968 6.

**Reference Books:**
1. Rajashekhar Sundarraman, "Oracle91 Programming:Primer",APearson Education, 2004,ISBN 81 297 0362 9.
2. Dr. Sadhu Singh, "Computer aided Design and Manufacturing", Khanna Publication, New Delhi.
3. Y. Kanetkar, "Let Us C", BPB Publications, 4$^{th}$ revised edition 2002,ISBN 81 7656 621 7.
4. B.S. Gottfried, "Programming with C", McGraw Hill Intl., Schaum's Outline Series, ISBN 0 007 100621 4.
5. S.C. Chapra, R.P. Canale, "Numerical Methods for engineers with  programming and software applications", Tata McGraw Hill Co.Ltd,New Delhi,ISBN 0 07 115895 2.

# 311091 Production Metallurgy

**Teaching Scheme:**                          **Examination Scheme:**
**Lectures: 4Hrs / Week**                   **Theory: 100 Marks**
**Practicals: 2Hrs / Week**               **Term work: 50 Marks**

## Unit I: Steels
Introduction to Metallography, micro and macro examination, metallurgical microscope, etching.
Steels: iron-iron carbide equilibrium diagram, Critical temperatures, Allotropy, cooling curve and volume changes of pure iron. Microstructure, non-equilibrium cooling of steel, widmanstatten structure, structure property relationship. Classification and applications of steels, specifications of some commonly used steels like BIS, EN, AISI, SAE.                    **(8)**

## Unit II: Heat treatment of Steels
Introduction to heat treatment furnaces and Furnace atmospheres, Transformation products of austenite, Time-temperature- transformation diagrams, Critical cooling rate, Continuous cooling transformation diagrams. Heat treatment of steels Quenching media, Annealing" Normalizing" Hardening" Retention of austenite" Effects of retained austenite" Elimination of retained austenite, Tempering" Secondary hardening, Temper embrittlement, Quench cracks, Hardenability testing" Defects due to heat treatment and remedial measure.                    **(8)**

## Unit III: Surface Hardening & Isothermal Treatments
Carburising, heat treatment after carburising, Nitriding, Carbonitriding, Flame hardening and Induction hardening. Commercial heat treatment practice of gears of different sizes, tools, springs. Isothermal heat treatments such as austempering, patenting, isoforming, martempering,ausforrning.                    **(8)**

## Unit IV: Alloy Steels & Cast Iron
Alloy Steels - Effects of alloying elements, classification of alloying elements. Stainless Steels, Sensitization of stainless steel, weld decay of stainless steel. Tool steels and tool materials, Heat treatment of high-speed steel. Special purpose steels with applications.
Cast irons- Classification, Gray cast iron, White cast iron, Malleable cast iron" Ductile Iron, Chilled and alloy cast irons. Effects of various parameters on structures and properties of cast irons, Heat treatments of cast iron. Applications of cast irons for different components of machine tool, automobiles, pumps etc.                    **(8)**

## Unit V: Non-Ferrous Alloys
Copper alloys - Brasses, Bronzes-: Tin, Aluminium, Beryllium, Silicon Copper nickel alloys, Nickel - Silver, Aluminium and aluminium alloys. Solders, Bearing materials and their applications, Precipitation hardening alloys. High Temperature materials such as Nimonics, Super alloys, Ti-alloys etc.                    **(8)**

## Unit VI: Modern Engineering Materials
Composites- Types, Characterization, Production techniques & applications. Metal - Matrix composites, Particulate & Fiber composites. Biomaterials, Nano materials, Sports materials.                    **(10)**

**List of Experiments (Any eight)**

1. Study and drawing of microstructures of mild steel, medium carbon steel, eutectoid steel and hypereutectoid steel.
2. Study and drawing of microstructures of white, malleable, grey and nodular cast iron.
3. Study and drawing of microstructures of alpha brass, alpha-beta brass, aluminum bronze, tin bronze and bearing metal.
4. Study and drawing of microstructures of hardened steel, tempered steel.
5. Hardening of steel- study of effect of carbon on hardness of hardened steel.
6. Tempering of steels - study of effect of temperature on hardness of tempered steel.
7. Study of change in microstructure on annealing and normalizing of tempered steel.
8. Sulphur print test on a steel specimen & flow lines examination of a forged component.
9. Jominy Hardenability test on a steel sample.
10. Testing of Composite materials (Like Hardness, Impact, Tension etc.)

**Text-books:**

1. Kodgire V. D., "Material science and metallurgy for Engineers", Everest Publishing House, Pune,ISBN 81 86314  00 8.
2. K. G. Bundinski , M. K. Bundinski , "Engineering Materials" Prentice  Hall of India Pvt. Ltd., New- Delhi.
3. Higgins "Engineering Metallurgy", Part I Applied Physical Met~llurgy, English Language book Society / Edward Arnold.
4. Smith W. F., "Principles of Material Science and Engineering", McGraw- Hill Inc. Book Co.,ISBN 0 07 122920 5.

**Reference Books:**

1. Rollason E. C., "Metallurgy for Engineering", ELBS Publishing.
2. Clark D.S.and Vamey W. R. "Physical Metallurgy for Engineers", East-West Press Pvt. Ltd., New Delhi.
3. Avner, *"An* introduction to physical metallurgy", TMH publication.
4. Donald R. Askeland & Pradeep Phule. ," The science and engineering of materials", Thomson Asia Pvt.LTD, ISBN 981 243 855 6.

# 311127 Production System Design

**Teaching Scheme**                                    **Examination Scheme**
**Practical: 2 Hrs / Week**                            **Term work: 50 Marks**

**Term work consists of writing the journal based on following points. Minimum one assignment on each point.**

1. Study and Design of special cutting tools like flat form tool and circular form tool.
2. Study and Design of multipoint cutting tools like milling cutter, drills, reamers and broach.
3. Study of process planning and design of process sheet for machine components under job and mass production.
   (The process sheet will contain material specifications and estimate, sequence of operations along with in process dimensions, gauging, special tools, jigs and fixtures required as well as time estimate for each operations.)
4. Study and layout design of material handling devices like belt and roller conveyors, cranes, hoist, construction equipments etc.
5. Study of process plant like sugar, paper, cement, chemical, ceramic, etc. (any one). Visit to any such plant and studying the conversion process in detail and drawing the plant layout in the report.
6. Facility and Plant layout design preferably using any Software.
7. Calculations for Capacity planning, Productivity, OEE, etc., for any above process plant or any manufacturing shop.
8. Preparation of Control Chart of various types.
9. Study of MRP & ERP systems.
10. Any one other assignment excluding above points but based on contents of Production and Industrial Management II subject.

### Reference Books

1. **P. C. Sharma, "**A textbook of Production Engineering", S. Chand & Company Ltd., ISBN 81-219-0111-1.
2. **Cyril Donaldson, "**Tool Design", Tata McGraw-Hill Pub. Co. Ltd., ISBN 0-07-099274-6.