

UNIVERSITY OF MUMBAI

No. UG/248 of 2010

CIRCULAR:-

A reference is invited to the Ordinances, Regulations and syllabi relating to the Bachelor of Engineering (B.E.) degree course vide this office Circular No.UG/60 of 2004, dated 24<sup>th</sup> February, 2004 and the Principals of the affiliated Colleges in Engineering are hereby informed that the recommendation made by the faculty of Technology at its meeting held on 9<sup>th</sup> December, 2009 has been accepted by the Academic Council at its meeting held on 27<sup>th</sup> July, 2010 vide item No. 4.14 and that, in accordance therewith, the revised syllabus of Fourth Year (Semester VII & VIII) of the B.E. Degree Course in branch of Production Engineering is as per Appendix and that the same has been brought into force with effect from the academic year 2010-2011.

MUMBAI-400 032  
12<sup>th</sup> August, 2010

L. R. Mane  
Offg. Registrar

To,

The Principals of the affiliated Colleges in Engineering.

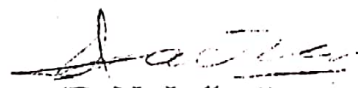
A.C./4.14/27/07/2010

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No. UG/248-A of 2010, MUMBAI-400 032 . 12<sup>th</sup> August, 2010

Copy forwarded with compliments for information to:-

- 1) The Dean, Faculty of Technology,
- 2) The Chairman, Board of Studies in Mechanical Engineering.
- 3) The Controller of Examinations,
- 4) The Co-Ordinator, University Computerization Centre,

  
(D. N. Jadhav)  
Ag. Deputy Registrar  
(UG/PG Section)

Copy to:-

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Executive Secretary to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-Center, Ratnagiri for information.

The Controller of Examinations (10 copies), the Finance and Accounts Officer (2 copies), Record Section (5 copies), Publications Section (5 copies), the Deputy Registrar, Enrolment, Eligibility and Migration Section (3 copies), the Deputy Registrar, Statistical Unit (2 copies), the Deputy Registrar (Accounts Section), Vidyanagari (2 copies), the Deputy Registrar, Affiliation Section (2 copies), the Professor-cum- Director, Institute of Distance and Open Learning Education, (10 copies) the Director University Computer Center (IDE Building), Vidyanagari, (2 copies) the Deputy Registrar (Special Cell), the Deputy Registrar, (PRO) the Assistant Registrar, Academic Authorities Unit (2 copies) and the Assistant Registrar, Executive Authorities Unit (2 copies). They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action. The Assistant Registrar Constituent Colleges Unit (2 copies), BUCT (1 copy), the Deputy Account, Unit V (1 copy), the In-charge Director, Centralize

UNIVERSITY OF MUMBAI



Revised Syllabus  
for the  
Final Year  
(Semester VII & VIII)  
of the  
B.E. Degree Course  
in  
Production Engineering

(With effect from the academic year 2010-2011)

# UNIVERSITY OF MUMBAI

## SCHEME OF INSTRUCTIONS AND EXAMINATION (R-2007) (with effect from the academic year 2010-2011)

### COURSE: B.E. (PRODUCTION ENGINEERING) YEAR: B.E., SEMESTER: VII \*

| Sr. No | Subjects                        | No. of periods of 1 Hour |           |          | Duration of Theory Paper Hours | Marks        |           |                        |      |       |
|--------|---------------------------------|--------------------------|-----------|----------|--------------------------------|--------------|-----------|------------------------|------|-------|
|        |                                 | Lecture                  | Practical | Tutorial |                                | Theory Paper | Term Work | Progressive Assessment | Oral | Total |
| 1      | Industrial Training and Project | -                        | -         | -        | -                              | -            | 100       | 50                     | 50   | 200   |

\*Industrial training and project report should be of 24 weeks.

Workload: Contact teacher hours for project guidance –One hour per student per week.

### COURSE: B.E. (PRODUCTION ENGINEERING) YEAR: B.E., SEMESTER: VIII \*

(with effect from the academic year 2010-2011)

| Sr. No       | Subjects                                               | No. of periods of 1 Hour |           |          | Duration of Theory Paper Hours | Marks        |            |           |           |            |
|--------------|--------------------------------------------------------|--------------------------|-----------|----------|--------------------------------|--------------|------------|-----------|-----------|------------|
|              |                                                        | Lecture                  | Practical | Tutorial |                                | Theory Paper | Term Work  | Practical | Oral      | Total      |
| 1            | Automation and Control Engineering                     | 4                        | 2         | -        | 4                              | 100          | 25         | 25        | -         | 150        |
| 2            | Computer Aided Manufacturing                           | 4                        | 2         | -        | 3                              | 100          | 25         | 25        | -         | 150        |
| 3            | Engineering Economics, Finance, Accounting and Costing | 4                        | 2         | -        | 3                              | 100          | 25         | -         | -         | 125        |
| 4            | Total Quality Strategy                                 | 4                        | 2         | -        | 3                              | 100          | 25         | -         | 25        | 150        |
| 5            | Industrial Relations and Human Resource Management     | 4                        | 2         | -        | 3                              | 100          | 25         | -         | -         | 125        |
| 6            | Elective                                               | 4                        | 2         | -        | 4                              | 100          | 25         | -         | 25        | 150        |
| <b>TOTAL</b> |                                                        | <b>24</b>                | <b>12</b> | <b>-</b> | <b>-</b>                       | <b>600</b>   | <b>150</b> | <b>50</b> | <b>50</b> | <b>850</b> |

#### List of Electives

|                                  |                        |                           |
|----------------------------------|------------------------|---------------------------|
| 1.Sales and Marketing Management | 2.Mechatronics         | 3.Supply Chain Management |
| 4. Industrial Robotics           | 5.Plastics Engineering | 6.Product Design          |

\*The Course contents in semester VII and semester VIII are interchangeable .The examination for these two semesters will be at the end of the semester VIII.

| University of Mumbai                |                        |  |              |       |
|-------------------------------------|------------------------|--|--------------|-------|
| CLASS:B.E. (PRODUCTION ENGINEERING) |                        |  | Semester-VII |       |
| SUBJECT: In-Plant Training          |                        |  |              |       |
|                                     |                        |  | Hours        | Marks |
| Evaluation System                   | Progressive Assessment |  | -            | 50    |
|                                     | Oral Examination       |  | -            | 50    |
|                                     | Term Work              |  | -            | 100   |
|                                     | Total                  |  | 200          |       |

### Objective

To acquaint the student with overall functioning of an industrial organization, exposure to the organization structure, allied direct/indirect activities and procedures associated with the production function.

### Approach

Hand on experience in tackling real appropriate case study and investigative assignments. An investigative and analytical approach looking at a problem in its entirety and not in isolation. The project report should contain problem definition and objective, background information, possible approaches and approach selected, data identification, analysis or investigation carried out, results and concluding discussion. Develop skill in presenting a factual report on specification directed study stressing clarity, brevity and simplicity of styles.

### Project Areas

1. Product and process innovation and development
2. Cost reduction, value engineering/analysis, method improvement, productivity analysis and improvement, layout and material handling investigation.
3. Design of production tooling.
4. Quality control, SQC, SPC, TQM and rejection analysis.
5. Production planning and control.
6. Any problem involving analysis and investigation in production technology, inventory, plant engineering maintenance, stored and purchase, process and tool engineering.
7. Any other areas of interest to the organization, connected with technology and management.(In line with Production Engineering Syllabus of Mumbai University)

CLASS: B.E. (PRODUCTION ENGINEERING)

Semester-VIII

SUBJECT: Automation And Control Engineering

|                                         |                       |       |       |
|-----------------------------------------|-----------------------|-------|-------|
| Periods per week<br>01 Period of 60 min | Lecture               | 4     |       |
|                                         | Practical             | 2     |       |
|                                         | Tutorial              | -     |       |
|                                         |                       | Hours | Marks |
| Evaluation System                       | Theory Examination    | 4     | 100   |
|                                         | Practical Examination | -     | 25    |
|                                         | Oral Examination      | -     | -     |
|                                         | Term Work             | -     | 25    |
|                                         | Total                 | 150   |       |

**Objective:**

To acquaint the student with need, options and applications of automation as cost saving effort and skill saving approach in manufacturing operations.

**Approach:**

Equal emphasis on theoretical principles and design features.

**Weightage:**

Proportional to the number of Hours indicated.

**Details of Syllabus:**

| S.No | Description                                                                                                                                                                                                                                                                                                                                                                                                                      | Hours |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1    | <b>Automation</b><br>Definition, concepts, types of automation, low/medium/high cost, hard/flexible automation, semi/fully automated machine tools, job/material transfer devices                                                                                                                                                                                                                                                | 02    |
| 2    | <b>Control System fundamentals</b><br>Control system concepts, classification of control systems, mathematical representation of system equations, response characteristics of components and systems through classical solution, analog computer and Laplace transformation. Frequency response analysis, polar plots, System's stability through Routh's criterion, Bode plots and Nyquist plot, Root locus method of analysis | 12    |
| 3    | <b>Low cost automation with pneumatics</b><br>Advantages & limitations of Pneumatic power systems, Types & selection of compressor, Preparation of air, functions of different pneumatic components and selection, construction of pneumatic controls                                                                                                                                                                            | 12    |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|   | and circuit diagrams for conveying, feeding, clamping, indexing, cutting and non-cutting operations, cascade and shift register circuits for multiple cylinder operations, principles of electro-pneumatic control, selection of electro-pneumatic components, control circuits for industrial applications with electro-pneumatic control for single and multiple actuators.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |
| 4 | <b>Hydraulic fluid power automation</b><br>Advantages of hydraulic fluid power automation, operational principles and uses of hydraulic power system, functioning of hydraulic components such as pumps, filters, control devices, linear and rotary actuators, hydraulic control for industrial application, design and development of hydraulic circuits for simple application areas involving selection of hydraulic components for specific applications, electro hydraulic principles and components used in electro-hydraulic, industrial applications based on electro hydraulic, circuit design for electro hydraulics, proportional valves and activation technology, industrial applications with proportional valves. Principles of digital hydraulics and servo hydraulics applications, comparison between proportional, digital and servo hydraulics. | 10 |
| 5 | <b>Logic Gates and Programmable logic controllers</b><br>AND, OR, NOT, NAND and NOR, applications of basic control circuits based on these gates, Karnaugh map for signal simplification, Over view and applications of programmable logic controllers in manufacturing, Relay logic, programming a PLC using ladder diagram programming, Ladder programme for control of single cylinder and two cylinder pneumatic systems                                                                                                                                                                                                                                                                                                                                                                                                                                         | 10 |
| 6 | <b>Electronics / Electrical control devices</b><br>Types of transducers / sensors & selection: Introduction to microprocessor based control systems .Features and design principles of electrical circuit in drives, clutches and brakes, thermal relays, time relays, electrical control circuits for industrial applications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 04 |

### Term work:

1. At least one class test to be conducted at middle of semester for 10 marks.
2. At least three assignments on concepts and applications:
  - 1) Pure pneumatic control, electro pneumatic control
  - 2) Electro hydraulic control, hydraulic automation
  - 3) Control engineering. Concepts through block diagram and block diagram reduction to find transfer function
  - 4) Root locus, Nyquist and Bode plots for system stability
3. Lab report for practical carried out in laboratory

|                 |           |
|-----------------|-----------|
| • Assignments   | 15 marks  |
| • Written tests | 10 marks  |
| TOTAL           | 25 marks. |

### Textbooks:

1. Pneumatic circuits and low cost automation, Fawce, JR.
2. Fundamentals of pneumatics- Festo series
3. Industrial Hydraulics; Pippenger
4. Automation, production system and CIM: Mikell groover, Prentice hall
5. Engineering systems and automation control: Peter Dransfield
6. Design of machine tools: S.K. Basu
7. Automated assembly: Geoffery, Broothroyd, Corradopoli and Lawrence E Murch, Marcel Decker Inc. 1982.

### Reference Books:

1. Vickers Manual on hydraulics
2. Pneumatic applications: Wener Deppert and Kurt Stoll
3. Hydraulics and Pneumatics for production: Stewart
4. Control of fluid power: Pippenger and Pace
5. Control system technology: C.J. Chemond
6. Industrial Hydraulic control: Peter Rohner
7. Automatic control engineering: Francis H. Raven

| University of Mumbai                    |                       |       |               |
|-----------------------------------------|-----------------------|-------|---------------|
| CLASS:B.E. (PRODUCTION ENGINEERING)     |                       |       | Semester-VIII |
| SUBJECT: Computer Aided Manufacturing   |                       |       |               |
| Periods per week<br>01 Period of 60 min | Lecture               | 4     |               |
|                                         | Practical             | 2     |               |
|                                         | Tutorial              | -     |               |
|                                         |                       | Hours | Marks         |
| Evaluation System                       | Theory Examination    | 3     | 100           |
|                                         | Practical Examination | -     | 25            |
|                                         | Oral Examination      | -     | -             |
|                                         | Term Work             | -     | 25            |
|                                         | Total                 | 150   |               |

**Objective:**

To provide understanding of modern trends in manufacturing using CNC machines and Computer Integrated Manufacturing

**Approach:**

Emphasis on concepts through Case studies

**Weightage:**

Proportional to number of hours indicated in the right column below

**Details of Syllabus:**

| Sr. No | Details                                                                                                                                                                                                                                                                               | Hrs |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1      | <b>Introduction :</b><br>Elements of CAM system, Brief history of NC machines like Tape formats & Tape readers etc, Computer Numerical control of Machine Tools, Fundamental elements of CNC, Benefits of CNC, Computer control concepts, Data processing units & Binary calculation. | 8   |
| 2      | <b>CNC control system:</b><br>Motion controller, Interpolation-Linear & Circular, Positioning & contouring control loops, Incremental & Absolute system, DNC & CNC systems, Adaptive control system.                                                                                  | 6   |
| 3      | <b>CNC Hardware Basics:</b><br>CNC drives, Spindle design, Actuation, Feedback devices                                                                                                                                                                                                | 4   |

|   |                                                                                                                                                                                                                                                                                                                                                                                        |    |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 4 | <b>CNC Tooling:</b><br>Turning tools, Milling tools, Tool presetter, ATC, work holding devices, Cutting process parameters.                                                                                                                                                                                                                                                            | 4  |
| 5 | <b>CNC Programming :</b><br>Introduction to CNC Lathe & Milling, Touch probe system, Tool length, nose radius & Diameter compensation, Turning & Machining centre programming, CNC part programming using ISO controllers, Canned cycles, Looping Jumping Subroutines Macros, Parametric programming, Computer aided part programming using APT & Post processing.                     | 12 |
| 6 | <b>CIM :</b><br>Computer applications in manufacturing, Automation, Integrated production management systems. Brief introduction to Inventory , MRP – I & MRP – II Concepts of ERP, Lean manufacturing, FMS systems Automated Material handling systems, Conveyors, AVG , AS/RS, CAPP, Automated inspection procedure, Distributed Numerical control & Benefits of CIM implementation, | 16 |

#### Term work:

1. At least one class test to be conducted at middle of semester for 10 marks.
2. Practical on CNC Turning centre.
3. Practical on CNC Milling centre.
4. Tool path simulation using Manufacturing Simulation software.
5. Four assignments on concepts & applications

|                 |                  |
|-----------------|------------------|
| • Assignments   | 15 marks         |
| • Written tests | 10 marks         |
| <b>TOTAL</b>    | <b>25 marks.</b> |

#### Text Books:

1. Mastering CAD/CAM by Ibrahim Zeid
2. CAD/CAM by P.N.Rao
3. Computer aided design and manufacturing by Mikel.P.Groover
4. CNC & CAM by G.E.Thyer.
5. Numerical Control and computer aided Manufacturing by T.K.Kundra, R.N.Rao, and N.K.Durai.
6. CAD/CAM/CIM by P.Radha Krishnan and S.Subramanyam.

#### Reference Books:

1. CAD/CAM Hand Book - Machever c and Baluth R.E
2. Programming for Numerical control of machines: Roberts A.D and Prentice R.C
3. Computer Integrated Manufacturing by Alan Weatherall
4. CAD/CAM systems, Planning and Implementation: Charles S Knox
5. CAD/CAM Handbook by Erich Teicholz

| University of Mumbai                                            |           |                       |               |       |
|-----------------------------------------------------------------|-----------|-----------------------|---------------|-------|
| CLASS: B.E. (PRODUCTION ENGINEERING)                            |           |                       | Semester-VIII |       |
| SUBJECT: Engineering Economics, Finance, Accounting and Costing |           |                       |               |       |
| Periods per week<br>of 60 min                                   | 01 Period | Lecture               | 4             |       |
|                                                                 |           | Practical             | 2             |       |
|                                                                 |           | Tutorial              | -             |       |
|                                                                 |           |                       | Hours         | Marks |
| Evaluation System                                               |           | Theory Examination    | 3             | 100   |
|                                                                 |           | Practical Examination | -             | -     |
|                                                                 |           | Oral Examination      | -             | -     |
|                                                                 |           | Term Work             | -             | -     |
|                                                                 |           | Total                 | 125           | 25    |

Objective:

### Objective:

The objective of this subject is to introduce financial thinking, tools and techniques to the student who will manage or venture in professional engineering after graduation.

This subject aims to familiarize students with basic knowledge in economics, finance, accounting and costing systems and methods. The sub-subjects will equip students with financial problem solving skills.

The students can apply knowledge in economics and financial environment of industries in decision making.

### Approach:

Emphasis on concepts, principles and analytical treatment supplemented by problem solving.

### Weightage:

Economics (15%), Finance (15%), Accounting (30%) and Costing (40%)

### Details of Syllabus:

| Sr. No | Details                                                                | Hrs |
|--------|------------------------------------------------------------------------|-----|
| 1      | Introduction to Economics, Economic problems, Choice and allocation of | 07  |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|   | resources, Opportunity cost, Demand-supply and market system, Elasticity of supply and Demand; Individual as producer, consumer and borrower; The private firm as producer and employer, The aims of government policies and government's influence on economy, Simple measures and indicators of comparative living standards.                                                                                                                                                   |    |
| 2 | Introduction to financial management, Financial Environment in industry, Requirements and use of money, Short term and long term uses of money, Sources of funds, Financial institutions, Capital investments, Working capital, Entrepreneurial finance analysis, Time value of money, Evaluation of cash flows, Annuities, Investment risks and returns, Depreciation, Comparison of investments, Preparation of budgets and budgetary control, Projects and contracts planning. | 07 |
| 3 | Purpose and context of the accounting framework, Introduction to the financial statements from typical Annual Reports of the Organizations, Role of accountant, Basic accounting concepts and principles. Double entry bookkeeping, Books of prime entry, The use of computer software in the processing of data, The role of journal.                                                                                                                                            | 06 |
| 4 | Trial balance, Presentation formats of Financial Statements, Profit and Loss concepts, Fixed and current parts of Liabilities and assets, Preparation of Profit and Loss Accounts and Balance Sheet, Review of performance, Financial Ratios                                                                                                                                                                                                                                      | 10 |
| 5 | Elements of Cost, Material and Labor cost accounting and control, Overheads allocation and absorption. Unit and Batch Costing, Activity based costing.                                                                                                                                                                                                                                                                                                                            | 10 |
| 6 | Process costing, Processing in sequence, Service Costing, Transport operations, Cost based management accounting, Marginal Costing, Break even point, PV ratios, Standard Costing, Cost elements variances                                                                                                                                                                                                                                                                        | 10 |

**Term Work:**

1. At least one class test (10 marks)
2. Six assignments on six given modules.
3. Study write-up on one (published within 3 years) Annual Report of Engineering Company.

|                 |                  |
|-----------------|------------------|
| • Assignments   | 15 marks         |
| • Written tests | 10 marks         |
| <b>TOTAL</b>    | <b>25 marks.</b> |

**References:**

1. Accounting for Management – Dr. Jawahar Lal
2. Accounting for Management – Dr. Khan and Jain.
3. Economics – Samuelson, Nordhaus
4. Basic Economics – Mr. Maheshvari
5. Financial Management – Dr. Prasanna Chandra
6. Financial Management – Mr. Bhattacharya
7. Costing – Mr. Babatosh Banerji
8. Costing - Dr. Jawahar Lal

| University of Mumbai                    |                       |       |               |
|-----------------------------------------|-----------------------|-------|---------------|
| CLASS:B.E. (PRODUCTION ENGINEERING)     |                       |       | Semester-VIII |
| SUBJECT: Total Quality Strategy         |                       |       |               |
| Periods per week<br>01 Period of 60 min | Lecture               | 4     |               |
|                                         | Practical             | 2     |               |
|                                         | Tutorial              | -     |               |
|                                         |                       | Hours | Marks         |
| Evaluation System                       | Theory Examination    | 3     | 100           |
|                                         | Practical Examination | -     | -             |
|                                         | Oral Examination      | -     | 25            |
|                                         | Term Work             | -     | 25            |
|                                         | Total                 | 150   |               |

**Objective**

Exposure to the newly emerging trends in total quality strategy of production systems with focus on managing quality in toto; aiming at customer satisfaction/ delight ness, quality delivery , moral and cost as the present day “mantra” for survival and growth at global level.

**Approach**

Focus on the necessity of flexible, competitive and responsive organization necessitated by compelling market forces operating in a widening and rapidly changing business environment at global level. Emphasis on quality systems and their associated responsibilities with case studies.

**Weightage:**

Equi potential Weightage for respective sections.

**Details of Syllabus:**

| Sr. No | Details | Hrs |
|--------|---------|-----|
|--------|---------|-----|

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1 | <b>Introduction:</b><br>Basic concepts and definitions, fitness for use & conformance to specification, historical review of quality & its awareness , quality task/ functions, productivity & quality relationship. Cost of quality as prevention, appraisal and failure costs, Hidden cost of quality.                                                                                                                                                                                                                                                                                     | 06 |
| 2 | <b>Strategic planning for quality:</b><br>Need for quality policies & objectives, examples of quality policies & objectives with statements, leadership concepts, role of senior management, quality council, strategic planning.<br>Quality improvement: Juran trilogy, management controllable defects, operator controllable defects, sporadic and chronic problems of quality.<br>Bench Marking: Introduction definition and signification, collection of data for bench marking and its use.                                                                                            | 10 |
| 3 | <b>Customer relation and satisfaction:</b><br>Origin of consumerism. Product knowledge, who is customer? Customer perception of quality; concept of value engineering & analysis, complaints and redressal, product safety and reliability (conceptual treatment only) , service quality.                                                                                                                                                                                                                                                                                                    | 06 |
| 4 | <b>Supplier Relations:</b><br>By development; assessment rating; quality of bought out components, managing supplier as partner, appraisal & certification, basic concept of supply chain management.                                                                                                                                                                                                                                                                                                                                                                                        | 05 |
| 5 | <b>Quality Systems</b><br>Historical review with focus on current status of ISO 9000&14000, QS 9000, TS16949 & their elements , policy, manual, procedures and documentation, internal audit, surveillance audit, maintaining of certification.                                                                                                                                                                                                                                                                                                                                              | 09 |
| 6 | <b>6. Quality / Productivity Improvement Tools.</b><br>QFD, Customer's/Supplier's voice, Productivity improvement techniques as 5S, POKA YOE, SMED, Kaizen, concurrent engineering, Continuous process improvement through: Control Charts $\bar{X}$ & R, P, nP, C.<br>Process capability, OC curve, acceptance sampling AQL, LTPD, AOQL , producers and consumers risk (Single & Double sampling plan only) , PDCA cycle, Problem solving tools (old & new), JIT, 6sigma, approach to world class manufacturing ( Toyota production system, Lean manufacturing, Zero defect supply concept) | 14 |

**Term Work:**

1. At least one class test ( 10 Marks ).
2. At least five assignments on above syllabus.

3. One seminar / Case study.

- Assignments

15 marks

- Written tests

10 marks

TOTAL

25 marks.

References:

1. Quality planning and analysis: J M Juran, FM Gryana, TMH
2. Total Quality Management: D.H.BesterField et al. prentice hall.
3. Quality is free : Philip B Crossbly, Mentor/ new American library 1979
4. What is Total Quality Control? The japnese way : Ishikawa k, PH1985
5. Total Quality Control: Armand V Feigenbaum
6. TQM in new product manufacturing: HG Menon: TMH2992
7. Managing for total quality:N.Logothetis/ prentice hall
8. Total quality management: Dr.Uday K.Haldar/Dhanpatrai & co.
9. Total quality management: Dr.K.C.Aurora/S.K.Kataria & sons.

| University of Mumbai                                        |                       |       |               |
|-------------------------------------------------------------|-----------------------|-------|---------------|
| CLASS:B.E. (PRODUCTION ENGINEERING)                         |                       |       | Semester-VIII |
| SUBJECT: Industrial Relations and Human Resource Management |                       |       |               |
| Periods per week<br>01 Period of 60 min                     | Lecture               | 4     |               |
|                                                             | Practical             | 2     |               |
|                                                             | Tutorial              | -     |               |
|                                                             |                       | Hours | Marks         |
| Evaluation System                                           | Theory Examination    | 3     | 100           |
|                                                             | Practical Examination | -     | -             |
|                                                             | Oral Examination      | -     | -             |
|                                                             | Term Work             | -     | 25            |
|                                                             | Total                 | 125   |               |

**Objective:**

Exposure to the various human resource aspects and industry related problems and possible solutions.

**Approach:**

Focus on the behavioural developments, leadership, individuals and groups.

**Weightage:**

Sr.No.1(15%)2(15%)3(20%)4(10%)5(30%)6(10%)

**Details of Syllabus:**

| Sr. No | Details                                                                                                                                                                                                                                                                                                 | Hrs |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1      | <b>Evolution and Developments of thought :</b><br>Evolution of managements thought, behavioural, contingency, and contempory management approach.<br><b>Organization structure :</b><br>Definition, need, types of organization responsibility, authority, accountability, delegation, span of control. | 8   |
| 2      | <b>Decision Making :</b><br>Types of decision, steps in rational decision making<br><b>Functions of personnel Management:</b><br>Managerial and operative functions.                                                                                                                                    | 8   |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |    |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 3 | <b>Planning:</b><br>Definition, characteristics of good plan, steps in planning, strategic planning.<br><b>Communication:</b><br>Principles of effective communication, Barriers of communication.<br><b>Leaderships:</b><br>Different styles of leadership, Their suitability, Manager as a leader.                                                                                                                                                                       | 10 |
| 4 | <b>Human Behavior:</b><br>Perception, attitude, Groups, Types of groups, Groups behavior, Morale, Job satisfaction.<br><b>Motivation:</b><br>Theories of Motivation, Job design, Job enlargement and enrichment, Performance appraisals.                                                                                                                                                                                                                                   | 6  |
| 5 | <b>Human resource development :</b><br>a) Human resource planning, Job description, Job analysis and job evolution, Recruitment and selection procedure.<br>b) Training and Development: Concepts and difference between training and development, Methods, Steps, Types of training.<br>c) Promotion: Basis for promotion and their merit and demerits.<br>Maintenance of human resource:<br>Safety, steps in safety programme, Occupational hazard, Accident prevention. | 12 |
| 6 | <b>Compensation and salary Administration:</b><br>Factory act, Industrial dispute act, Salary and wage fixation, Machinery for setting grievances, Collective bargaining, Industrial relations, and Trade unions, Conflicts management.                                                                                                                                                                                                                                    | 6  |

#### Term Work

1. At least one class test (10 marks)
2. At least four assignments and two case studies based on above topics.

|                 |                  |
|-----------------|------------------|
| • Assignments   | 15 marks         |
| • Written tests | 10 marks         |
| <b>TOTAL</b>    | <b>25 marks.</b> |

#### Text Books

1. Personnel Management and Human Resources : C.S. Venkataratnam, B.K, Srivastava
2. Principles of Management : P.C. Tripathi, P.N. Reddy
3. Industrial and Business Management : Martand T. Teslang
4. Organization Behavior, Text and case : Uma Sekram
5. Organizational Behavior : F. Luthans

6. Personnel Management: C.B. Memoria.
7. Factory Administration and Management: A.S.Deshpande.

#### Reference Books

1. The Change in world of the Executive: Peter Drucker.
2. In search of excellence: Tom Peter and R, H. Waterman Harper.

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|------------------------------------------------------|-----------------------|---------------|-------|
| CLASS: B. E. (PRODUCTION ENGINEERING)                |                       | Semester-VIII |       |
| SUBJECT: Elective 1 (Sales and Marketing Management) |                       |               |       |
| Periods per week<br>01 Period of 60 min              | Lecture               | 4             |       |
|                                                      | Practical             | 2             |       |
|                                                      | Tutorial              | -             |       |
|                                                      |                       | Hours         | Marks |
| Evaluation System                                    | Theory Examination    | 4             | 100   |
|                                                      | Practical Examination | -             | -     |
|                                                      | Oral Examination      | -             | 25    |
|                                                      | Term Work             | -             | 25    |
|                                                      | Total                 | 150           |       |

#### Objective

The objective of this subject is to introduce marketing thinking, tools and techniques to the student who will manage or venture in professional engineering after graduation.

This subject aims to familiarize student with basic knowledge in sales and marketing systems and methods. The subject will equip student with marketing creativity and problem solving skills.

The student can apply the knowledge in engineering and marketing environment of industries in managerial decision making.

#### Approach

Emphasis on concepts, principles and marketing situations through lectures supplemented by case studies and seminars.

#### Weightage

Sr. No. 1 (10%), 2 (10%), 3 (30%), 4 (20%), 5 (10%), 6 (20%)

**Details of Syllabus**

| Sr. No | Details                                                                                                                                                                                                                                                                                                                          | Hrs |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1      | Definition of marketing, Understanding marketing, Sales, Company orientations, Journey from sales to marketing, New economy, Environmental forces, Marketing task, Marketing concepts and tools, Major drivers of the economy, Changing of business practices, Changing of marketing practices, E-business                       | 05  |
| 2      | Customer value and satisfaction, Organizational culture, Attracting and retaining customers, Cost of lost customer, Total customer satisfaction, Customer relationship management, Survey of customer needs, Consumers, Organizational and Government buyers.                                                                    | 05  |
| 3      | Assessing marketing opportunities, Gathering information and measuring marketing demand, Forecasting and demand measurement, Differentiation, Segmenting, Targeting, Positioning, Marketing decision support system, Product life cycle, Portfolio management, Customer perception of product features, New product development. | 15  |
| 4      | Competition, Market research, Management strategies, 4Ps of product marketing and 7Ps of service marketing, Product policies, Product brands, Services offering, Pricing, Customer perceived value, Distribution channels, Retailing, Marketing Plan and implementation, Market testing.                                         | 10  |
| 5      | Marketing Organization, Selection of marketing staff, Specialized Training, Role of a salesman, Routine management, Salaries and incentives, Marketing intelligence, Marketing performance.                                                                                                                                      | 05  |
| 6      | Customer focus, Advertising, Sales promotion, Motivation research, Consumer behavior, Buying decision process, Competitive strategies, Audit of customer satisfaction, Improvements through benchmarking. Supporting world class goals.                                                                                          | 10  |

**Term Work**

1. At least one class test (10 marks)
2. Six assignments on six given modules.
3. Study write-up and a seminar delivery on product/service Marketing Practices.

|                 |                  |
|-----------------|------------------|
| • Assignments   | 15 marks         |
| • Written tests | 10 marks         |
| <b>TOTAL</b>    | <b>25 marks.</b> |

**References**

1. Marketing Management - Philip Kotler
2. Marketing, A Managerial Introduction – J. C. Gandhi
3. Marketing – Mamoria and Joshi
4. Principles of Marketing and Salesmanship – J. C. Sinha

5. Marketing management – V. S. Ramaswamy, S. Namakumari
6. Indian Cases in Marketing – M. D. Kakade
7. Advertising: Art and Ideas – Dr. G. M. Rege
8. Advertising - Chakaraborty

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|-----------------------------------------|-----------------------|-------|---------------|
| CLASS:B.E. (PRODUCTION ENGINEERING)     |                       |       | Semester-VIII |
| SUBJECT: Elective 2 (Mechatronics)      |                       |       |               |
| Periods per week<br>01 Period of 60 min | Lecture               | 4     |               |
|                                         | Practical             | 2     |               |
|                                         | Tutorial              | -     |               |
|                                         |                       | Hours | Marks         |
| Evaluation System                       | Theory Examination    | 4     | 100           |
|                                         | Practical Examination | -     | -             |
|                                         | Oral Examination      | -     | 25            |
|                                         | Term Work             | -     | 25            |
|                                         | Total                 | 150   |               |

**Objective:**

Highlight managerial aspects of these crucial resources.

**Approach:**

A system approach stressing analysis and design features directed towards organizational goals.

**Weightage:**

Equal weightage for all sections.

**Details of Syllabus:**

| Sr. No | Details                                                                                                                                                                                   | Hrs |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1      | Mechatronics definition, scope, various engineering philosophies forming the mechatronics roles played by mechanics and electronics in modern technological fields.                       | 4   |
| 2      | Architecture & addressing modes of 8086/8088 microprocessor, its instructions set, programming for 8086/8088 with assembly language and its use other than as a computer.                 | 8   |
| 3      | Interfacing hardware with real world, analog interface and data acquisition, digital i/o interfacing, special function interfacing signal conditioning, special utility support hardware. | 6   |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |    |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 4 | Signal processing and data processing: Provincials of analogue signal conditioning, signal level changes, linearization, conversion, filtering and impedance matching passive circuits' instrumentation amplifier using pampas specifications and circuits in instrumentation, digital signal conditioning, and converters compactors DAC/ADC data acquisition system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 8  |
| 5 | PLC: introduction to the design and mode of operation of programmable logic control (PLC) conversion and documentation of control into runnable PLC programme.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 8  |
| 6 | <p>Mechanical elements of roots robot co-coordinating system, robot drive, mechanism lead screws chain and linkage belt drives ,gear drives, harmonic drives, cyclo speed reducers, end effectors, gripper techniques, gripper drives, systems hydraulics drives, pneumatic drives, electric motor drives.</p> <p><b>Robot arm kinematics:</b> Kinematics, rotation matrix, composite representation, homogeneous co-ordinate and transformation matrix, Danvit Hartenberg representation.</p> <p><b>Robot programming languages:</b> various robot programming languages, characteristics of robot level language, characteristics of task level programming.</p> <p><b>Concepts of computerized numerical control machines tools :</b> open loop servo systems, design consideration of spindle drives and machines slide motions, stepper motors, servo motors, ball screws linear bearings, closed loop servo systems, feed back systems linear and rotary transducers, automatic tool changing devices.</p> | 16 |

### Term Work

At least one class test of (10 Marks)

Term work shall be based on the following topics:

1. Microprocessor based stepper / DL motor drive
2. Microprocessor based instrumentation read out.
3. Microprocessor based PID controller
4. Microprocessor based servo drive
5. Robot programming
6. CNC programming
7. Power electronic
8. Signal conditioning with OPAMPS

|                 |                  |
|-----------------|------------------|
| • Assignments   | 15 marks         |
| • Written tests | 10 marks         |
| <b>TOTAL</b>    | <b>25 marks.</b> |

### References Books

1. 8086/8088 Microprocessor Programming : Lieu Fibson
2. 8086/8088 Microprocessor Programming : Triebel & Singh
3. OPAMP and linear Integrated Circuits : Couphlin & Driscoll
4. Process control & Instrumentation technology : Cirtis D Johnson
5. Robotics : K S Fu, R C Gonzalex, S C Lee Johnson
6. Robotics: An introduction - D Maclogy - D. M. J. Harris
7. Industrial control & instrumentation W Bolaton, ( Orient Longman)

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|----------------------------------------------|-----------------------|-------|---------------|
| CLASS:B.E. (PRODUCTION ENGINEERING)          |                       |       | Semester-VIII |
| SUBJECT: Elective 3(Supply Chain Management) |                       |       |               |
| Periods per week      01<br>Period of 60 min | Lecture               | 4     |               |
|                                              | Practical             | 2     |               |
|                                              | Tutorial              | -     |               |
|                                              |                       | Hours | Marks         |
| Evaluation System                            | Theory Examination    | 4     | 100           |
|                                              | Practical Examination | -     | -             |
|                                              | Oral Examination      | -     | 25            |
|                                              | Term Work             | -     | 25            |
|                                              | Total                 | 150   |               |
| Objective                                    |                       |       |               |

### Objective

To provide an introduction to the concepts, Principles of Logistics and Supply Chain Management.

### Approach

Emphasis on concepts through Case studies

### Weightage

Proportional to number of hours indicated in the right column below

### Details of Syllabus

| Sr. No. | Details                                                                                                                                                                                                                                                                                                                                                                                                                                        | Hrs |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1       | <b>BUILDING A STRATEGIC FRAME WORK TO ANALYSE SUPPLY CHAINS</b><br><br>Supply chain stages and decision phases, Process view of supply chain: Supply chain flows, Examples of supply chains, Competitive and supply chain strategies, Achieving strategic fit: Expanding strategic scope, Drivers of supply chain performance. Framework for structuring drivers: inventory, transportation facilities, information obstacles to achieving fit | 08  |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 2 | <b>DESIGNING THE SUPPLY CHAIN NETWORK</b><br><br>Distribution Networking: Role, Design, Supply chain network(SCN):Role, Factors, framework for design decisions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 06 |
| 3 | <b>MATERIALS MANAGEMENT</b><br><br>Scope, Importance, Classification of materials, Procurement, Purchasing policies, Vendor development and evaluation. Inventory control systems of stock replenishment, Cost elements, EOQ and its derivative modules, Use of computers for materials function.                                                                                                                                                                                                                                                                                                                                                                                                     | 06 |
| 4 | <b>DIMENSIONS OF LOGISTICS</b><br><br>Introduction: A macro and Micro Dimensions, Logistics interfaces with other areas, Approach to analyzing logistics system, Logistics and systems analyzing: Techniques of logistics system analysis, factors affecting the cost and Importance of logistics.                                                                                                                                                                                                                                                                                                                                                                                                    | 08 |
| 5 | <b>WAREHOUSE AND TRANSPORT MANAGEMENT</b><br><br>Concept of strategic storage, Warehouse functionality, Warehouse operating principles, Developing warehouse resources, Material handling and packaging in warehouses, Transportation Management, Transport functionality and principles, Transport infrastructure, transport economics and Pricing. Transport decision making                                                                                                                                                                                                                                                                                                                        | 07 |
| 6 | <b>IT IN SUPPLY CHAIN</b><br><br>IT framework, Customer Relationship Management(CRM),internal Supply chain management, Supplier Relationship Management (SRM),Transaction management, Future of IT<br><br><b>CO,ORDINATION IN A SUPPLY CHAIN</b><br><br>Lack of supply chain coordination and the Bullwhip effect, Obstacle to coordination, Managerial levers, Building partnerships and trust.<br><br><b>EMERGING TRENDS AND ISSUES</b><br><br>Collaborative strategies, Vendor managed inventory-3PL-4PL,Reverse logistics: Reasons, Role, Activities; RFID systems: Components, Applications, Implementation; Lean supply chain, Implementation of Six Sigma in supply chain, Green supply chain. | 15 |

### TERM WORK:

1. Assignment on each Topic
2. Case Study : Present a report of 10,15 pages on any topic from the syllabus.
3. One Class Test

|                 |                  |
|-----------------|------------------|
| • Assignments   | 15 marks         |
| • Written tests | 10 marks         |
| <b>TOTAL</b>    | <b>25 marks.</b> |

### REFERENCES:

1. Supply Chain Management Strategy . Planning, and operations ,Sunil Chopra and Peter Meindl
2. Materials Management & Purchasing , Ammer D.S. Taraporawala
3. Designing & Managing Supply chain , David Simchi Levi, Philip Kaminsky & Edith Smichi Levi
4. Supply Chain Redesign: Transforming Supply Chains into Integrated Value Systems, Robert B Handfield, Ernest L Nicholas
5. The Management of Business Logistics: A Supply Chain Perspective, Coyle, Bardi, Langley

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|-------------------------------------------|-----------------------|-------|---------------|
| CLASS:B.E. (PRODUCTION ENGINEERING)       |                       |       | Semester-VIII |
| SUBJECT: Elective 4 (Industrial Robotics) |                       |       |               |
| Periods per week<br>01 Period of 60 min   | Lecture               | 4     |               |
|                                           | Practical             | 2     |               |
|                                           | Tutorial              | -     |               |
|                                           |                       | Hours | Marks         |
| Evaluation System                         | Theory Examination    | 4     | 100           |
|                                           | Practical Examination | -     | -             |
|                                           | Oral Examination      | -     | 25            |
|                                           | Term Work             | -     | 25            |
|                                           | Total                 | 150   |               |

**Objective:**

To acquaint the student with need, options and application of artificial intelligence in manufacturing operation

**Approach:**

A system approach stressing concepts, logic, basic problem method, algorithm, interfacing with an expert system.

**Weightage:**

Equal weightage for all sections

**Details of Syllabus:**

| Sr. No | Details                                                                                                                                                                                                                                                                                                                                                                                                             | Hrs |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1      | <b>Introduction :</b><br>Automation , robotics , Robotic system & Anatomy, Classification, Future Prospects.                                                                                                                                                                                                                                                                                                        | 2   |
| 2      | <b>Drives:</b><br>Control Loops, Basic Control System Concepts & Models, Control System Analysis, Robot Activation & Feedback Components, Position & Velocity Sensors, Actuators, Power Transmission system.<br><b>Robot &amp; its Peripherals:</b><br><b>End Effecters :</b> Type mechanical and other grippers, Tool as end effecter.<br><b>Sensors :</b> Sensors in Robotics, Tactile Sensors, Proximity & Range | 12  |

|   | Sensors, Sensor Based Systems, Vision systems – Equipment                                                                                                                                                                                                                                                                                                                                                                                      |    |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 3 | <b>Machine vision :</b><br>Introduction, Low level & High level Vision, Sensing & Digitizing, Image Processing & analysis, Segmentation , Edge detection, Object Description & recognition, interpretation, Applications.<br><b>Programming for Robots:</b><br>Method, Robot Programme as a path in space, Motion interpolation, motion & task level Languages, Robot languages, Programming in suitable languages , characteristics of robot. | 12 |
| 4 | <b>Robot Kinematics :</b><br>Forward ,reverse & Homogeneous Transformations, Manipulator Path control, Robot Dynamics.                                                                                                                                                                                                                                                                                                                         | 8  |
| 5 | <b>Robot Intelligence &amp; Task Planning:</b><br>Introduction, State space search, Problem reduction, use of predictive logic, Means – Ends Analysis, Problem solving, Robot learning, Robot task planning.                                                                                                                                                                                                                                   | 8  |
| 6 | <b>Robot application in manufacturing:</b><br>Material transfer, machine loading & un loading, processing operation, Assembly & inspectors, robotic Cell design & control, Social issues & Economics of Robotics.                                                                                                                                                                                                                              | 8  |

#### Term Work:

1. At least one class test.
2. Minimum SIX exercises based on above topics including programming of robots.

|                 |                  |
|-----------------|------------------|
| • Assignments   | 15 marks         |
| • Written tests | 10 marks         |
| <b>TOTAL</b>    | <b>25 marks.</b> |

#### References:

1. Industrial Robotics : Technology, Programming & Applications : Grover, Weiss, Nagel, Ordey ( Mc Graw Hill)
2. Robotics: Control, Sensing, Vision & Intelligence: Fu, Gonzalez, Lee ( Mc Graw Hill)
3. Robotic technology & Flexible Automation : S R Deb ( TMH)
4. Robotics for Engineers : Yoram Koren ( Mc Graw hill 0
5. Fundamentals of Robotics : Larry Heath
6. Robot Analysis & Control : H Asada, JJE Slotine
7. Robot Technology: Ed. A Pugh( Peter Peregrinus Ltd. IEE, UK)
8. Handbook of Industrial Robotics: Ed. Shimon Y. No. Of (John Wiley)

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|--------------------------------------------|-----------------------|---------------|-------|
| CLASS:B.E. (PRODUCTION ENGINEERING)        |                       | Semester-VIII |       |
| SUBJECT: Elective 5 (Plastics Engineering) |                       |               |       |
| Periods per week<br>01 Period of 60 min    | Lecture               | 4             |       |
|                                            | Practical             | 2             |       |
|                                            | Tutorial              | -             |       |
|                                            |                       | Hours         | Marks |
| Evaluation System                          | Theory Examination    | 4             | 100   |
|                                            | Practical Examination | -             | -     |
|                                            | Oral Examination      | -             | 25    |
|                                            | Term Work             | -             | 25    |
|                                            | Total                 | 150           |       |

### Objective:

Polymers have emerged as important materials finding vast potential in domestic, engineering and specialty application areas. The scope of the subject is to introduce the student to the world of polymers, focusing on plastic materials, their properties and applications, processing techniques and tooling. The knowledge base will help them to pursue further higher level programmes and /or take up career / entrepreneurship in this field.

### Approach:

The main focus will be on important processing techniques and design of moulds and dies.

### Weightage:

Proportional to the number of hours indicated.

### Details of Syllabus

| Sr. No | Details                                                                                                                                                                                                                                                                                                                                                         | Hrs |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1      | <b>Materials:</b><br>Definition and classification of polymers. Important plastics materials, their properties, moulding characteristic and applications.<br>Additives for plastics- need, types , uses and methods of incorporating .<br>Introduction to plastics blends ,alloys and composites. Recycling of plastics and waste management - principles only. | 4   |
| 2      | <b>Processing:</b><br><b>Injection Moulding :</b>                                                                                                                                                                                                                                                                                                               | 20  |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|   | <p>Moulding materials, molding cycle-phases and significance. <b>Moulding Machinery:</b> Types, construction and design features of injection and clamping units. , Technical specifications and selection. <b>Processing techniques:</b> Process parameters and their influence on product quality, trouble shooting. <b>Auxiliary equipment for plastics processing:</b> Hopper dryers, Deccant dryers, Granulators, mould temperature controllers, Proportionating devices, chilling units, automatic material conveying systems.</p> <p><b>Extrusion Process:</b></p> <p>Constructional and design features of extrusion machinery. Technical specifications and selection.</p> <p>Extrusion lines for pipes, Films (Monolayer and multilayer, blown and cast films), sheets, Extrusion coating , monofilaments, box strapping , cables/wires and profiles.</p> <p>(Coverage for the above should include materials, plant layouts, in line equipment, extrusion techniques, process parameter and their influence on extruded products and trouble shooting)</p> <p><b>Blow moulding:</b></p> <p>Materials, types, Machinery, technical specifications and selection.( Extrusion Blow Moulding, Injection blow Moulding. and stretch Blow Moulding)</p> <p><b>Processing technique:</b> Process parameters and their influence on product quality, trouble shooting</p> <p>Comparison between types of BM processes.</p> <p><b>Other Process:</b></p> <p>Brief coverage of the following processes with relevant details like machinery, materials, processing techniques and applications.</p> <p>Thermoset Moulding, Thermoforming, Rotational Moulding, calendaring, fabrication and decorating with plastics.</p> <p><b>FRP techniques:</b> Raw materials and ancillaries used , techniques like Hand lay-up, Spray up and filament winding processes, applications.</p> |    |
| 3 | <p><b>Product designing with plastics :</b></p> <p>Mechanical behaviour of plastics, creep data and its significance in designing. Product designing tips for designing articles to be manufactured by Injection Moulding , Blow Moulding and Extrusion process.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2  |
| 4 | <p><b>Design of moulds:</b></p> <p><b>Compression and transfer moulds:</b></p> <p>General arrangement of compression moulds - flash, semi positive and</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 16 |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|   | <p>positive version. General arrangement of transfer moulds - moulds for integral pot and auxillary transfer.</p> <p><b>Injection moulds :</b></p> <p>General arrangement of two plate moulds. Design of mould components, design of feeding , cooling and ejection systems, three plate moulds, Designing for moulds for articles with undercuts- split moulds and moulds with side cores actuation techniques, moulds for internally threaded articles, fully automatic moulds, mould standardization and innovative mould component, Hot runner systems- General arrangement, Design of manifold blocks, flow ways and nozzles , advantages &amp; limitations</p> |   |
| 5 | <p><b>Blow moulds :</b></p> <p>General arrangement and mould components, design of neck and base pinch offs and flash pockets, Venting of moulds, selection of parting lines.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2 |
| 6 | <p><b>Extrusion dies :</b></p> <p>Design of extrusion dies for pipes, films, sheets, cables and profiles.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4 |
| 7 | <p><b>Mould Materials of Construction:</b></p> <p>Characteristics , Tool steels and alloys ,non-ferrous materials.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2 |

#### Term work:

1. At least one written test.
2. Assignments on the topics indicated above, case study .
3. Design and drawing of at least one injection mould and one extrusion die.

|                 |                  |
|-----------------|------------------|
| • Assignments   | 15 marks         |
| • Written tests | 10 marks         |
| <b>TOTAL</b>    | <b>25 marks.</b> |

#### Reference:

1. Moulding of Plastics – Bickales
2. Design of Extrusion dies – M.V.Joshi
3. Injection Mould Design – R.G.W.Pyre
4. Plastic Materials – Brydson
5. Extrusion Technology – Allen Griff
6. Practical guide to Blow Moulding – Lee
7. Injection Moulding: Theory & Practice – Rubin

8. Mould Engineering – Rees
9. Moulded Thermosets: A handbook for plastic Engineers , Moulders & designers.-Wright
10. Handbook of Plastic Processes – Harper
11. Injection Moulds: 130 Proven Designs - Gastrow

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|-----------------------------------------|-----------------------|-------|---------------|
| CLASS: B.E. (PRODUCTION ENGINEERING)    |                       |       | Semester-VIII |
| SUBJECT: Elective 6 (Product Design)    |                       |       |               |
| Periods per week<br>01 Period of 60 min | Lecture               | 4     |               |
|                                         | Practical             | 2     |               |
|                                         | Tutorial              | -     |               |
|                                         |                       | Hours | Marks         |
| Evaluation System                       | Theory Examination    | 4     | 100           |
|                                         | Practical Examination | -     | -             |
|                                         | Oral Examination      | -     | 25            |
|                                         | Term Work             | -     | 25            |
|                                         | Total                 | 150   |               |

**Objective:**

To acquaint student with various approaches in designing and developing new products from industrial designing principal.

**Approach:**

Emphasis on concepts through Case studies

**Weightage:**

Proportional to number of hours indicated in the right column below.

**Details of Syllabus:**

| Sr. No | Details                                                                                                                                                                                                                                                                                                                                                  | Hrs |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1      | <b>Introduction :</b><br>Stages in Product Design, Consideration in designing,<br>Concept of line, texture, colour, form, balance, proportions, size, shape, mass, Spatial relationship and compositions in 2 and 3 dimensional space, radii manipulation and form transition. Graphic composition and layout.<br>Use of grids in graphic – composition. | 10  |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|   | Exploration and study of formal elements to develop visual awareness, imagination and creative insight. Form elements in the context of product design, modular concepts in design. Introduction to colour and colour as an element in design. Colour classification and dimensions of colour, hue, value and chroma relationships, colour dynamics and interaction of colours. Psychological use of colours.                                                                                                                                                                                                                                               |    |
| 2 | <b>Conceptual Design &amp; Marketing :</b><br>Market research, product planning and product positioning, understanding of problem areas and limitations. User group and their cultural, physical and psychological background. Need based origin of a product, and technology driven products, Analysis of ideas from various angles of design methodology to fit it to the user needs. Analysis of function, component process study through computer simulation, building, reliability into the product.<br>2D presentation, rendering, sketches of concept drawings and computer generated images, 3D presentations in the form of dummy and prototypes. | 8  |
| 3 | <b>Material science and product detailing:</b><br>Overview of materials including new age materials & their characteristics, Material selection process.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4  |
| 4 | <b>Product Ergonomics:</b><br>Gross human autonomy, anthropometry, Environmental conditions including thermal, illusion, noise & vibration controls and displays, Psycho and physiological aspects of design.                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6  |
| 5 | <b>Designing for production:</b><br>Process consideration in Design, Design of cast members, welded parts, Designing parts to be machined, designing for easy assembly, convenience of maintenance, operation and safety. Tolerance system, standardization. Preferred number series.<br>Usage of Polymeric Materials, its application and properties, Mechanical behaviour of polymers, designing for polymeric products to be injection moulded, blow moulded & extruded. Designing for load bearing applications.                                                                                                                                        | 10 |
| 6 | Analysis and organization of control panel & displays in product design. Functions and controls, Display elements, dials, knobs, buttons, handles, and electronics displays, investigation of the study of visual, functional & Ergonomical requirements of controls and display elements. Study of product graphics and textures.                                                                                                                                                                                                                                                                                                                          | 4  |
| 7 | <b>Product aesthetics:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 4  |