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SHIVAJI UNIVERSITY, KOLHAPUR.

Revised Syllabus of

(B.E. Production Engineering Sem –VII & VIII)

To be introduced from the academic year 2010-11
(i.e. from June 2010) Onwards

(Subject to the modifications will be made from time to time)

SHIVAJI UNUVERSITY, KOLHAPUR

Structure of B. E. (Prod. Engg.) Semesters VII & VII

Sr. No.	SUBJECT	Teaching Hours/Week				Paper Duration Hrs.	Examination Scheme				
		L	Pr	Tut	Total		PT	TW	Oral	Pract	Total
1	Operations Research	3	2	-	5	3	100	25	-	-	125
2	Mechatronic Systems	3	2	-	5	3	100	25	-	25	150
3	Process Engineering	3	2	-	5	3	100	25	-	-	125
4	Production & Operations Management	3	-	2	5	3	100	25	-	-	125
5	Computer Aided Design & Analysis	3	2	-	5	3	100	25	25	-	150
6	Advanced CNC Laboratory	-	2	-	2	-	-	50	-	50	100
7	Vacational In-plant Training Report*	-	1	-	1	-	-	25	-	-	25
8	Project Work – Phase I*	-	2	-	2	-	-	25	25	-	50
	TOTAL	15	13	2	30	-	500	225	50	75	850

L: Lecture, Pr: Practical, Tut: Tutorial, PT: Paper (Theory), TW: Term Work, Pract: Practical

*Note: For VIT Report and Project Work-Phase I workload, groups of nine students each shall be considered.

B. E. (Prod. Engg.) - Semester VIII

Sr. No.	SUBJECT	Teaching Hours/Week				Paper Duration Hrs.	Examination Scheme				
		L	Pr	Tut	Total		PT	TW	Oral	Pract	Total
1	Costing and Cost Control	3	2	-	5	3	100	25	-	-	125
2	Computer Integrated Manufacturing Systems	3	2	-	5	3	100	25	-	-	125
3	Advanced Industrial Engineering	3	2	-	5	3	100	25	-	-	125
4	Elective - I	3	1	-	4	3	100	25	-	-	125
5	Elective - II	3	2	-	5	3	100	25	25	-	150
6	Project Work – Phase II*	-	6	-	6	-	-	75	75	-	150
	TOTAL	15	15	-	30	-	500	200	100	-	800

*Note: For Project Work-Phase II workload, a group of nine students shall be considered.

[Note :- Examination scheme and term work marks strictly as per above structure]

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ELECTIVE – I	ELECTIVE – II
1. Marketing Management	**1. Flexible Manufacturing Systems**
2. Materials Management	**2. Artificial Intelligence**
3. Data Base Management	**3. Industrial Robotics**
4. Entrepreneurship Development	**4. Low Cost Automation**
5. Financial Management	**5. Material Handling Systems**
6. Environment & Pollution Control	**6. Advanced Foundry Technology**
7. Organizational Behaviour	**7. Advanced Tool & Die Design**

B. E. (Production Engineering) – Semester VII

1. OPERATIONS RESEARCH

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 2 Hr. / Week/ Batch

Examination Scheme:
Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks

Course Objective

Study of quantitative techniques in management decision-making and its applications by using mathematical models.

SECTION – I

1. Introduction: Birth of O.R., Methodology, Scope and Limitations. Types of O.R. Models, Applications in Production Management, Use of computers in O.R. **(1)**

2. Linear Programming: Formulation, graphical method, Simplex algorithm for maximization and minimization problems, sensitivity analysis, duality theory and its use in economic interpretation and decision making. **(7)**

3. Transportation and Assignment Models: Structure, industrial and business applications.
a) Transportation problems: Use of various methods for solving transportation problems, degeneracy and its solution.
b) Assignment problems: Solution of various types of problems, Traveling Salesman problem. **(7)**

4. Sequencing: Sequencing of n jobs and 2 and 3 machines, 2 jobs and m machines. **(3)**

5. Replacement Analysis: With and without time value of money, single item and group replacement. **(2)**

SECTION- II

6. Inventory Models: Various costs involved, classification of models, EOQ model with and without shortage, EOQ with uniform demand and production lot size model, EOQ model with single price break. **(7)**

7. Decision Theory: Pay off and regret tables, decision rules, decisions under uncertainty and risk, decision tree. **(3)**

8. Project Management: Fundamentals of CPM / PERT networks;
CPM – construction of networks, critical path, forward and backward pass, floats & their significance, crashing for minimum cost and optimum and minimum duration, resource allocation and leveling.
PERT – Time Estimates, Construction of Networks, Probability of completing projects by given date. **(6)**

9. Network Techniques: Shortest Path Model- Systematic Method, Dijkstra's Algorithm, Floyd's Algorithm **(3)**

Note: The University question paper shall include numerical treatment on all topics except topic no. "1. Introduction".

TERM WORK

It shall comprise of the following numerical assignments. **The assignments shall be different for each group of about 3-4 students each.**
(At least two assignments must be based on Case study. Use of computers is essential for at least two assignments.)

1. Formulation of LPP and Graphical Solution.
2. Assignment on Maximization / Minimization of L. P. Problems.
3. Assignment on Transportation / Assignment Problems.
4. Assignment on Replacement Analysis.
5. Assignment on Sequencing Problems.
6. Assignment on Inventory control.
7. Assignment on CPM/PERT Problems
8. Assignment on Decision Theory.
9. Assignment on Shortest Path Models

REFERENCE BOOKS

1) Introduction to O.R., 7/e (with CD) – Hamdy A. Taha, (PHI)
2) Quantitative Techniques in Management, 4/e - N.D. Vora. (TMH)
3) Introduction to O.R., 7/e (with CD) – Hillier & Lieberman (TMH)
4) Operations Research, 2/e – R. Panneerselvam (PHI)
5) Operations Research – Natarajan, A.M.; Balasubramani, P. & Tamilrasi, A. (Pearson Education)
6) Operations Research – J.K. Sharma. (Mac Millan)
7) Operations Research – P. Sankara Iyer (TMH- Sigma Series, 2008)
8) Operations Research – Principles & Practice - Ravindran, Phillips & Solberg (John Wily & Sons, Wiley India, 2006)
9) Introduction to Operations Research-Theory & Applications, - H.S. Kasana & K.D. Kumar, (Springer International Edition, 2005, Springer India)
10) Operations Research- Applications & Algorithms, 4/e, - Wayne L. Winston (CENGAGE Learning 2003)

B. E. (Production Engineering) – Semester VII

2. MECHATRONIC SYSTEMS

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 2 Hr. / Week/ Batch

Examination Scheme:
Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks
Practical Examination: 25 Marks

Course Objective

To understand working principle of necessary components required for Mechatronic Systems and their applications in system designing.

SECTION – I

1) Introduction: Evolution, scope, components of mechatronic systems, Control Systems: Automatic control, open loop and closed loop control, servo system, concept of transfer function. System Modeling: Mechanical, Electrical, Fluid systems, D.C. motor, hydraulic motor. Types of standard inputs (signals), Time response specifications of first and second order systems, Modes of control: on/off, P, PI, PD and PID **(5)**

2) Sensors & Transducers: Performance, terminology, characteristics, types, binary and analog; Position, displacement, velocity and force sensors: Contact and non-contact type switches and proximity sensors- inductive, capacitive, optical, pneumatic, potentiometric; Incremental and absolute encoders, tachogenerator **(3)**

3) Electromagnetic Actuators and control: Switching devices- relays, solid state switches-diodes, thyristors, triacs, bipolar transistor switch, MOSFETs, solenoid controlled valves, Pulse width modulation to control AC frequency, cycloconvertor for controlling AC frequency, Brushless DC servomotors, timing motors, torque motors, SCR (Silicon Controlled Rectifiers) motors, Stepper motors- types, specifications and control, piezoelectric actuators. **(5)**

4) Programmable Logic Controllers (PLC): Structure, input/output units and i/o processing, programming, ladder diagrams, logic functions, latching, sequencing, timers, jumps, analog i/o and applications. **(5)**

SECTION –II

5) Signal Conditioning & Interfacing: Signal conditioning process, clock signal, voltage divider, rectification, Operational Amplifiers: inverting and non-inverting, summing, integrating, differential, logarithmic, comparator; 555 timer, sample and hold, analog to digital and digital to analog converters, multiplexing; Interfacing input output ports, serial and parallel interfacing requirements, buffers, handshaking, polling and interrupts. **(4)**

6) Microcontroller: Comparison between microprocessor and micro controller, organization of a microcontroller system, architecture of MCS 51 controller, pin diagram of 8051, addressing modes, instruction types and set, applications. **(5)**

7) Computer Numerical Control systems: Structure of CNC controller, Adaptive Control- applicability of AC, elements of AC system, AC machining system, types – AC with optimization and constraints, advantages of AC **(3)**

8) MEMS: Overview of MEMS and Microsystems, Typical MEMS and Micro system products & applications. (i) Micro sensors and micro actuators: Phototransistors, pressure sensors, thermal sensors, micro grippers, micro motors, micro valves, micro pumps. (ii)Micro-manufacturing: Bulk manufacturing, surface manufacturing, LIGA Process. **(3)**

9) Design of Mechatronic systems: The design process, traditional and mechatronic designs, A few case studies like piece counting system, pick and place manipulator,

simple assembly task involving a few parts, part loading / unloading system, automatic tool and pallet changers etc. **(3)**

TERM WORK

1 Fabrication of a simple mechatronics **working** project by a group of 2-3 students, (A list of some sample projects is given further. One Project shall be carried out by each of the student groups and submitted as a part of term work.).**
2. Minimum two programs and their execution on PLC for logic, timer, counter and sequencing applications.
3. Minimum two exercises on analog-digital trainer kit involving logic/universal gates, waveforms, A-to-D and D-to-A conversion, flip-flops (counters) etc.
4. Interfacing of stepper motor with microcontroller/PLC for position, speed and direction control
5. One Exercise involving interfacing of sensors with microcontroller/ PLC- Analog I/O
6. Simple MATLAB Programming exercises for control system. (Minimum two)
7. Industrial visit to study Mechatronic system application and submission of visit report.

****Note:** This project exercises shall include use of PLC, microcontroller, various sensors, Analog-to-digital and Digital-to-analog conversion, simple electronic circuits etc. for Mechanical/Production Engg. applications. **The list given below is indicative only and other suitable projects may be undertaken.**
List of Sample Projects: Automatic Door control (Open/Close), Water level control, Automatic Belt conveyor, Soft touch bi-directional motor control, Temperature sensor with analogue to digital output, Overheat control using heat sensor to operate cooling fan, Automatic railway gate control, Clap operated relays, Piece counters etc.

Note for Practical Examination: A batch of two students will perform any one exercise from 2,3,4,5 and 6 of above-mentioned list and show the results. This will be followed by oral examination.

REFERENCE BOOKS

1. Ogata – Modern Control Engineering (Pearson Education) ISBN 81-7808-579-8
2. Industrial Automation – David. W. Pessen (John Wiley & Sons) ISBN 9971- 51-054-5.
3. Automated Manufacturing Systems: Sensors, Actuators – S. Brain Morriss (McGraw Hill) ISBN 0-07-113999-0
4. Mechatronics 3/e - W. Bolton (Addison Wesley) ISBN 81-7758-284-4
5. Introduction to Mechatronics & Measurement System – David G. Alciatore & Michael B. Histand (TMH) ISBN 0-07-052908
6. Mechatronics Principles, Concepts & Applications – N.P.Mahalik (TMH) ISBN 0-07-0483744
7. Mechatronics – Dan Necsulescu (Pearson Education) ISBN 81-7808 -676 – X. 8. The 8051 Microcontroller: Architecture, Programming & Applications, 2/e – Kenneth J. Ayala (Penram International) ISBN – 81-900828-7
9. Computer Control of Manufacturing systems-Yoram Koren (McGraw Hill) ISBN 0-07-066379-3
10. MEMS & Microsystems Design & Manufacture – Tai – Ran Hsu – TMH 0-07-048709.
11. MEMS – Mahalik, N.P. (TMH) ISBN :13 978-0-07-063445-9
12.CAD/CAM –Concepts & Applications, Channakesava R. Alavala (PHI)
13. Mechatronics, Singh, M.D,. & Joshi J.G. (EEE) (PHI) (2006- ISBN 81-203-2986-4

B. E. (Production Engineering) – Semester VII

3. PROCESS ENGINEERING

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 2 Hr. / Week/ Batch

Examination Scheme:
Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks

Course Objective

To understand the principles of planning the process for a given component and learn to design an optimum process.

SECTION – I

1. Introduction: Process planning function and activities-drawing interpretation, material evaluation and process selection, selection of machines and tooling, setting process parameters, work-holding devices, selecting quality assurance methods, costing and documentation, Inputs and outputs for process planning, Position of product and process engineering department in the organisation, functions of product and process engineers **(4)**

2. Part Print Interpretation: Originating process, major and minor operations, identifying useful supplementary information, material specification and treatments, interchangeability and standardization, screw thread forms, tool references, dimensional and geometrical tolerances, surface finish, identifying critical processing factors **(3)**

3. Study of Machining Accuracies: Factors affecting accuracies, work piece control theories, product tolerances, process tolerances, tolerance stack -types and effects, tolerance charts **(5)**

4. Technical Feasibility Study: Raw material, basic originating process, accuracy level, processes required, machine tools and accessories required Manufacturing feasibility study with illustrations **(2)**

5. Selection of Process: General guidelines for and factors in process selection, process selection method, process and operation sequencing – guidelines; Combining and eliminating operations, economic aspects of processing; Introduction to computer aided process planning-Generative and Retrival type. **(5)**

SECTION – II

6. Selection of Equipment: Various sources of information, technical, economical and managerial considerations, selection criteria for GPMs, SPMs and CNCs for processing in job, batch and mass mode. **(3)**

7. Selection of Tooling: Technical specifications of standard cutting tools and gauges required for various machining operations, selection criteria for cutting tools and gauges, study of special tools, gauges and work holding devices, selection of machining data **(5)**

8. Process Planning: Preparation of process sheet for machining of a component for job, batch and mass production, process benchmarking, methods of process proving, selection of quality assurance method and tools. **(5)**

9. Time Estimation: Calculation of standard time and production rates for various operations by consideration of various allowances. **(3)**

10. Automated Processing: Automated part orientation, automated loading and unloading of parts, automatic process control by in-process gauging. **(3)**

TERM WORK

1) Part print interpretation of one industrial component drawing
2) One case study of process documentation as per ISO, QS and TS

3) Process design of one component (made from casting, forging, bar stock, etc.) on conventional and CNC machine tools for batch production
4) Process design of one component for mass production
5) Time estimation for processing a component on conventional and CNC machine tools for batch production
6) Industrial visit to study process designing and its report

(During process design, use of cutting tool manufacturers' catalogues is essential.)

REFERENCE BOOKS

1) Process Engineering for Manufacturing – Eary & Johnson (Prentice Hall)
2) Process Planning: The Design/Manufacturing Interface, –Petert Scallan, (2003), (Buttreworth Heinmann, Elsevier) ISBN: 0-7506-51-29-6
3) A Text Book of Production Engg, –P.C. Sharma, (Millennium Edition, 2000) (S. Chand & Co.)
4) Principles of Machine Tools- Sen, Bhattacharya
5) Automation, Production Systems, and C.I.M. – Groover, M.P. 3/e, (PHI)
6) Workshop Technology Vol. III – Chapman (ELBS)
7) Manufacturing Technology: Principles for Optimisation – Daniel
8) Mechanical Estimating and Costing – TTTI Chennai (TMH)
9) Standard manuals of ISO, QS, TS etc.
10) Manufacturers' catalogues for cutting tools and inspection equipments
11) Product Design-Kevin Otto and Kristin Wood (Pearson)
12) All About Machine Tools-Heinrich Gerling (New Age International)
13) Westerman Tables (Metals) (New Age International)

B. E. (Production Engineering) – Semester VII

4. PRODUCTION & OPERATIONS MANAGEMENT

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hrs. / Week	Theory Paper (3 Hrs): 100 Marks
Practical: 2 Hr. / Week/ Batch	Term work: 25 Marks

Course Objective

To study concepts of Production and Operations Management and their applications.

SECTION – I

1. Introduction: definition, importance, relative position in organization, functions of production management, types of production and their characteristics, continuous and intermittent.
(2)

2. Pre-production functions:
a) Product design and development: marketing, functional, manufacturing and economical aspects, 3 'S' -simplification, standardization, specialization
b) Sales forecasting: use of forecast, types, accuracy, statistical forecasting, types of demands, various types of forecasting methods, verifying and controlling the forecast.
c) Capacity planning: machines and equipment planning, requirement of personnel, make or buy decision, line balancing, economic lot size.
(6)

3. Production Planning:
Production functions- routing, scheduling, machine loading, intermittent and continuous routing -Process charts, job cards, route cards, operation charts, Scheduling: definition, need and objectives, factors affecting, Loading: machine loading, techniques.
Drum-buffer-rope concept: Production scheduling application in Theory of Constraints
(3)

4. Production Control: Definition, dispatching, progressing, coordination,
Dispatching: job orders and issue systems, dispatching rules
Progressing: follow up, feedback, corrective actions
Coordination: relationship of PPC department with other departments, coordinating with other departments for planning and execution.
(3)

5. Introduction to Modern Production/Operation Management Techniques: Toyota Production System, Five 'S', Lean manufacturing, Poka Yoke, Kaizen, SMED.
(3)

6. Rejection analysis: Factors contributing to rejection on shop floor, cost of rejection, plans to control rejection, Introduction to Six Sigma concept and methodology.
(2)

SECTION – II

7. Inventory Management: Aims, buffer stocks, lead time, ROL, fixed order quantity system, periodic review system, Selective Inventory Control Techniques - ABC and VED analysis, JIT manufacturing / purchasing, Stores management: objectives, functions, procedure, documentation, stock taking and reconciliation
(5)

8. Maintenance: Types, break down, preventive and predictive (condition based maintenance), selection of maintenance strategy, Total Productive Maintenance – Concept, Calculations of OEE.
(4)

9. Supply chain management: Definition, decision phases in supply chain, process view of supply chain, importance.
(2)

10. Logistics Management: Meaning, scope and elements of logistics, need for logistics engineering
(2)

11. Human Consideration in Production Management: Industrial Psychology – Introduction, motivational factors, behavioral aspects, grievances, working conditions, safety; shop supervisor's role in above functions. **(2)**

12. Disaster Management: Reasons, analysis and prevention in manufacturing establishments. **(2)**

TERM WORK

Any Six assignments out of Sr. No. 1 to 7. Assignment No. 8 is compulsory.

1. A Case study on Pre – production functions
2. Exercise on Production planning/scheduling of batch production of about 5 – 10 variety of parts for given batch sizes with preparation of Gantt's Chart
3. A case study on production control and production status reporting
4. A case study on rejection analysis on shop floor
5. Exercise on formulation of maintenance strategy in manufacturing industry
6. A case study on Supply Chain Management in manufacturing industry
7. A case study on logistic management in manufacturing industry
8. Industrial visit to study various Production/Operations management techniques and preparation of report

REFERENCE BOOKS

1) Production Planning & Control – Samuel.Eilon (Universal)
2) Production Systems – James L. Riggs (Wiley)
3) Production Management – Lockyer (ELBS)
4) Production Handbook – Carson, Boltz & Young (Ronald Press)
5) Production Management – R. Mayer (McGraw Hill)
6) Operations Management: Strategy & Analysis, 6/e – Krajewsky, Ritzman (Pearson Education)
7) Modern Production Management – E.S. Buffa (John Wiley)
8) Production Management – Burbridge (ELBS)
9) Operation Management – Schroeder (McGraw Hill)
10) Stores Management – K.S. Menon (Mac Millan)
11) Just In Time Manufacturing – Korgaonkar (Mac Millan)
12) Supply Chain Management; Strategy, Planning & Operation – Sunil Chopra, Peter Meindl (Pearson Education Asia)
13) Logistics Engineering & Management – Bejamin S. Blanchard (Pearson Education Asia)
14) Total Quality Management - R S Naagarazan, A A Arivalagar (Publisher-New Age International)
15) Stein, R. E., (1996) Re-engineering the manufacturing system: applying the theory of constraints (TOC). Marcel Dekker.
16)Operations Management – B. Mahadevan, (Pearson Education)
17) Operations Management- Haizer & Render, (Pearson Education)

B. E. (Production Engineering) – Semester VII

5. COMPUTER AIDED DESIGN & ANALYSIS

Teaching Scheme: Examination Scheme:

Lectures: 3 Hrs. / Week
Practical: 2 Hr. / Week/ Batch

Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks
Oral Examination: 25 Marks

Course Objective

To introduce students with the computer aided design techniques and finite element analysis using computing techniques.

1. Introduction: CAD/CAM Processes, Role of CAD/CAM/CAE in the Product Cycle, CAD tools to support the design process and manufacturing, Benefits of CAD/CAM/CAE in the industry. **(2)**

2. Geometric Modeling: Wire frame modeling – entities, curve representation methods, parametric representation of analytic and synthetic curves, Surface modeling - parametric representation of analytic and synthetic surfaces, Solid modeling – Boundary representation, constructive solid geometry, **(3)**

3. Geometrical transformation: Two-dimensional transformation Three-dimensional transformation representation of matrix : translation, scaling, rotation, mirror, shearing, Solid modeling types : parametric, solid , surface. **(3)**

4. Standards for CAD: Need, Graphics and Computing standards, Data Exchange standards, Communications Standards **(3)**

5. Application of CAD in Design: Application to Drafting, 3 – D Modeling Applications, Integration of Design, Analysis and CAD, System Customization and Design Automation Parametric and Variational Modeling, Feature based modeling, Design information system **(7)**

SECTION II

6. Fundamental of Solid Mechanics : concepts of Stress Strain Curve, true stress, true strain, stress tensor, strain tensor, Plane stress and strain, Principal stress and strain, yield criteria- Tresca and Von Mises. **(3)**

7. Finite Element Analysis: Step in FEA, Pre processing, Solution, Post Processing, Result Interpretation, Types of Analysis: Static, Dynamic, Linear, Non-linear, Thermal, Crash. **(2)**

8. Discritization: Types of elements 1-D, 2-D, 3-D and their selections, interpolation and shape functions, geometrical approximations for FEM, concept of free and mapped meshing, Size and number of elements, Quality checks for element shapes, Co-ordinate systems in FEA. **(4)**

9. Analysis of Spring Element: stiffness matrix, displacement, stress and strain. **(3)**

10. Analysis of Link element: 1d link, Matrix formation, Calculations of displacement, stress and strain. Analysis of 2D truss element. **(4)**

11. Analysis of Beam element: Displacement, Stress and strain analysis **(4)**

TERM WORK

1. Study of Import and Export options, translators, report generation using CAD/Analysis software.
2. At least two assignments on surface modeling using CAD software.
3. A case study on Present practices adopted in Industries for CAD and CAE.

4. Importing CAD models in FEM software
5. Numerical hand calculations for FE analysis of 1-D link, spring, beam elements. (At least two exercises for each type).
6. Validation of above numerical problems with the help of FEM software.
7. Structural analysis of any one simple component using FEM software.

Oral examination shall be based on the above syllabus and term work.

REFERENCE BOOKS

1.Computer Aided Design (Software and Analytical Tool) 2/e, - C.S.Krishnamoorthy, S.Rajeev. A.Rajaraman, Narosa Publishing House, New Delhi.
2.Computer Aided Design and Manufacturing :Dr. Sadhasingh, Khanna Publication.
3.Advanced Mechanics of Solids - L. S. Srinath, McGraw Hill.
4.Mechanical Metallurgy (3/e)- Dieter McGraw Hill.
5.Introduction to Finite Element Methods: Tirupati Chandrupatala, Ashok, Belegundu (PHI)
6.CAD/CAMTheory and practices,2/e-Ibrahim Zeid (McGraw Hill)
7.The Finite Element Methods,3/e –Sienkiewicz (Tata McGraw Hill).
8.The Finite Element Analysis - P. Seshu (PHI)
9.The Finite Element Analysis by :Theory and Programming- Krishnamoorthy (Tata McGraw Hill)
10.Finite Element Analysis- J N Reddy, (McGraw Hill)

B. E. (Production Engineering) – Semester VII

6. ADVANCED CNC LABORATORY

Teaching Scheme:
Practical: 2 Hr. / Week/ Batch

Examination Scheme:
Term work: 50 Marks
Practical Examination: 50 Marks

Course Objective

To expose the student to the Computer Aided Manufacturing practices followed in the industry.

The Term Work shall consist of following exercises.

1. Generating and simulating CNC part programs from the CAD models (at least two exercises each).

1.1) Preparing a suitable CAD model for a part to be turned and generating the CNC part program to machine the same on a CNC lathe from the given form of raw material using a suitable CAM software and a post processor.

1.2) Preparing a suitable CAD model for a part to be machined and generating the CNC part program to machine the same on a CNC machining center (vertical/horizontal) from the given form of raw material using a suitable CAM software and a post processor. (2 dimensional machining like drilling, tapping, reaming, boring, face/slot milling etc.)

1.3) Preparing a suitable CAD model for a part to be machined and generating the CNC part program to machine the same on a CNC machining center (vertical/horizontal) from the given form of raw material using a suitable CAM software and a post processor. (3 dimensional machining like simple cylindrical/rectangular cavities or pockets).

Note: A different exercise shall be given to each group of two students in the batch.

2. Generating a simple part program using CAM software and executing it on a CNC machine (at least one exercise each) on CNC lathe and CNC machining center.

Note: A different exercise shall be given to each group of up to four students in the batch.

The journal shall consist of the printouts and report of the above exercises.

Practical Examination: (Duration 2 hours)
It shall consist of,

1) From a CAD model Generating and simulating a simple CNC part program (Lathe or Machining Center) using a CAM software by individual candidate (15 Marks)
2) Oral Examination based on the Term Work (10 Marks)

Reference: Use of Help Manuals of CAM software and CNC Machines manuals is recommended.

B. E. (Production Engineering) – Semester VII

7. VACATIONAL INPLANT TRAINING

Teaching Scheme: Examination Scheme:
Practical: 1 Hr. / Week Term work: 25 Marks

Course Objective

To expose the students to industrial systems and working atmosphere.

Every student should prepare a report of the work carried out during vacational in-plant training in a prescribed format under the guidance of the Project Guide, before end of Part I, semester VII. The report shall be comprehensive and presented in duplicate, typed on standard A4 size sheet and bound. This will form the term work. **Reports of students undergoing training in the same organization must be different.** The project guide will assess the term work.

8. PROJECT WORK - PHASE I

Teaching Scheme: Examination Scheme:
Practical: 2 Hr. / Week Term work: 25 Marks
Oral Examination: 25 Marks

Course Objective

To prepare the students to carry out a comprehensive study of any design or process or phenomenon, to encourage the process of independent / creative thinking and working in groups and to expose them to industrial atmosphere of accountability.

Term Work

The students in a group of not more than FOUR will work under the guidance of the faculty member on the project work undertaken by them. The work started in Semester VII will be continued in the Semester VIII and the final submission of the report will be at the end of the Semester VIII.

The project work may consist of,
1. A comprehensive and up-to-date survey of literature related to study of a phenomenon or product.
2. Design of any equipment and / or its fabrication and testing.
3. Critical Analysis of any design or process for optimizing it.
4. Experimental verification of principles used in applications related to Production or Mechanical Engineering.
5. A combination of the above.

A synopsis of the selected project work (two to three pages typed on A4 size sheets) will be submitted and assessed by the Project Guide and one more faculty member appointed by the Head of the Department / concerned responsible official of the sponsoring industry (Co-guide). The synopsis shall be endorsed by the Head of Department.

The work to be completed in Semester VII shall include,
a) Problem Identification
b) Methodology / Design Documents
c) Activity planning for the time frame and **division of responsibility to each student**.

An interim report of the work completed in Semester VII in the form of workbook / project diary and other relevant documents shall be submitted for the term work. The term work shall be assessed by the Guide and one more faculty member appointed by the Head of the Department. The assessment shall be based on a presentation of the work completed and submission of interim report.

The oral examination shall be based on the work planned and <u>actually</u> completed in Semester VII.

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B. E. (Production Engineering) – Semester VIII

1. COSTING & COST CONTROL

Teaching Scheme: Examination Scheme:

Lectures: 3 Hrs. / Week
Practical: 2 Hr. / Week/ Batch

Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks

Course Objective

Study of various aspects of costing, estimation and control and its application in manufacturing industry.

SECTION – I

1. Introduction: (a) Concept of cost, cost unit, cost center, classification of cost, different costs for different purposes. (b) Definition of costing, cost-price-profit equation, desirable conditions for a costing system. **(2)**

2. Cost Estimating: Definition, purpose and functions of estimation, role of estimator, constituents of estimates, estimating procedures. **(2)**

3. Estimation of Weight and Material Cost: a) Process of breaking down product drawing in to simpler elements or shapes, estimating the volume, weight and cost

b) Review of purchasing procedure, recording of stock and consumption of material by LIFO, FIFO, Weighted average method **(4)**

4.a) Estimation of fabrication cost : Constitutes, direct cost, indirect cost, Procedure of estimation of fabrication cost

b) Estimation of foundry cost: Constitutes, direct cost, indirect cost, Procedure of estimation foundry cost

c) Estimation of forging cost: Constitutes, direct cost, indirect cost, Procedure of estimation of forging cost.

d) Estimation of machining cost: Constitutes, direct cost, indirect cost, Procedure of estimation of machining cost. **(6)**

5. Machine hour rate: definition, constituents, direct cost, indirect cost, steps for estimation of machine hour rate for conventional machines, CNC lathe and machining center **(4)**

6. Labour Cost – Direct and indirect labour, Workmen classification, Definition of wages, Methods of remuneration **(2)**

SECTION –II

7. Overheads: Elements of overheads, classification, general considerations for collection, analysis of overheads, different methods for allocation, apportionment, absorption of overheads, **(4)**

8. Cost Accounting Methods: Job costing, Batch costing, Unit costing, Process costing, Contract costing, Activity based costing **(6)**

9. Cost Control: Use of cost data for policymaking and routine operation, control techniques such as budgetary control, standard cost, variance analysis, marginal cost and break even analysis **(3)**

10.Cost Reduction Areas: Procedures and systems in product, methods and layouts, administrative and marketing, rejection analysis, cost of poor quality, value analysis and value engineering, Zero Base Budgeting **(6)**

Note: Numerical treatment on topics 3, 4, 5, 7, 8 and 9 is essential.

TERM WORK

Note: Use of computers is essential for at least one exercise.

1. Estimation of weight and material cost for an assembly of three to five components.
2. Valuation of inventory by LIFO, FIFO, Weighted average method

3. Estimation for machine hour rate for representative machines – one conventional machine and one CNC lathe or machining center
4. Case study on estimation of overheads for a manufacturing unit
5. Study of different methods for allocation, apportionment, absorption of overheads
6. Case study in any one industry using any of the method of costing.
7. Different examples illustrating cost control
8. Case studies of cost reduction

REFERENCE BOOKS

1. Principles & Practice of Cost Accounting – N. K. Prasad (Book Syndicate Pvt. Ltd.)
2. Costing Simplified: Wheldom Series – Brown & Owier (ELBS)
3. Cost Accounting: B. Jawaharlal (TMH)
4. Cost Accounting: R.R. Gupta.
5. Cost Accounting, 13/e - B. K. Bhar, (Academic Publishers, Kolkata)
6. Cost Accounting: Jain, Narang (Kalyani Publishers)
7. A Text Book of Estimating and Costing Mechanical – J.S. Charaya & G. S. Narang (Satya Prakashan)
8. Mechanical Estimation and Costing – TTTI, Chennai (TMH)
9. Theory & Problems of Management & Cost Accounting – M.Y. Khan, P. K. Jain (TMH)

B. E. (Production Engineering) – Semester VIII

2. COMPUTER INTEGRATED MANUFACTURING SYSTEMS

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hrs. / Week	Theory Paper (3 Hrs): 100 Marks
Practical: 2 Hr. / Week/ Batch	Term work: 25 Marks

Course Objective

To understand the concepts of computer integrated manufacturing system and its applications.

SECTION – I

1. Introduction: Scope, islands of automation, architecture of CIM, information flow in CIM, elements of CIM, benefits, limitations, obstacles in implementation. **(2)**

2. CAD/CAM/CAE: Product Design and CAD, application of computers in design, CAM – manufacturing planning and control, scope of CAD / CAM and CIM, concurrent engineering, design for manufacturing and assembly **(4)**

3. Group Technology: Concept, design and manufacturing attributes, part families, composite part, methods of grouping, PFA, classification and coding system- OPITZ, Relevance of GT in CIM, GT and CAD, benefits and limitations of GT. **(3)**

4. Computer Aided Process Planning and Control: need, retrieval and generative type CAPP, role of CAPP in CIM. **(2)**

5. Flexible Manufacturing Systems: Concept, flexible & rigid manufacturing, manufacturing cell and FMS structure, types, components of FMS, Distributed Numerical Control (DNC), Building Blocks of FMS, Flexible Assembly System **(3)**

6. Computer Aided Production Planning and Control: Computer integrated production management system, aggregate planning, master production schedule, shop floor control, materials requirement planning, capacity planning, manufacturing resource planning and enterprise resource planning **(5)**

SECTION II

7. Computer Aided Quality Control: Objectives, non contact inspection methods, equipment; contact type inspection: Co-ordinate Measuring Machines (CMM), construction, working principle and applications, Inspection robots **(3)**

8. Production Support Machines and Systems in CIM: Industrial robots for load/unload, automated material handling, automatic guided vehicles, automated storage and retrieval system **(4)**

9. Data Acquisition and Database Management Systems: (a) Data acquisition system, type of data, automatic data identification methods, bar code technology, machine vision. (b) Data and database management system, database design requirements, types of DBMS models- hierarchical, network and relational models and their applications **(5)**

10. Communication in CIMS: Role of communication in CIMS, requirements of shop floor communication, types and components of communication systems in CIM, Networking concepts, network topology, access methods, ISO-OSI reference model for protocols, MAP/TOP, TCP/IP. **(4)**

11. Planning and Implementation of CIMS: Planning for CIMS, need for planning, Phases of CIM implementation, incremental implementation and one time implementation, CIM benchmarking, Economic and social justification of CIM. **(3)**

TERMWORK

1. Exercise on classification and coding of components using GT Techniques, related to a) Design Attributes, b) Manufacturing attributes.
2. Exercise on building MRP system for a company manufacturing approximately 3 – 5 assembly products involving total about 15 components.
3. Exercise on capacity planning for a turning shop with 5 – 10 lathes, 15 turned components with average 3 to 4 turning operations each, for given batch sizes.
4. Study of co-ordinate measuring machine involving study of dimensions and geometrical features of components, accessories of C.M.M.s and programming aspects, through an industrial visit and its report
5. Exercise on Database Management- Creation of a simple manufacturing database using MS Access or similar software involving query, sorting.
6. Case study on data acquisition systems, LAN structure & communication interface.

REFERENCE BOOKS

1. Automation, Production systems and Computer Integrated Manufacturing, 3/e - M.P. Groover (PHI or Pearson Education)
2. Computer Integrated Design and Manufacturing - Bedworth, Henderson & Wolfe, (McGraw Hill)
3. Performance Modeling of Automated Manufacturing Systems, 2/e - Viswanadham, N. & Narahari, Y. (EEE) (PHI)
4. Principles of Computer Integrated Manufacturing - S. Kant Vajpayee, (PHI)
5. CAD / CAM Principles and Applications - P.N. Rao (Tata McGraw Hill)
6. CIM Handbook - Teicholtz & Orr (McGraw Hill)
7. CAD/CAM/CIM, 3/e – Radhakrishnan, Subramanayam & Raju (New Age International)
8. Computer Integrated Manufacturing, 2/e - James A. Rehg, H. W. Kraebber, (Pearson Education)
9. MAP/TOP Networking : Foundation of CIM – Vincent Jones (McGraw Hill)

10. Computer Aided Manufacturing - Chang, Wysk & Wong (Prentice Hall of India)

B. E. (Production Engineering) – Semester VIII

3. ADVANCED INDUSTRIAL ENGINEERING

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 2 Hr. / Week/ Batch

Examination Scheme:
Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks

Course Objective

To acquire interdisciplinary knowledge of method study, work measurement techniques and ergonomics for improving overall productivity and effectiveness.

SECTION I

1. Introduction to Productivity and Work Study: Definition and scope, Productivity and quality of life, Evolution of work study, contribution of Taylor and Gilbreth, Work study-techniques and basic procedure, Human factor in application of work-study. **(3)**

2. Method study:

a) Definition, objectives and basic procedure.

b) Record, Examine, Develop – Process chart symbols, Outline and flow process charts, Flow diagrams, Critically Examine Techniques

c) Movement of workers and material – string diagram, flow process charts worker material and equipment type, multiple activity chart – Man – Machine, Machine-Machine chart, Travel charts for workplace

d) Methods and Movements at workplace- Principles of motion economy, Classification of movements, Two handed process chart, SIMO chart, Micro Motion study, Therbligs

e) Evaluate, Define, Install and Maintain methods **(11)**

3. Working conditions and Environment: Occupational hazards, health and safety, housekeeping, lighting, noise and vibrations, climatic conditions, ILO norms **(2)**

4. Ergonomics: Human factor engineering, man- machine interaction **(2)**

5. Value Engineering: Introduction, Concept, Difference between Value Engineering and Value Analysis, Case study. **(1)**

SECTION II

6. Work Measurement:

Definition, objectives, basic procedure, Techniques of work measurement,

Time study – Equipment and forms, selection of a job, steps in time study, breaking the job into elements, timing the elements; Rating in time study – standard rating and standard performance, factors affecting rate of working, standard time determination, use of time standards, allowances;

Work sampling – Need, procedure for work sampling, determining time standard by work sampling.

Predetermined time standards (PTS) – definition, methods time measurement (MTM) standard data from PTS, applications of PTS

MOST (Maynard Operation Sequence Technique) – Introduction, Methodology **(10)**

7. Location Layout:

Factors affecting site selection, factors affecting layout design, types of layout, systematic layout planning procedure, travel chart, information gathering, flow analysis and activity analysis relationship diagram, space requirement and availability, designing of layout – use of CAD; Material Handling Systems– Principles, functions and equipments **(4)**

8. Job Evaluations and Merit Rating: Job analysis, Ranking system, Grade description system, Point system, Factor comparison system; Method of merit rating systems **(2)**
9. Incentives: Types of Incentives, Relationship of motion and time study with the incentives **(3)**

TERM WORK:

1. At least one industrial visit to study applications related to the subject and submission of the relevant report.
2. Method study with present and proposed methods for a manufacturing related task
3. Design and drawing of work place layout in a manufacturing environment
4. Assignment on Job Evaluation and Merit rating.
5. Time study for a processing operation on a job and calculation of standard time
6. One experiment on micro motion study with the help of video camera.

REFERENCE BOOKS:

1. Work Study: - I L O
2. Work Study: - Curie and Faraday (ELBS)
3. Industrial Engineering Handbook, Maynard (Mc Graw Hill)
5. Time and Motion Study Design, Barnes, R.M. (John Wiley)
4. Work Study & Ergonomics, L.C. Jhamb (Everest)
5. Facility Layout and Location – An Analytical Approach, Francis et. al.(PHI)
6. Facilities Planning – 3/e, Tompkins, White, Bozer, Tanchoco (John Wiley & Sons)
7. Job Evaluation - ILO
8. Payment by Results, - ILO
9. Work Study by O.P. Khanna (Dhanapat Rai and Sons)

B. E. (Production Engineering) – Semester VIII

Elective I – 1. MARKETING MANAGEMENT

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 1 Hr. / Week/ Batch

Examination Scheme:
Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks

Course Objective

Study of fundamentals of marketing and its commercial and technical application

SECTION – I

1. Introduction: Meaning, scope, needs and importance of marketing, difference between marketing and selling, concept of market, types of markets, marketing concepts and tools, concept of societal marketing, marketing strategies, impact of Multi National Corporations, privatization etc. E commerce/ On line marketing. **(5)**

2. Buying Behavior of Organizational and Consumer Buyers: Factors influencing buying process analysis of behavior. **(3)**

3. Marketing Planning: Meaning and importance, marketing strategies, sales forecasting, methods of sales forecasting, marketing budget and marketing organization, data banks utilization **(3)**

4. Market Segmentation: Meaning, bases for segmenting consumer markets, market coverage strategies adopted for segmenting the market, aggregation strategy, single segment strategy and multiple segment strategy. **(3)**

5. Marketing Information systems [MIS]: Marketing research marketing research procedure, the order – shipping - billing cycle, the system of sales reporting, computer integration. **(5)**

SECTION – II

6. Marketing Mix: Introduction to marketing Mix elements - product, place, promotion and price

a] Product [Goods and Services]: Concept of product, classification of consumer goods - convenience goods, shopping goods and specialty goods, product life cycle, product mix, product decisions to be made such as brand policy decisions, product modification decisions, product elimination decisions, new product development decisions and product mix decisions, procedure for new product development.

b] Place: Channels of distribution, meaning, types of channels, selecting the type of a channel, channel management, physical distribution wholesaling and retailing.

c] Promotion: An introduction to promotion-mix elements, advertising, personal selling, sales promotion and publicity

d] Pricing: Meaning and importance of price, pricing objectives, procedure for setting the base price, price modification and price negotiation **(8)**

7. Advertising: Objectives, types of advertisements, developing advertising campaign, deciding on advertising media, sales promotion and publicity, ethics, regulations for advertising. **(2)**

8. Sales Management: Meaning and its role in marketing function responsibilities of sales department, personal selling, sales force, designing a sales force, recruiting and selecting a sales force, training and remuneration of sales force, sales territories, sales quotas, performance evaluation of sales staff, salesmanship **(4)**

9. Industrial Marketing: MNCs, other major participants, cultural environment, attitudes, practices, ethics, monetary system; Export marketing – need, information, database and legislation **(3)**

TERM WORK

Any five exercises to be conducted based on topics below (Sr. No. 6 compulsory).

1. Survey of Buyers.
- Questionnaire Preparation – product / service
- Obtaining the feedback
- Analysis

2. Case study based on selection of product / service and its technical study from various competitors available nearby.
3. Development of market segmentation strategy for a product of a company.
4. New product development based on survey of 10-15 potential buyers.
5. Case study based on (any one)
• Distribution network of a company
• Developing an Advertising campaign for a product.
6. Group discussion on any one of the above topic (each group of about 8 students).

REFERENCE BOOKS

1. Kotler, Armstrong, "Principles of Marketing", 10/e, Pearson Education
2. Philip Kotler, "Marketing Management", Prentice-Hall of India.
3. J.C.Gandhi, "Marketing- A Managerial Introduction", TMH
4. David Luck et al, "Marketing Research", TMH
5. Mahendra Mohan, "Advertising Management" TMH.
6. James S. Norris, "Advertising", Prentice-Hall of India.
7. B. Horvard Levy, " Marketing made simple", Rupa Paperback on Business Management
8. J.C.Gandhi, " Principles of Marketing and Salesmanship"
9. Hill," Industrial Marketing"
10. S.A.Sherlekar,"Marketing Management"
11. Ramswami and Namkumari, "Marketing Management"
12. Stanton, Etzel, Walker, "Fundamentals of Marketing", McGraw Hill
13. P. J. Joshef, "E – Commerce", PHI

B. E. (Production Engineering) – Semester VIII

Elective I – 2. MATERIALS MANAGEMENT

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hrs. / Week	Theory Paper (3 Hrs): 100 Marks
Practical: 1 Hr. / Week/ Batch	Term work: 25 Marks

Course Objective

Study of fundamental concepts and applications of various techniques of Materials Management in practice

SECTION – I

1. Introduction: integrated materials management concept. objectives, organizational structure, material cycle **(2)**
2. Make/Buy Decisions: factors, financial and manufacturing aspects **(2)**
3. Materials Forecasting: general economic forecast, major cyclical indicators, forecasting the price, materials requirement planning. **(3)**
4. Purchasing: Functions, procedures, documents used as per ISO / QS 9000, policies, types of purchasing - hand to mouth, forward buying, speculative buying, commodity markets, price cost analysis, negotiations **(6)**
5. Selecting sources of supply, vendor evaluation and rating, vendor development. **(3)**
6. Purchase research, value analysis, introduction to legal aspects of purchasing. **(4)**

SECTION –II

7. Inventory Management: Basic concepts, need, deterministic and probabilistic EOQ models, inventory analysis, ABC and VED, Inventory Control Techniques fixed quantity, periodic review system, Spare Parts Inventory Management, safety stock determination **(8)**
8. Recent Trends In Inventory Management: Zero inventory, JIT concept and tools **(3)**
9. Stores Management: Objectives, stores layout, storage system and equipment, automated storage and retrieval stores, procedures as per ISO / QS 9000, material classification and codification as per ISO / QS 9000, materials accounting system. **(6)**
10. Materials Management: Management performance evaluation, information systems and computers in materials management. **(3)**

TERM WORK

Any Five exercises based on topics given below. (At least one exercise based on computers)
1. Case study on Make or Buy decision
2. Study of Material cycle, documents as per ISO / QS 9000.
3. Case study on vendor rating
4. Case study on fixed period orders and fixed quantity inventory system with safety stock analysis
5. Exercise on MRP for a system with 2 to 3 product assemblies, each having about five components
6. Exercises on probabilistic EOQ models
7. Study of material codification and classification

REFERENCE BOOKS

1. Materials Management - Dean S. Ammer (Taraporwalla & Sons)
2. Purchasing Management- J.H. Westing, I.V. Fine C.J. Zenc (John Wiley and Sons)
3. Purchasing & Materials Management - Lamer Lee Jr... Donad W. Dobler (TMH)
4. Integrated Materials Management- A. K. Dutta (S. Chand & Co.)
5. Stores House and Stock management - H. K. Comption (Business Books Ltd.)
6. Storage Controls & Stocks - Alex Morrison (ELBS)
7. Purchasing and Materials Management- P. Gopalkrishnan (TMH)
8. Materials Management - A. K. Dutta (PHI)
9. Stores Management – K.S.Menon (MACMILLAN)

B. E. (Production Engineering) – Semester VIII

Elective I – 3. DATABASE MANAGEMENT

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 1 Hr. / Week/ Batch

Examination Scheme:
Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks

Course Objective

To study of fundamentals of data base management systems, their design and application.

SECTION – I

1. Introduction to DBMS: Purpose of data base system, view of data, data models, data base languages, data base administrator. **(5)**

2. Entity relationship model: Basic concept, design issues, mapping constraints, keys, entity relationship diagram. **(5)**

3. Structured Query Language (SQL): Background, basic structure, set operations, aggregate functions, null values, nested sub-queries, views, modification of data base, introduction to joins, data definition language, indexing: basic concepts, ordered indices.**(5)**

4. Integrity Constraints and Design: Domain constraints, referential integrity, triggers, functional dependencies; decomposition, normalization – first, second, third normal forms.

(5)

SECTION – II

5. File and System Structure: Overview of physical storage media, file organization, organization of records in files, data dictionary storage, sequential files. **(4)**

6. Query Processing: Overview, general strategies for query optimization, measure of query cost, selection operation, sorting, join, duplicate eliminations, projection, set operations.

(5)

7. Transaction Management: Introduction, transactions, transaction recovery, system recovery, media recovery. **(4)**

8. Concurrency: Introduction, three concurrency problems, locking, dead-lock, serializability

(4)

9. Scope and Application areas of DBMS in modern manufacturing systems. **(3)**

TERM WORK

Minimum six exercises using any commercial database software (e.g. MS Access, ORACLE, SQL Server, etc.) and Database development using C++ / VB, based on application areas like,

a) Inventory Management

b) MRP and MRP II

c) MIS
d) Group Technology, process planning and CAD/ CAM data base
e) Quality management
f) Tool management systems
g) Production planning, scheduling and controlling.
h) Computer generated work standards
i) Study of database soft wares: commercial and educational (Use of INTERNET is expected)

REFERENCE BOOKS

1. Data Base System Concepts - Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 3/e, 1997, McGraw Hill International Edition.
2. An Introduction to Data Base Systems - C. J. Date, 7/e (2003) (PearsonEducation)
3. C++ Data Base Development - A. L. Stevens, 2/e (1995) (BPB Publications)
4. Principles of Data Base Systems –Jeffery D. Ullman, 2/e (2000) Galgotia Publications.
5. Principles of Data Base Management – James Martin (10th Reprint, 1998) (EEE) (PHI).
6. Data Structures with C/C++ - Tanenbaum (TMH)

B. E. (Production Engineering) – Semester VIII

Elective I – 4. ENTREPRENEURSHIP DEVELOPMENT

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hrs. / Week	Theory Paper (3 Hrs): 100 Marks
Practical: 1 Hr. / Week/ Batch	Term work: 25 Marks

Course Objective

To familiarize students with fundamentals of Entrepreneurship and to encourage them to become successful entrepreneurs.

Section – I

1. Entrepreneurship: Definition of Entrepreneur and Entrepreneurship, entrepreneurial process, Entrepreneurship and economic development, job creation, Indian scene. **(2)**
2. Small Scale Units: Concept and definition, role of S.S.I. in Indian economy, government policies and facilities. **(3)**
3. Planning Small Scale Business: Business opportunity identification, idea generation, ideas from marketplace, market assessment, demand estimation. **(5)**
4. Government Support Organizations:
a) Central Government
b) State government
c) Financial support organizations
d) Government schemes and procedures **(5)**
5. Entrepreneurial Motivation: Self-disclosure, personality effectiveness, risk taking, entrepreneurial competencies, case studies. **(4)**

Section – II

6. Business plan preparation: Meaning of business plan, project parameters, information sources of economical and technical know how, selection of location,

identification of raw material, suppliers, plants/machinery, process, manpower and other inputs such as power, water etc. **(4)**

7. Small Business Management: Techniques of marketing, materials, production, manpower and financial management, crisis management, working capital management, fixed capital assessment, cash flow analysis, ROI, techniques of decision making. **(6)**

8. Statutory Requirements: Factories Act 1948, Industrial disputes Act 1947, Indian Contract Act, Indian sales and Goods Act, Indian Partnership Act, Central Excise Sales tax, Income Tax Act, Value Added Tax (VAT) **(4)**

9. Preparation of project report:

1) Selection of product
2) Process and plant and machinery selection
3) Layout planning
4) Financial viability
5) Marketing and distribution of goods
6) Study of probable reasons of failure **(3)**

10. Business Aspects: Business ethics, export environment, procedure and documentation, venture capital financing, intellectual property act, patents, GATT. **(2)**

TERM WORK

Minimum Five exercises / case studies based on the topics below.

1. Study of Government policies and procedures to start SSI
2. Preparation of feasibility report for a product.
3. Calculation of working capital requirements
4. Study of resources and procedures to get financial assistance.
5. Study of tax procedures
6. Study of export procedures

REFERENCE BOOKS

1. Developing New Entrepreneurs - Entrepreneurship Development Institute of India, Ahmedabad.
2. Handbook of New Entrepreneurs
3. Management of Small Scale Industry - Vasant Desai (Himalaya Publication)
4. Entrepreneurship Playing to Win- Gordon Betty (Taraporwala & Co.)
5. Motivating Economic Achievement- David C. McClelland, David G. Winter
6. Industrial Maharashtra- Facts, Figures and Opportunities (M.I.D.C. Mumbai).
7. Project Planning & Entrepreneurship Development - T. R. Banga
8. Dynamics of Entrepreneurial Development & Management- Vasant Desai (Himalaya Publication)
10. S.S.I. and Entrepreneurship- Vasant Desai (Himalaya Publication)

B. E. (Production Engineering) – Semester VIII

Elective I – 5. FINANCIAL MANAGEMENT

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hrs. / Week	Theory Paper (3 Hrs): 100 Marks
Practical: 1 Hr. / Week/ Batch	Term work: 25 Marks

Course Objective

To study the basic concepts of financial management applied to industry.

SECTION – I

1. Finance Function: - Objectives of Financial management finance function, the ROI concept of financial management and control **(4)**

2. Analysis and Interpretation of financial statement: - Using Ratio Analysis, cost volume profit analysis, capital budgeting – Nature and significance .Techniques of capital budgeting **(8)**

3. Financing decisions: - Planning capital structure, Debt – Equity Ratio and financing, cost of capital, concept of operating and financial leverage, Working capital management **(6)**

4. Sources of Finance: - Internal and External, Short, medium, and long term finance **(2)**

SECTION - II

5. Project Planning: - Generation and screening of project ideas market and demand analysis, technical analysis financial estimates and projection. **(4)**

6. Marketing of Securities: - Underwriting, role of stock exchange functions, operations, government regulations of stock exchanges in India. **(4)**

7. Management of Profits: - Appropriation of profits, Dividend policies determinants of dividend policies Issue of bonus shares, Right issue. **(4)**

8. Budgeting and Budgetary control: classification, flexible budget, cash budget, sales budget **(8)**

Note: - Numerical Treatment is expected for the following topics:

1. Ratio Analysis.
2. Cost volume profit analysis
3. Capital Budgeting
4. Cost of Capital
5. Leverage
6. Working Capital
7. Dividend Policy
8. Budgeting: a) Flexible Budgeting b) Cash Budget c) Sales Budget

TERM WORK

1. One assignment on Finance Function to be studied by visiting a local industrial organization.
2. Numerical exercises on the areas mentioned above
3. Two case studies on industrial financing

REFERENCE BOOKS

1. Financial Management- I.M Pandey. Vikas Publishing House Pvt Ltd.
2. Management Accounting & Financial Management – R.K.Sharma & Shashi K. Gupta –Kalyani Publishers.
3. Project Planning, Analysis, Selection, Implementation & Review. - Prasanna Chandra- Tata Mac Grew Hill Publishers.
4. Financial Management- P.V. Konkani &B.G Sashay Prasad – Himalaya Publishing

House.
5. Management Accounting- R S.N Pillai, Bagavathi – S.Chand & Company Ltd.
6. Corporate Finance – S. C. Kuchhal & Suchitra Mittal (Chaitanya Publication House)

B. E. (Production Engineering) – Semester VIII

Elective I – 6. ENVIRONMENT & POLLUTION CONTROL

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hrs. / Week	Theory Paper (3 Hrs): 100 Marks
Practical: 1 Hr. / Week/ Batch	Term work: 25 Marks

Course Objective

To bring awareness in students about prevention of environmental pollution as applied to Mechanical / Manufacturing Engineering Industries.

SECTION – I

1. Man and Environment: Factors affecting environment, Measures to protect Natural Balance, Carbon and Oxygen cycle, Different Ecosystems existing in Nature Population, Dynamics, Ecological Imbalances due to pollution, Prey-predator relationship **(4)**

2. Water Pollution: Industrial water demand, Principles of Industrial Waste Water Treatment; Primary, secondary and tertiary treatment, Removal of Oil and Grease; Treatment of Waste Water from Units like Heat Treatment, Electroplating etc. **(6)**

3. Air Pollution: Structure of Atmosphere, Definition, Scope and scales of Air Pollution, Sources of Industrial Air Pollution such as Foundries, Furnaces etc., Effects of Air Pollutants, Standards for Emission and Ambient Air Quality, Meteorological Aspects of Air Pollution, Control of Air Pollution, Incineration, Hood and duct design, Methods and Equipments, Introduction to Clean Development Mechanism and carbon credits **(8)**

4. Noise Pollution: Definition and Sources, Decibel Levels of Common Noise, Hazards of Noise Pollution, Control Measures. **(2)**

SECTION – II

5. Solid & Hazardous Waste: Sources, Handling Measures, Labeling, Storage, Treatment and Disposal. **(4)**

6. Environmental Management: Environmental Management systems, life cycle assessment, Environmental Impact Assessment, Environmental economics **(6)**

7. Disaster Planning & Risk Analysis: Concept of disasters, hazards and accidents, Emergency preparedness plan, Risk assessment, Risk management, Lethal Dose 50, **(4)**

8.Industrial Hygiene & Safety: Concept of industrial hygiene, Factories Act 1948, Importance of safety, OHSAS 18001, Personal Protective Equipment, Safety audit, Occupational Hazards, Exposure Tolerance Levels, Protection in Nature, Housekeeping - Basic Elements, Ventilation, Illumination, Plumbing and Drainage **(6)**

TERM WORK

Minimum six exercises based on following topics including at least two case studies.
1. Characterization of Industrial waste water
2. Stack monitoring

3. Ambient air monitoring
4. Determination of CO_2 for carbon credits
5. Noise level measurement
6. Case study of ISO 14001 and OHSAS 18001

REFERENCE BOOKS

1. Environmental Engineering & Sanitation - Salvato (John Wiley & Sons)
2. Environmental Engg. - Howard S. Peavy, Donald K. Rowe, (McGraw Hill)
3. Water Supply & Wast Water Treatments - Fair, Geyer (Vol. I & II) (John Wiley & Sons)
4. Air Pollution - Wark & Warner (Academic Internet Publishers)
5. Air Pollution. Vol. I, II, III – Stern (Academic Press)
6. Solid Waste Management Handbook – Pavoni (Krieger Publishing Co.)
7. Environment Impact Assessment - Canter (Mc Graw Hill)
8. ISO 14000:2004 Manual
9. OHSAS 18001 Manual

B. E. (Production Engineering) – Semester VIII

Elective II – 1. FLEXIBLE MANUFACTURING SYSTEMS

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hrs. / Week	Theory Paper (3 Hrs): 100 Marks
Practical: 2 Hr. / Week/ Batch	Term work: 25 Marks
	Oral Examination: 25 Marks

Course Objective

To study fundamental concepts of flexible manufacturing systems.

SECTION – I

1. Introduction: Flexible and rigid manufacturing, Concept of F.M. Cell and F.M. System, Functions of a manufacturing cell, Types and components of FMS, Tests of flexibility, Group Technology and FMS, Optimization of FMS, Tasks in selection of FMS **(3)**

2. Control structure of FMS: Architecture of typical FMS, Automated work piece flow in FMS, Hierarchical control system architecture of FMS – Factory level, Cell level and Equipment level; Factory networks, Distributed Numerical Control (DNC), unmanned operation, FMS Diagnostics **(3)**

3. Production Scheduling in FMS: Shop Floor Control system, phases in SFC, Variable route part programming system in FMS, dynamic scheduling in FMS, procedure, Performance analysis of FMS – measures, Deadlocks in automated manufacturing systems- handling deadlocks **(4)**

4. Tooling in FMS: Tool holders for CNC machines, modular tooling, tool monitoring; preset, offset and wear compensation values, robotized tool assembly, tool database, tool management system, tool flow control in FMS **(4)**

5. Fixturing in FMS: Palletizing of parts, pallet pool, flexible fixturing – principles and methodologies, standard fixtures, modular fixturing system – T-slot based and dowel pin based and their components; Computer aided fixture design – approaches, use of GT in fixture design – fixture design process, fixturing structure and fixturing information tree, fixture database **(4)**

SECTION – II

6. Database Management Systems in FMS: Conceptual DBMS, types of data structures and their applications in FMS, Integrated DBMS in FMS and its implementation **(3)**

7. Material Handling in FMS: Functions of an integrated material handling system in FMS, Flexibilities in material handling, Layouts in FMS, Industrial robots for load / unload applications, Robotic cell layouts; **Automatically Guided Vehicles** (AGVs) – types, Control of AGVs- Wire guided, optically guided, dead reckoning, free ranging AGVs, Scheduling of AGV, Storage and retrieval machines in AS/RS, **(4)**

8. Automated Inspection Systems: In-process gauging, Coordinate Measuring Machines –applications, Probes – various shapes, types and applications, programming of CMMs, Types of CMM software, Inspection routines / cycles on CMM for various measurements – manual and programmed, CNC machines as CMM **(4)**

9. Designing FMS: Simulation – Need, techniques, inputs, procedure, performance analysis **(2)**

10. Flexible Assembly Systems: Basic concepts, classification, planning and scheduling in FAS, loading and scheduling in F.A. cells **(3)**

11. Reconfigurable Manufacturing Systems: Definition, goals, elements, rationale, characteristics, principles, RMS and FMS **(2)**

TERM WORK

Minimum eight assignments based on the following.

1. Exercise on scheduling using various dispatching rules, heuristics or local search techniques for the following cases, using scheduling software package (like LEKIN Scheduling System), involving schedule generation, preparation of Gantt's Chart and comparison of alternative schedules on the basis of various parameters with the output printouts.

a) Single machine / parallel machines b) Flow shop c) Job shop d) Flexible Job shop e)Flexible Flow shop

2. Simulation of FMS shop, using Simulation software package (like ARENA or FLEXSIM) including various modules like Arrive, Server, Depart, Simulate modules, Creating models of FMS shops and simulating the performance to obtain output results

3. Exercises on assessment of performance of batch production systems for the following measures

a) Manufacturing lead time, b) Work - in – process c) Machine utilization

4. Development of a simple manufacturing or tool or fixture database using a suitable software like MS Access or similar.

5. Industrial visit to study components of FMS and submission of visit report (At least one visit is compulsory.)

REFERENCE BOOKS

1. Ranky, Dr. Paul, (1984), "The Design & Operation of FMS",
2. Groover, Mikell P., 3/e, "Automation, Production Systems & Computer Integrated Manufacturing", Pearson Education or PHI
3. Viswanadhan, N. & Narahari, Y., "Performance Modelling of Automated Manufacturing Systems" 2/e, PHI
4. Pinedo, Michael & Chao, Xiuly (1999), "Operations Scheduling with Applications in Manufacturing & Services", McGraw Hill International Editions (with LEKIN Scheduling Software, also available on INTERNET)
5. Kelton, Sadowsky & Sadowsky, "Simulation with ARENA",2/e, McGraw Hill International Editions (with CD of ARENA Simulation Software)
6. CAD/CAM/CIM, 3/e – Radhakrishnan, Subramanayam & Raju (New Age International)
7. Rao, PN, Tewari NK, Kundra TK, "Computer Aided Manufacturing", TMH

8. Rong, Yeming; "Computer Aided Fixture Design", Marcel Dekker, ISBN 0-8247-9961-5
9. Sewik, "Production Planning & Scheduling in Flexible Assembly Systems", Springer Verlag, ISBN 3-540-64998-0
10 Koren, Y.: Computer Control of Manufacturing Systems. McGraw-Hill Book Co., New York,
11. Computer Aided Manufacturing - Chang, Wysk & Wong (Prentice Hall of India)
12. Changeable and Reconfigurable Manufacturing Systems (Springer Series in Advanced Manufacturing) (Ed. Hoda A. Elmaraghy)
13. Computer Integrated Manufacturing- A. Alavudeen & N.Venkateshwaran, (2008), (PHI), ISBN-978-81-203-3345-1
14. Planning and Scheduling in Manufacturing and Services- Pinedo, Michael, (2005), Springer, ISBN 0-387-22198-0 (with CD)
15. CAD/CAM –Concepts & Applications, - Channakesava R. Alavala, (2008), (PHI) ISBN-978-81-203-3340-6

B. E. (Production Engineering) – Semester VIII

Elective II – 2. ARTIFICIAL INTELLIGENCE

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hrs. / Week	Theory Paper (3 Hrs): 100 Marks
Practical: 2 Hr. / Week/ Batch	Term work: 25 Marks
	Oral Examination: 25 Marks

Course Objective

To understand fundamental concepts of Artificial Intelligence and its applications.

SECTION – I

1. Introduction: Concept of AI, approaches – acting and thinking like humans and rationally, brief history of A.I, foundations of A.I, underlying assumptions, application areas **(3)**

2. Problem formulation: Problem solving agents, components of problem definition, defining the problem as state space approach, Problem characteristics, Production system, searching for solutions ,Forward & Backward reasoning, means end analysis, Graphs and Trees, measuring problem solving performance. **(4)**

3. Search Strategies: a) Uninformed (blind) search – breadth first, depth first and their variations, avoiding repeated states b) Informed (Heuristic) Search – evaluation / heuristic function, Generate and Test, Best first search, A* search, Local search algorithms – Hill climbing, simulated annealing, local beam search, Branch & Bound search, Genetic Algorithms, terminology. **(5)**

4.Knowledge Representation: Simple relational knowledge, Inheritable knowledge, Inferential knowledge, Procedural knowledge, the frame problem, Propositional Logic – Syntax and semantics, properties of statements, Inference rules, First Order Predicate Logic: syntax and semantics, well formed formulas (WFF), Properties of WFFs, conversion to clausal form, using FOPL, inference rules, unification, non-deductive inference methods, resolution, forward and backward chaining, the knowledge engineering process. Handling uncertain knowledge, probability propositions, atomic events, unconditional (prior) and conditional (posterior) priority, Bayes' rules and its use, Bayesian network and its semantics, inference in Bayesian networks. **(6)**

SECTION – II

5. Learning: Forms of learning, inductive learning, decision trees learning, ensemble learning, pattern recognition: introduction, recognition and classification process, learning classification patterns. **(4)**

6. Knowledge Based Systems: Expert systems, components, characteristic features of expert systems, applications, rule based system architecture, representing and using domain knowledge, expert system shell, explaining the reasoning and knowledge acquisition, applications. **(5)**

7. A.I. in Robotics: State space search, Block word and robot example, path selection, Monkey and Banana problem, AND – OR graph, means end analysis in a robotic problem, robot problem solving as a production system, triangle table, robot learning, robot task planning, phases in task planning, symbolic spatial relationships, obstacle avoidance, graph planning. **(5)**

8. Machine Vision: Introduction, functions in a vision system, imaging devices, lighting, A-D conversion, quantization, encoding image storage, image data reduction, segmentation techniques, feature extraction, object recognition, training the vision system, robotic applications of machine vision **(5)**

TERM WORK

1. Minimum Six programming exercises using a suitable language (e.g. PROLOG, LISP, C++ etc.) preferably in manufacturing related area
2. One case study on application of A.I. & E.S. in Manufacturing Engineering / Management.

REFERENCE BOOKS

1. Artificial Intelligence: A Modern Approach- 2 /e (2003) Stuart Russel, Peter Norvig (Pearson Education).
2. Artificial Intelligence: 2/e (1991)- Elaine Rich, Kevin Knight (TMH).
3. Introduction to Artificial Intelligence & Expert Systems – Dan W. Patterson. (Seventh Indian Reprint 1999) (EEE) (PHI).
4. Handbook of Expert Systems in Manufacturing – Rex Mauss, Jessica Keyes (Mc Graw Hill).
5. Industrial Robotics – Technology, Programming and Applications - Groover, Weiss, Nagel, Odrey, (Mc Graw Hill).
6. Robotics: Control, Sensing, Vision and Intelligence – Fu, Gonzalez and Lee. (Mc Graw Hill).
7. Conference Proceedings & Current Journals for case studies and applications.

B. E. (Production Engineering) – Semester VIII

Elective II – 3. INDUSTRIAL ROBOTICS

Teaching Scheme: Examination Scheme:
Lectures: 3 Hrs. / Week Theory Paper (3 Hrs): 100 Marks

Practical: 2 Hr. / Week/ Batch

Term work: 25 Marks
Oral Examination: 25 Marks

Course Objective

To study fundamentals, analysis, applications and programming for industrial robots.

SECTION – I

1. Introduction: Automation and Robotic System, Anatomy and work volumes, Classification. **(2)**

2. Drives & Control System: Hydraulics and pneumatic actuators, electrical drives for robotics, control loops, basic control system concepts and models, control system analysis, robot activation & feedback components, position and velocity sensors, power transmission system. **(4)**

3. Robot & Peripherals: End effecters – types, mechanical electromagnetic, pneumatic grippers, tool as end effecter, robot end effecter interface. Sensors – sensors in robotics, tactile sensors, proximity and range sensors, sensor based systems and uses. **(4)**

4. Machine Vision: Introduction, low level and high level vision, sensing and digitizing, image processing and analysis, segmentation, edge detection, object description and recognition, interpretation, applications. **(4)**

5. Programming for Robots: Methods, robot program as a path in space, motion interpolation, characteristics of robot level and task level languages, robot languages, programming in suitable languages, Simulation of robot programs. **(6)**

SECTION-II

6. Robot Kinematics: Introduction, forward, reverse & homogeneous transformations, manipulator path control, introduction to robot dynamics configuration of a robot controller. **(6)**

7. Robot Intelligence and Task Planning: Introduction, state space search, problem reduction, use of predictive logic, means – ends analysis, problem solving, robot learning, robot task planning. **(6)**

8. Robotic Applications: Applications in manufacturing -material transfer, machine loading and unloading, processing operations, assembly and inspections, robotic cell design and control, applications in other areas: toxic, hazardous and inaccessible, service industry **(6)**

9. Social Issues, safety and economics in robotics. **(2)**

TERM WORK

Minimum Six exercises from

1. Two Programming exercises for robots.
2. Three case studies of applications in industry involving working out the scheme with type of robots, other accessories with sequence and logic.
3. Three exercises using a suitable robotic simulation software for handling applications.

REFERENCE BOOKS

1. Industrial Robotics: Technology, Programming & Applications- Groover, Weiss, Nagel, Ordey (McGraw Hill)
2. Robotics: Control, Sensing, Vision & Intelligence. - Fu, Gonzalez, Lee (McGraw Hill)
3. Robotics Technology & Flexible Automation – S.R. Deb (TMH)
4. Handbook of Industrial Robotics – Ed. Shimon Y. Nof (John Wiley.)
5. Fundamental of Robotics, Analysis & Control – Robert J. Schilling (PHI)
6. Robotics for Engineers – Yoram Koren (McGraw Hill)

7. Introduction to Robotics: Analysis, Systems & Applications – Saeed B. Niku (Pearson Education)
8. Keramas, James G. (1998), " Robot Technology Fundamentals", ISBN: 981-240-621-2 (CENGAGE)

B. E. (Production Engineering) – Semester VIII

Elective II – 4. LOW COST AUTOMATION

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 2 Hr. / Week/ Batch

Examination Scheme:
Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks
Oral Examination: 25 Marks

Course Objective

To make the students aware of the low cost automation technology suitable for industrial applications.

SECTION I

1. Automation: Production systems - Facilities, Manufacturing support systems, Automated manufacturing systems, reasons to justify automation, automation principles and strategies, Levels of automation in process industry and discrete manufacturing industry, Economics of automation, Low cost automation. **(3)**

2. Hardware Components of Automation: Electromagnetic actuators – Micro-switches, reed switches, servomotors, stepping motors, variable frequency drive (VFD) for speed control of AC induction motors, Electronic Sensors - Limit switches; Inductive, optical and capacitive proximity switches, binary counters, timers, programmed mechanical switches for sequence/timing, temperature sensors, flow sensors, force sensors. **(4)**

3. Advanced Pneumatics: Review of types of cylinders and their mountings, Cylinders according to duty, Special Cylinders – with magnetic pistons, non-rotational guiding, rodless, tandem, multi-position, rotary, Bellows actuators, pneumatic muscles, pneumatic grippers- fingerlike and suction cups; Hydro-pneumatic feed unit; displacement step diagrams, elimination of signal conflicts, Selection and optimization criteria for Pneumatic applications. **(5)**

4. Electro-Pneumatics: Solenoids, push, pull, linear, rotary types, characteristics, DC Vs. AC solenoids, Electric actuation of DC valves, Electro-pneumatic multiple actuator circuits, Developing an Electropneumatic control system- project design, selection and configuration of components and implementation, sample applications, Relay and logic control, Relay control systems, logic operations, memory function-latching circuits, delay, sequence, **(6)**

SECTION II

5. Programmable Logic Controllers: Brief review of structure, operation and functions, input/output of PLC, shift registers, data movement and comparison, Multiple actuator

circuits with PLC control- sequence, latching, timers, counters; Interfacing with sensors and actuators for analog input/outputs **(3)**

6. Supervisory Control And Data Acquisition (SCADA): Concept of SCADA, its industrial significance and applications. **(4)**

7. Interfacing of SCADA with PLC: Steps, methodology, procedure of implementation and protocols. **(6)**

8. Applications of SCADA: Applications of SCADA in process control, industrial automation and various manufacturing systems. Effecting control using data generated through SCADA, Analysis of data for various MIS related tasks. **(6)**

TERM WORK

1. Developing and simulating pneumatic control circuits such as, speed control, memory control, automatic returns (Minimum two)
2. Developing electropneumatic circuits for handling applications like part lifting, feeding, presses, sorting, two-handed safety circuits, liquid level control (Minimum two)
3. Developing and testing PLC programs for automation of handling, Loading-unloading, bottle filling, sequencing, piece counting, packaging etc. using various features of PLC (Minimum two)
4. Assignments on SCADA applications for simple problems using suitable SCADA software (Minimum two)

REFERENCE BOOKS

1. Automation, Production Systems & C.I.M. – Groover, Michell P. 3/e, Pearson Education
2. Computer Aided Manufacturing - Chang, Wysk & Wong (Prentice Hall of India)
3. Pneumatic Controls – Joji P. (2008), (Wiley India), (ISBN 978-81-265-1542-4)
4. Electropneumatics, Basic Level - G. Prede, D. Scholz, (FESTO Didactic), (2002), FESTO Controls Pvt. Ltd., Bengaluru.
5. Programmable Logic Controllers: Programming Methods & Applications – John R, Hackworth & Frederick D. Hackworth, Jr. (PHI)
6. Programmable Logic Control: Principles & Applications – NIIT, (2008), (PHI)
7. “Programmable Logic Controller – Principles and Applications”, 5/e, J. W. Webb, R.A. Reis; Prentice Hall of India Ltd. ISBN 81-203-2308-4.
8. Introduction to PLC – Gary Dumming – CENGAGE Publ.
9. SCADA, Stuart A. Boyer (ISA Publi.) ISBN 1-55617-660-0.
10. Practical SCADA for industry, David Bailey, (Elsevier Publi.) ISBN 0-7506-5805-3.
11. website : http://www.dpstele.com/dpsnews/press-releases/scada-sensor-tutorial-white-paper.php
12. IGSS, version 8.0 build number 9212 SCADA Software (Available on Internet) with **INDUSTRIAL AUTOMATION** Interactive Graphical SCADA System INSIGHT AND OVERVIEW (Help manual) (Website: www.7t.dk.)

B. E. (Production Engineering) – Semester VIII

Elective II – 5. MATERIAL HANDLING SYSTEMS

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 2 Hr. / Week/ Batch

Examination Scheme:
Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks
Oral Examination: 25 Marks

Course Objective

To study material handling equipments their selection, design concepts and applications.

SECTION – I

1. Introduction: Definition, scope, basic concepts, principles of material handling, economics of handling, Concepts of unit load, containerization and palletisation. **(4)**

2. Facilities Design Function: Scope, objectives and types; relationship of plant layouts with material handling, factors to be considered for plant layout design;
Space planning for various activities like office, storage, and production etc., factors - area allocation, location, relative positions, future expansion. **(7)**

3. Material Flow: Operation sequence, material flow pattern, Part flow analysis in group technology, stages of material flow - at receiving, in process and at shipping, flow planning criteria and design of flow pattern. **(5)**

4. Warehousing: Concept, Types, Storage and design considerations for in-house warehouses. **(2)**

5. Safety and Training: Need, environmental and human factors in material handling.**(2)**

SECTION – II

6. Equipment for Material Handling Systems for Various Materials:
a) Storing equipments like pallets, bins, racks, decking, order picking, positioning equipments. **(4)**
b) Hoisting equipment like jacks, pulleys, hand trolleys, hoists, power hoist, various types of cranes and elevators. **(3)**

7. Equipment for Material Movement: a) Conveying equipments like belt, chain, roller, wheel, trolley, tray conveyors, gravity and vibratory type conveyors, screw conveyors. **(3)**
b) Mobile equipment like hand trucks, fork lift trucks, powered industrial trucks and tractors, powered stackers, reach trucks, order pickers. **(3)**

8. Design and Selection of M. H. Equipment: Factors affecting, procedure for selection, design of conveyor, electric hoist, case studies **(4)**

9. Automated Material Handling: Need, Comparison with conventional systems, equipments like industrial robots and automatically guided vehicles, ASRS, use of simulation software for design of m. h. system. **(3)**

TERM WORK

Assignments sr. no. 1 to 4 shall consist of actual case studies in industry
1. Study of Facility design
2. Study of Material flow analysis
3. Study of Storing and hoisting equipments

4. Study of Conveying and mobile equipments
5. Selection of M.H. equipments and design of conveyor/electric hoist.
6. Exercise on design / simulation of M.H.S. using simulation software like FLEXSIM or similar
7. Industrial visit to study material handling practices and its report

REFERENCE BOOKS

1. Material Handling - Immer J. R. (McGraw Hill)
2. Plant Layout & Material Handling - James Apple (John Wiley)
3. Material Handling System Design - James Apple ((John Wiley)
4. Material Handling Principles & Practice - Theodore H. Allegre Sr. (CBS Publishers & Distributors)
5. Facilities Planning – 3/e, Tompkins, White, Bozer, Tanchoco (John Wiley & Sons)
6. Material Handling Handbooks
7. Work Study - O. P. Khanna (Dhanpatrai & Sons)

B. E. (Production Engineering) – Semester VIII

Elective II – 6. ADVANCED FOUNDRY TECHNOLOGY

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hrs. / Week	Theory Paper (3 Hrs): 100 Marks
Practical: 2 Hr. / Week/ Batch	Term work: 25 Marks
	Oral Examination: 25 Marks

Course Objective

Study of advanced casting processes, gating system design, die / pattern design and mechanization of foundry

SECTION – I

1. Trends and Scope In Foundry Industry: Position of foundry industry worldwide and in India, analysis of data in respect of production and demand, recent trends in quality specifications like dimensional accuracy, surface finish and property requirements, specifications, properties and applications of modern cast alloys- SG iron. Al – alloys, Cu- alloys, Zn – alloys **(2)**

2. Design considerations in manufacturing of patterns and dies: Computer Aided pattern design and manufacture, pattern making machines and equipments, Computer aided design of dies in die casting and centrifugal casting, materials used – epoxy resins and heat treated Al alloys, allowances in patterns and dies **(4)**

3. Design of Gating System: Elements and types of gating systems, gating ratio pressurized and non-pressurized gating, systems- applications, Risers – types and functions of risers, directional solidification – factor affecting and significance, use of exothermic sleeves, bricks, chills and their types, types and uses of filters, computer aided design for gating and risering systems. **(4)**

4. Principles of Solidification: Nucleation kinetics, fundamentals of growth, solidification of single-phase alloys, solidification of eutectic alloys **(3)**

5. Melting Practices and Furnaces for Ferrous and Non- ferrous Alloys: Melting practices of Al- alloys, Mg – alloys, Cu – based alloys and Zn- based alloys and SG Iron; Degassing process and methods in Al – alloys, modification treatment in Al- alloys, use of covering fluxes to avoid oxidation; Furnaces used - oil and gas fired furnaces,

induction furnaces, rotary furnaces, arc furnaces; Desulphurization, spherodisation treatment, inoculation practice, de-oxidation and alloy additions; Principle of working of thermocouples, spectrometers, and C.E. meters – applications; use of pyrometers for temperature measurement and control, energy saving in melting practices. **(5)**

SECTION – II

6. **Modern Molding and Core Making Processes and Equipments:** Various types of sands used for molding and core making, testing of sand, high pressure line molding, Dissamatic, chemically bonded sands; shell molding binder, hardener and type of sand used in shell molding, procedure used for making shell sand, plants used, properties and tests on shell sand, stick point strength, advantages and applications; Resin bonded sands, alkyl resins, phenolic resins and furnace sands, cold box method of core making – advantages and applications, ceramic molding, vacuum molding, sand reclamation – importance, methods and plants. **(5)**

7. **Special Casting Processes:** Investments casting processes and applications; Continuous casting, principle, processes and applications; Die casting, low pressure / gravity, pressure and squeeze, advantages, limitations and applications, centrifugal casting, calculations of various parameters in centrifugal casting, die temperature, rotational speeds, advantages, limitations and applications of centrifugal casting, defects in centrifugal casting. **(4)**

8. **Quality Control in Foundries:** Quality specifications in respect of raw materials used in foundry sand, sand additives, furnace charging material, alloys; Q.C. checklists maintained for raw materials, Q.C. checklists for mould – core properties; Heat wise pouring reports, details of melting log sheets, test bars, calibration records of testing equipments (U.T.M., Sand testing equipments); Results of chemical analysis, mechanical properties, test reports, rejection report analysis, defect diagnosis, remedies, use of cause - effect or fish- bone diagrams, Application of S.Q.C. in foundries, control charts **(5)**

9. **Mechanization in Foundries:** Conveying systems – sand bins, belt conveyors, roller conveyors, bucket elevators; Pouring systems – monorail, auto pour systems; sand plants, practical aspects, layout and mechanization **(3)**

10. **Productivity Improvement Techniques and Cost Analysis in Foundries:** Auditing in foundries, optimization techniques, costing of castings; importance and implementation of TS, ISO and QS in foundries, KAIZEN, safety measures, pollution and its control (compliance to pollution control norms as specified by govt. authorities **(4)**

TERMWORK

1. Design of pattern layout for a given component
2. Design of gating system for a given component (ferrous / non ferrous)
3. Design of risering system for a given component (ferrous / non ferrous)
4. Die design for pressure die casting / centrifugal casting
5. Design of a foundry layout for a given case
6. Study of any one type of melting furnace
7. Study of TS/ISO / QS norms for foundry industry
8. Industrial visit to a modern foundry and its report

(Use of computer in designs is essential)

REFERENCE BOOKS

1) Principles of Metal Castings - Heine, Loper and Rosenthal (TMH)
2) Principles of Foundry Technology - P.L. Jain (TMH)
3) Indian Institution of Foundrymen - Foundry Journal

4) Advanced Pattern Making – Cox I.I. (The Technical Press, London.)
5) ASM Handbook – Vol. 15 Castings. (McGraw Hill)
6) Metal Castings – Principles & Practice - T.V. Ramana Rao. (New Age International Pvt. Ltd. Publishers.)
7) AFS and Control hand book – AFS.
8) Mechanization of Foundry Shops – Machine Construction - P.N. Aeksenov (MIR)
9) Fundamentals of Metal Casting Technology - P.C. Mukherjee (Oxford, IBH)
10) Foundry Engineering – Taylor, Fleming & Wulff (John Wiley)
11) The Foseco Foundryman's Handbook, -Foseco, CBS Publishers & Distributors ISBN **:** 9780750619394
12) The New Metallurgy of Cast Metals Castings – Campbell, CBS Publishers & Distributors, ISBN- 9788131200919

B. E. (Production Engineering) – Semester VIII

Elective II – 7. ADVANCED TOOL & DIE DESIGN

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 2 Hr. / Week/ Batch

Examination Scheme:
Theory Paper (3 Hrs): 100 Marks
Term work: 25 Marks
Oral Examination: 25 Marks

Course Objective

To study principles of designing fixtures and dies for industrial applications.

SECTION – I

1. Introduction: Jigs and Fixtures, Flexible Fixturing, Materials for Tools, Fixture and Dies. **(2)**

2. Modular Fixture Systems: Development of modular fixtures, T- slot based and Dowel pin based Modular Fixture systems, Interactive Computer Aided Fixture Design (I-CAFD) Structure, Locating / clamping Model Analysis and classification, Fixture Component Selection, Fixture component Assembly Manipulation. **(8)**

3. Group Technology based Computer Aided Fixture Design: Fixture Design process analysis, Fixture Structure Analysis, Fixture Feature Analysis, Fixture Design Similarity Analysis, Representation of Fixturing Feature information, Automated Fixture configuration Design **(6)**

4. Geometric and Accuracy Analysis: Geometric constraint conditions, Assembly Analysis, 3-D Fixture configurations, Locating Accuracy and Error analysis, clamp planning, Machining accuracy analysis. **(4)**

SECTION – II

5. Basic Principles of Metal Forming: Flow conditions and flow curve, Deformation and material flow, force and work, Formability. **(4)**

6. Die Design for Deep Drawing and Stretch Drawing: design considerations, die materials, efforts of friction, wear and lubrication, Die handling, Die clamping, dies for hydro mechanical deep drawing. **(5)**

7. Die Design for Hydro Forming: Process Technology, Die design considerations, die layout, die clamping, lubricants.
(4)
8. Extrusion Dies: Die Design for metal and plastic extrusion, die materials, die clamping, die handling, Dies for Solid Sections, Dies for hollow section.
(7)

TERM WORK

1) Case Study of T- Slot based Modular Fixturing system.
2) Case Study of Dowel pin based Modular Fixturing system.
3) Computer Aided Fixture Design for Simple Component.
4) Die Design for stretch drawing operation for a component.
5) Extrusion die design for solid section in plastic.
6) Study of die clamping systems for various processes.

REFERENCE BOOKS

1) Rong, Yeming; "Computer Aided Fixture Design", Marcel Dekker, ISBN 0-8247-9961-5
2) Metal Forming Handbook – Schuler, Springer- Verlag Berlin.
3) Dies for Plastic Extrusion – M.V. Joshi – Mc Millan.
4) Tool Design – C. Donaldson, LeCain & Goold (TMH)
5) Tool Design – H.W. Pollack (Taraporwalla)
6) ASM Handbook – Forming – ASME
7) Handbook of Die Design, 2/e – Suchy, I (McGraw Hill), 2006.
8) Design of Jigs and Fixtures – Hoffman (Pearson)
9) An Introduction to Jig & Tool Design, M.H.A. Kempster, (ELBS)
10) Jigs and Fixture Design Manual, Henrikson (Industrial Press, NY)
11) Die Design Fundamentals, J. R. Paquin, R. E. Crowley, Industrial Press Inc.
12) Jigs & Fixtures; Design Manual – (2/e), P.H. Joshi, (TMH) (2003)

B. E. (Production Engineering) - Part II

6. PROJECT WORK- Phase II

Teaching Scheme:
Practical: 6Hr. / Week/ Batch

Examination Scheme:
Term work: 75 Marks

Oral Examination: 75 Marks

The students will complete their project work as given under B.E. (Production Engineering) – Semester VII and will submit the report in a prescribed format, at the end of Semester VIII. The report shall be submitted, typed on A4 size sheets and hard bound. (One copy for the department and one copy for each student). The contents of the report shall include the following in a broad sense. **Detailing may be done according to the problem undertaken.**

a) Problem identification and statement
b) Review of relevant literature / present practices regarding the problem
c) Methodology followed to carryout the work
d) Inputs for the project design
e) Processing / conversion of these inputs
f) Outputs testing / validation
g) Results, conclusion, future scope, references, acknowledgement
h) **Review of initial plan and deviations in it.**

1) Term work will be assessed by the project guide along with Co-guide from sponsoring industry **or** one more faculty member appointed by the Head of Department for in-house projects; based on the work done and the report submitted.

2) The students will be examined orally by the examiner appointed by the university and the project guide as the internal examiner. **Marks will be awarded on the basis of the work done and performance in the oral examination.**

EQUIVALENCE FOR B.E.(Prod. Engg.)

Sr. No.	Subjects as per Pre- revised Syllabus	Subjects as per revised Syllabus
B.E.(Prod. Engg.) Semester VII		
1	Operations Research	Operations Research
2	Mechatronic Systems	Mechatronic Systems
3	Process Engineering	Process Engineering
4	Production & Operations Management	Production & Operations Management
5	Computer Aided Design, Analysis & Manufacture	Computer Aided Design & Analysis
6	Vacational In-plant Training Report	Vacational In-plant Training Report
7	Project Work – Phase I	Project Work – Phase I
B.E.(Prod. Engg.) Semester VIII		
1	Costing and Cost Control	Costing and Cost Control
2	Computer Integrated Manufacturing Systems	Computer Integrated Manufacturing Systems
3	Quality Management	No equivalent subject, as this subject is transferred to (T.E. Prod. Engg.) Sem. VI (Two Extra Chances to be given).
4	**Elective - I**	
	1. Marketing Management	1. Marketing Management
	2. Materials Management	2. Materials Management
	3. Data Base Management	3. Data Base Management
	4. Entrepreneurship Development	4. Entrepreneurship Development

	5. Financial Management	5. Financial Management
	6. Environment & Pollution Control	6. Environment & Pollution Control
	7. Organizational Behaviour	7. Organizational Behaviour
5	**Elective - II**	
	1. Flexible Manufacturing Systems	1. Flexible Manufacturing Systems
	2. Artificial Intelligence	2. Artificial Intelligence
	3. Industrial Robotics	3. Industrial Robotics
	4. Rolling & Roll Pass Design	4. Low Cost Automation
	5. Material Handling Systems	5. Material Handling Systems
	6. Advanced Foundry Technology	6. Advanced Foundry Technology
	7. Advanced Tool & Die Design	7. Advanced Tool & Die Design
6	Project Work – Phase II	Project Work – Phase II