FACULTY OF ENGINEERING

Syllabus for the
B.E. (Industrial Engineering)
(w. e. f. 2014 – 2015)

SAVITRIBAI PHULE PUNE UNIVERSITY
# BE (Industrial Engineering) Course structure

## Semester I

<table>
<thead>
<tr>
<th>Subject</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
<th>Marks Total</th>
</tr>
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<td>411202 Project Management</td>
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## Semester II

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### Elective I

1. Advanced Ergonomics
2. Logistics & Warehousing Management
3. Material Forming

### Elective II

1. Industrial Laws
2. World class Manufacturing Management
3. Machine Tool Technology
4. Development of Professional skills
Elective III
1. IE applications in service sector
2. Supply chain Management
3. Manufacturing Automation
4. Process Planning & Manufacturing Engineering

Elective IV
1. ***
2. Plastics Engineering
3. Manufacturing Strategies
4. Quality Management

*** Any Elective IV from Mechanical Engineering, Production Engineering 2008 Syllabi
Subject Code: 411201

Financial Management and Costing

Teaching Schedule:  
[Lectures: 03]

Examination Scheme:  
[In Semester Examination - 70]  
[End Semester Examination - 30]

Unit I - Financial Management:  
Financial Function, Scope, goals and tools. Sources of finance. Cost of Capital & Means of Finance

UNIT II - Ratio Analysis:  
Classification, Ratio Analysis and its limitations. Index Statement & Common Size Statement

UNIT III - Working Capital Management:  
Concept and design of Working Capital, types of working capital, sources of working capital, Time value of money, definition of cost and capital., Cash management, creditors management, debtors management

Unit IV - Costing:  
Methods of costing and elements of cost.  
Material Cost  
Different methods of pricing of issue of materials.  
Labour Cost  
Different methods, wages and incentive plans. Principles of good remunerating system, labour turnover.  
Depreciation  
Concept, importance and different methods of depreciation

Unit V - Overheads:  
Classification, collection of overheads, Primary and Secondary apportionment of overheads, absorption of overheads- Machine hour and labour hour rate. Under and over absorption of overheads.

UNIT VI - Standard costing:  
Concept, development and use of standard costing, variance analysis.  
Marginal Costing  
Use of Marginal Costing in decision-making.  
Capital Budgeting  
Control of Capital Expenditure, Evaluation Process-Payback approach, IRR, present value method.

Text Books:
Reference Books:

Subject Code: 411202

Project Management

Teaching Schedule:  
[Hours / week]  
Lectures: 03

Examination Scheme:  
[Maximum Marks]  
In Semester Examination - 70  
End Semester Examination - 30

Unit 1: Introduction:  
Definition of project, difference with respect to standard routine production. Parameters involved in Project identification. Difference in projects under private, public & joint sector.

Unit 2: Types of project:  
Projects under BMRED – Balancing, Modernization, Replacement, Expansion & Diversification; Consideration involved in decision-making in each of these.

Unit 3: Project Formulation:  
Preparation of feasibility Report & Specification; Budgeting; criteria for pre-investment decision; Incentives from state & central govt.; Import-substitution projects.

Unit 4: Project Finance:  

Unit 5 Project costing:  
Costs of Contracting; Labour & Equipment costs; Development & Codification of cost data; Accounting; Activity-Based costing.

Unit 6 Project Administration:  
Cash flow planning; Project scheduling; PERT, CPM & GANTT Charts; Crashing, resource leveling, resource smoothening, Time- Cost trade –off; Project overruns costs; Participation & Team work.

Text Books:

Subject Code: 411203

Quantitative Techniques

Teaching Schedule:  
[Hours / week]  
Lectures: 04

Examination Scheme:  
[Maximum Marks]  
In Semester Examination - 70  
End Semester Examination - 30

Unit I - Advanced Linear programming  
Duality, Economic interpretation of Dual, Solution of LPP using duality concept, Dual simplex method, integer programming by branch & bound, cutting plane method

Unit II - Inventory Management:  
New product planning, inventory system, different Inventory models, problems on inventory model.

Unit III - Dynamic programming:  
Introduction, application, capital budgeting, different problems solved by Dynamic programming

Unit IV - Geometric and Goal Programming:  
Definition, Introduction, application of Geometric and Goal Programming

Unit IV - Queuing theory:  
Operating characteristics, Poisson single and multi channel queuing system models like M/M/1, M/M/C, M/E_k/1.

Unit VI – Simulation:  
Definition, Introduction, application, Monte Carlo simulation, Need of simulation in manufacturing and material handling systems, Components of manufacturing systems – product, resources, demand, control; Downtime, Rework and reentrancy, Random events and performance measures used in manufacturing systems with a case study on any manufacturing system

Term Work:  
Term work should consist of at least one assignment per unit. Each assignment should be analyzed through relevant softwares (e.g. Lindo, Arena, promodel, Tora, etc.)

TEXT BOOKS:  

REFERENCE BOOKS:  
Subject Code: 411204 – Elective I - I

Advanced Ergonomics

Teaching Schedule: 03

Examination Scheme:

In Semester Examination - 70
End Semester Examination - 30

Unit 1 - Introduction: [7]

Unit 2 – Anatomy, Posture and Body Mechanics: [7]
Muscle Functionin, Spine, Musculoskeletal problems in Sitting and Standing.

Unit 3 - Anthropometric Principles: [7]
Anthropometric Data – sample, equipment, analysis. Applications of Anthropometry in Design. Workstation design for standing and seated posture.

Unit 4 – Upper Body at Work: [7]
Injuries due to upper body at work, Neck problems, shoulder, elbow and wrist, Design of manual handling tasks.

Unit 5 – Physiology, Workload and Work Capacity: [7]

Unit 6 – Legal Aspects: [7]
Legal and Safety Aspects.

Practical: One assignment based on each of the topics mentioned above.

Text Books:

2. E. Grad jean, “Fitting Task to the Man” Taylor and Francis.

Reference Books:

1. ILO, “Introduction to Work study”.
3. R. S. Bridger, “Introduction to Ergonomics”, Taylor and Francis
**Subject Code: 411204 – Elective I - II**

**Logistics and Warehousing Management**

Teaching Schedule:  
[Hours / week]  
Lectures: 03

Examination Scheme:  
[Maximum Marks]  
In Semester Examination - 70  
End Semester Examination - 30

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UNIT 1 - Introduction: [7]  
Logistics. Producer – Consumer system. Logistics communication, costs & role of modern technology in logistics management

UNIT 2 - Marketing and product distribution: [7]  
Inter dependence and interaction. Multilevel system and sensitivity analysis

UNIT 3 - Logistic information system: [7]  
Nature, purpose and scope of information system, Customer order cycle and order processing, neutral networks bar-coding.

UNIT 4 – Transportation: [7]  
Time and place utility, transportation -logistic –marketing interface different modes of transportation – merits demerits and costs

UNIT 5 – Warehousing: [7]  
Nature purpose and scope of warehousing. Own warehouse, third party warehouses. Economics of warehousing. Inventory management; Material handling storage and packaging issues

UNIT 6 – Logistics Support: [7]  
Organizing for effective logistic support –strategies supply chain management in the context of globalisation

Practical: One assignment based on each of the topics mentioned above.

**Text Books:**

2) Ronald H.,Balfour, “Basic Business Logistics”, Prentice Hall of India  
3) Benjamin & Blamhord, “Logistics Engineering and Management”; Prentice Hall of India
Subject Code: 411204 – Elective I - III

Material Forming

Teaching Schedule:

<table>
<thead>
<tr>
<th>[Hours / week]</th>
<th>[Maximum Marks]</th>
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<tbody>
<tr>
<td>Lectures: 03</td>
<td>In Semester Examination - 70</td>
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<td>End Semester Examination - 30</td>
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</tbody>
</table>

Examination Scheme:

UNIT I - Fundamentals of Material Forming:

Engineering stress-strain and true stress-strain, Strain hardening, work done in tensile test, temperature rise in plastic deformation compression test, Concept of flow stress determination, Effect of temperature, strain rate, Mohrs circle for three dimensional state of stress Theory of plasticity- Yield criteria of Von mises criteria and Tresca criteria. Classification of material forming process. Concept of workability, formability and forming diagram.

UNIT II - Forging Processes:

Comparison of forging with other manufacturing processes. Classification of forging processes- open die and closed die forging Forging equipment- Hammers and presses, construction working capacities and selection of equipment. Basic forging operations such as drawing, fullering, edging, blocking etc. Determination of forging load considering friction, Other forging techniques- Liquid metal forging, Isothermal forging, Rotary swaging, Orbital forging Lubrications in forging. Forgability tests, Forging defects and remedies.

UNIT III - Wire and Tube Drawing:

Introduction rod and wire drawing machines - construction and working. Preparation of stock for wire drawing. Wire drawing dies, material and design. Variables in wire drawing, Maximum reduction in wire in one pass, forces required in drawing. Multiple drawing, work hardening, lubrication in wire drawing. Tube drawing: Methods, force calculation, stock preparation. lubrication in tube drawing

UNIT IV - Rolling of Metals:


UNIT V – Extrusion:

UNIT VI - Miscellaneous Forming processes:

High velocity forming principles, comparison of high velocity and conventional Forming processes. Explosive forming, Magnetic pulse forming, Electro hydraulic forming, Stretch forming, coining embossing, curling, spinning, flow forming advantages, limitations and application of the process.

Practical: To be based upon each of the units above.

TEXT BOOKS:


Reference Books:

3. ASM Metal handbook Volume IV Forming.
Subject Code: 411204 – Elective I - IV

Human Resource Management

Teaching Schedule:
[Hours / week]
Lectures: 03

Examination Scheme:
[Maximum Marks]
In Semester Examination - 70
End Semester Examination - 30

UNIT I - Fundamentals of HR Management:
Importance of HRM to an organization. Changes in technology, work-force diversity, and skill requirements affect human resource management. Identify the four external influences affecting human resource management. Characterize how government legislation, Labor unions, and management practices affect HRM. Describe the goals, components and major activities within HRM.

UNIT II – Job Design and HR Planning:
Job design: definition, approaches, job design options; Job analysis: definition, process, benefits of job analysis
HR planning: introduction, objectives of HRP, linkage of HRP to other plans, definition and need for HRP, benefits of HRP, factors affecting HRP, process, problems and limitations of HRP

UNIT III - Recruiting & Selection:
Define what is meant by the term recruiting. Identify the principal sources involved in recruiting employees. Describe the selection process. Discuss the problems associated with job interviews and means of correcting them. Discuss the use of various types of interview questions

UNIT IV - Benefits & Rewards:
Explain various classifications for rewards. Define goal of compensation administration. Discuss job evaluation and approaches. Describe competency and team-based compensation programs. Discuss why employers offer benefits to their employees. Contrast Social Security unemployment compensation and worker’s compensation benefits. Identify and describe insurance options

UNIT V - Evaluating Performance:
Identify purposes of performance management systems and who is served by them. Describe the two categories of difficulties in Performance Management Systems. Explain the steps in the appraisal process. Describe the absolute and relative methods of appraising employees. Discuss how management by objectives (MBO) can be used as an appraisal method. Identify ways to make performance management systems more effective
UNIT VI - Ethics in HRM & Labor Relations:

Define “ethics” and “code of ethics”. Describe what determines whether or not a code of ethics will be effective in an organization. Discuss HRM’s role in ensuring that ethics exist in an organization and are adhered to. Describe the guidelines for making ethical choices. Define what is meant by the term unions. Discuss the effect of Wagner and Taft-Hartley Acts on labor management relations. Describe the components of the collective-bargaining process.

Practical: To be based upon each of the units above.

TEXT BOOKS:


REFERENCE BOOKS:

Industrial Laws

Teaching Schedule:  
[Lectures: 03]

Examination Scheme:  
[In Semester Examination - 70, End Semester Examination - 30]

UNIT I - The Industrial Disputes Act, 1947:  

UNIT II - The Trade Union Act 1926:  
Formation of Trade Unions, Collective bargaining capacity.

Draft Standing Orders, conditions for certification of Standing Orders, Appeals, Register of Standing Orders. Temporary application of model standing orders.

UNIT IV - The Factories Act, 1948:  

UNIT V - The Sale of Goods Act, 1930 (3 of 1930):  

UNIT VI - The Monopolies and Restrictive Trade Practices Act, 1969 (54 of 1969) & The Competition Act, 2002:  
Monopolies and Restrictive Trade Practices Commission, Unfair and Restrictive trade practices. The Competition Commission,

Text Books:

3. Taxman, Commercial Laws.

Reference Books: Bare Acts and Bare Acts with Cases for each of these.
Subject Code: 411205 – Elective II - II

World Class Manufacturing

Teaching Schedule:
[Hours / week]
Lectures: 03

Examination Scheme:
[Maximum Marks]
In Semester Examination - 70
End Semester Examination - 30

Unit 1 - Industrial Decline and Ascendancy:
Manufacturing excellence - US Manufacturers - French Manufacturers - Japan decade - American decade - Global decade

Unit 2 - Building strength through customer - Focused principles:
Customer - Focused principles - General principles - Design - Operations - Human resources - Quality and Process improvement - Promotion and Marketing

Unit 3 - Value and Valuation:
Product Costing - Motivation to improve - Value of the enterprises

Quality
The Organization: Bulwark of stability and effectiveness - Employee stability - Quality Individuals Vs. Teams - Team stability and cohesiveness - Project cohesiveness and stability

Unit 4 - Strategic Linkages:
Product decisions and customer service - Multi-company planning - Internal manufacturing planning - Soothing the demand turbulence

Unit 5 – Impediments:
Bad plant design - Mismanagement of capacity - Production Lines - Assembly Lines - Whole Plant

Unit 6 - Remaking Human Resource Management:
Associates - Facilitators - Teamsmanship - Motivation and reward in the age of continuous improvement

Text Books
Subject Code: 411205 – Elective II - III

Machine Tool Technology

Teaching Schedule:

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<td>In Semester Examination - 70</td>
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<td>End Semester Examination - 30</td>
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Unit I – Drives:
Design considerations for drives based on continuous and intermittent requirement of power, Types and selection of motor for the drive, Regulation and range of speed based on preferred number series, geometric progression. Design of speed gear box for spindle drive and feed gear box. Stepless drives, Design considerations of Stepless drives, electromechanical system of regulation, friction, and ball variators, PIV drive, Epicyclic drive, principle of self locking,

Unit II - Design of Machine Tool Structures:
Analysis of forces on machine tool structure, static and dynamic stiffness. Design of beds, columns, housings, bases and tables.

Unit III - Design of Guide-ways and Power Screws:
Functions and types of guideways, design criteria and calculation for slideways, design of hydrodynamic, hydrostatic and aerostatic slideways, Stick-Slip motion in slideways. Design of power screws: Distribution of load and rigidity analysis.

Unit IV - Design of Spindles and Spindle Supports:
Design of spindle and spindle support using deflection and rigidity analysis, analysis of anti-friction bearings, preloading of anti-friction bearing.

Unit V - Dynamics of machine tools:

Unit VI - Advances in Machine Tool Design:
Design considerations for SPM, NC/CNC, and micro machining, Retrofitting, Recent trends in machine tools, Design Layout of machine tool using matrices.

Text Books:
Reference Books:
Subject Code: 411205 – Elective II - IV

Development of Professional Skills

Teaching Schedule:
[Hours / week]
Lectures: 03

Examination Scheme:
[Maximum Marks]
In Semester Examination - 70
End Semester Examination - 30

Unit I - Introduction:
[7]
Status of youth employment – Global, Asian and Indian scenario, employment by organized and unorganized sectors in India, challenges and opportunities in turning job seekers into job creators, An entrepreneurship as an alternative.

Unit II - Types of Organizations and Current issues:
[7]
The Government policy environment, problems in current youth environment, problems in India, Education gaps, role of stakeholders in entrepreneurship – Government, NGOs, financial institutions, corporate sector, industrial parks, educational and training institutes, Overview on rules and regulations for different types of business units.

Unit III - Entrepreneur:
[7]
Meaning of Entrepreneur; Evolution of the Concept; Functions of an Entrepreneur, Types of entrepreneur, Intrapreneur – an emerging class, Concept of Entrepreneurship-Evolution of Entrepreneurship; Development of Entrepreneurship; The entrepreneurial Culture; Stages in entrepreneurial process.

UNIT IV – Creativity and Innovation:
[7]

UNIT V – Intellectual Property Rights:
[7]
Berne convention, Universal Copyright Convention, the Paris Union, the World Intellectual Property Rights Organization (WIPO) and the UNESCO; TRIPS; WIPO.

UNIT VI – Copyrights and Trademarks: [7]

Meaning of Copyright Copyright in literacy, dramatic and musical works ,Copyright in Musical and Works and cinematograph films , Ownership of Copyright, Assignment of Copyright, Author’s special rights, Infringement of copyright, Fair use Provisions, Remedies.

Intellectual Property in Trademarks: The rationale of protection of trade marks as (a) an aspect of commercial and (b) of consumer rights, definition, conception of Trade Marks, Registration; Distinction Between Trade Mark and Property Mark, Geographical Indicators.

TEXT BOOKS:

3. Dr. Mathew J. Manimala, Entrepreneurship theory at crossroads, Biztantra,
4. Vasant Desai, Entrepreneurial Development and Management, Himalaya Publishing House,
5. Maddhurima Lall, Shikha Sahai, Entrepreneurship, Excel Books
6. Kurakto, Entrepreneurship-Principles and practices, Thomson publication

REFERENCE BOOKS:

Subject Code: 411206

Financial Management & Costing

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<td>Oral – 50</td>
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During the practical students should be asked to solve real life cases on

1. Financial Management – theory assignment
2. Ratio Analysis
3. Working Capital Management
4. Costing
5. Depreciation
6. Overheads
7. Standard costing
8. Marginal Costing
Subject Code: 411208

Quantitative Techniques

Teaching Schedule:
[Hours / week]
Practical: 02

Examination Scheme:
[Maximum Marks]
Oral – 50

During the practical students should be asked to solve at least 8 real life cases on the following topics making sure that there is at least one case on each topic.
**Subject Code: 411207**

**Project Management**

**Teaching Schedule:**  
[Hours / week]  
Practical: 02

**Examination Scheme:**  
[Maximum Marks]  
Oral – 50

During the practical students should be asked to solve at least 8 real life cases on the following topics making sure that there is at least one case on each topic.

1. Project Management – General write up
2. Types of project
3. Project Formulation
4. Project Finance
5. Project costing
6. Project Administration
Subject Code: 411209

Elective I

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<td>[Hours / week]</td>
<td>[Maximum Marks]</td>
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<tr>
<td>Practical: 02</td>
<td>Oral – 50</td>
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</table>

During the practical students should be asked to solve at least 8 real life cases on each unit making sure that there is at least one case on each unit.
Subject Code: 411210 & 411219

Project Work

Teaching Schedule:

<table>
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<th>[Hours / week]</th>
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<td>Practical: 02 – I Term</td>
<td>Term Work: 50 each I and II Term</td>
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<tr>
<td>Practical: 06 – II Term</td>
<td>Oral: 100 – II Term</td>
</tr>
</tbody>
</table>

The student shall take up suitable project; the scope of the project shall be such as to complete it with the time schedule. The term work shall consist of, extensive analysis of some problems done with the help of a computer individually or in a group not exceeding two students. The assignment can be on any aspect of the industrial engineering. The work can be done in a laboratory or in any other organization.

Each student should prepare report based upon his contribution in the work and review of at least two research papers relating to the work at the end of the first term.

The final report should be based upon the work done during both the terms.

The oral examination, shall be based on the term work submitted and jointly conducted by an internal and an; external examiner from industry, at the end of second semester. Format of the project report should be as follows:

1. Paper: The Project report should be types. printed on white paper of A-4 size.
2. Typing: The typing shall be with single spacing and on one side of the paper.
3. Binding: The Industrial Inplant Report should be submitted with front and back cover in black hand bound, with golden embossing.
4. Margins: Left - 1.25", Right - 1". Top and Bottom 1 "
5. Sequence of Pages:
   1. Title page
   2. Certificate form Institute
   4. Acknowledgement
   5. Abstract
   6. Index
   7. Nomenclature and Symbols
   8. Actual Content
   9. Conclusion
   10. References.
6. Front cover: The front cover shall have the following details in block capitals
   i. Title at the top.
   ii. Name of the candidate in the centre, and
   iii. Name of the Institute, Name of Industry, if sponsored and the year of submission on separate lines, at the bottom.
7. Blank sheets: No blank sheets be left any where in the report. 8. Project Completion Certificate: The approval sheet follow the title sheet and shall be as shown with proper spacing.
CERTIFICATE
This is to certify that Mr. /Ms ..........................................................
Has carried out a Project entitled, (Name)

..................................................during the course of his
(Name of Project)
training at..............................................................in
(Name of Industry)
partial fulfillment of the requirement of the B.E. Production Course of
University of Pune
at ..............................................during the academic Year ...............  
(Name of Industry)

Date:                                                                           (Guide)
Place:

(Examiner)                                                                 (Head of Department)
Subject Code: 411211

Reliability Engineering

Teaching Schedule:
[Hours / week]
Lectures: 03

Examination Scheme:
[Maximum Marks]
In Semester Examination - 70
End Semester Examination - 30

Unit I - Introduction to Reliability:
Importance of reliability, performance cost and reliability, quality and safety, system configuration with examples, stochastic processes, bathtub concept, MTBF, MTTR, hazard rate, failure rate, probability and sampling, cumulative probability distribution function, data and distributions.

Unit II - System safety analysis:
Fault tree and event tree concept, construction and analysis, failure modes effects and criticality analysis, systems approach, techno-physio constraints, typical failure analysis, risk priority number and its allocation.

Unit III - Reliability in design and Life Cycle costing:
Survival rate, bath-tub curve analysis of characteristics of failure regimes, design synthesis, reliability effort function, safety margin, allocation of reliabilities by AGREE, ARINC, proportional distribution of unreliability, heuristic method, mean and median methods.

Unit IV - System reliability and redundancy:
Active and Passive Redundancy, redundancy allocation and limitations, Evaluation of overall system reliability, Conditional probability, Matrix methods, set theory analysis of system reliability.

Unit V - Loads, capacity, maintainability and availability:
Reliability and safety factors, Repetitive loading, Preventive maintenance, Testing and repair, reliability centered maintenance, system availability and maintainability.

Unit VI - Reliability testing and Failure Interactions:
Reliability growth models, grouped. and ungrouped data, censored data, accelerated life testing, Markov analysis of two independent components, reliability with standby system, multi component systems, DTMC and CTMS models.

Text Books:

References Books:
1. Lewis Elmer Eugene, “Introduction to Reliability Engineering”, John Wiley and Sons

Subject Code: 411212
## Energy Management

### Teaching Schedule:

<table>
<thead>
<tr>
<th>[Hours / week]</th>
<th>Examination Scheme:</th>
</tr>
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<tbody>
<tr>
<td>Lectures: 03</td>
<td>[Maximum Marks]</td>
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In Semester Examination - 70
End Semester Examination - 30

### Unit 1: Introduction:

Energy Scenario – global, sub continental and Indian, Energy economy relation, Future energy demand and supply scenario, Integrated energy planning with particular reference to Industrial Sector in India, Captive power units and others – demand v/s supply.

### Unit 2: Types of Energy:


### Unit 3: Legal Provisions:


### Unit 4: Demand Side Management:

Energy Demand Management: Energy utilization, Instrumentation and data analysis, Financial aspects of energy management, Energy management as a separate function and its place in plant management hierarchy.

Energy Demand Management: Scope, Methodology, modes of energy savings, Plant energy and utility systems, Efficient energy management – Nine steps – i) Identification ii) Investigation iii) Quantification iv) Decisions v) Presentation vi) Implementation vii) follow-up viii) Set Targets ix) Re-examine;

### Unit 5: Energy Audit and Energy Saving:

modification for better efficiency, Improved periodic maintenance; Energy conservation with particular reference to waste heat recovery in different industries; Improvement in combustion system and use of Industrial waste; Co-generation and rational operation of production processes. Case study analysis. Provisions under the Electricity Act, functions of Bureau of Energy Efficiency


Text Books

Reference Books:

Subject Code: 411213 – Elective III - I

Industrial Engineering Applications in Service Sector

Teaching Schedule: [Hours / week] Lectures: 03

Examination Scheme: [Maximum Marks] In Semester Examination - 70
UNIT I - Introduction to Service Sector: [7]

UNIT I - 2. Resources used in Service Sector: [7]

i) Customer Satisfaction ii) Cost reduction iii) Efficiency iv) Quality & Productivity of Service organisations, Measurement of these characteristics.

UNIT I - 4. Application of Industrial Engineering Techniques to the Service Sector: [7]
i) Data collection – Various charting techniques, Flow Diagram, work measurement – time study, activity sampling, self recording, etc. ii) Quantitative techniques. iii) Data analysis – Critical Examination / evaluation of data. iv) Work of simplification, form design. v) Computer application to collection, storage and retrieval of information / data.

UNIT I - 5. Use of computers in Service organizations: [7]
Plant, local area network, wide area network to Collect, store, retrieve, transmit information / data.

UNIT I - 6. Future of Service Sector: [7]

Practical:
The term work shall consist of report on minimum two assignments - based on six techniques used for actual work done in service organizations listed in the syllabus.
1. Management Methods
2. Resource Optimization
3. Manpower Planning
4. Materials Planning
5. Cost Reduction
6. Efficiency
7. Charting Techniques
8. Work Simplification
9. Queuing Techniques
10. Project Planning in case of Service Projects

Oral –
The oral will be based upon the term-work.

Text Books:


Reference Books:

3. Fitzsimmons; Service Management; Mc Graw Hill Publications.

Subject Code: 411213 – Elective III - II

Supply Chain Management

Teaching Schedule:
[Hours / week]
Lectures: 03

Examination Scheme:
[Maximum Marks]
In Semester Examination - 70
End Semester Examination - 30
UNIT 1 - Concept of SCM: [7]
Concept of Logistics Mgmt, Supply Chain, Types of Supply Chain; Functions in SCM, Transportation Mgmt, Warehousing Mgmt; Warehouse Management Systems

UNIT 2 - Designing the Supply Chain Network: [7]
Designing the Distribution Network; Network Design; Network Design in an Uncertain Environment

UNIT 3 - Planning Demand & Supply in a Supply Chain: [7]
Demand Forecasting; Aggregate Planning; Planning Supply & Demand

UNIT 4 - Planning & Managing Inventories in a Supply Chain: [7]
Managing Economies of scale: Cycle Inventory; Managing Uncertainty: Safety Inventory; Optimal Level of Product Availability

UNIT 5 - Sourcing, Transporting & Pricing products: [7]
Sourcing Decisions; Transportation; Pricing & Revenue Management

UNIT 6 - Co-ordination & Technology in the Supply Chains: [7]
Co-ordination in Supply Chain; Information Technology and Supply Chain; E-business & Supply Chain

Practical: To be based upon each of the units.

Text Books


Reference Books:

Subject Code: 411213 – Elective III - III

Manufacturing Automation

<table>
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<th>Teaching Schedule:</th>
<th>Examination Scheme:</th>
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<tr>
<td>[Hours / week]</td>
<td>[Maximum Marks]</td>
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<tr>
<td>Lectures: 03</td>
<td>In Semester Examination - 70</td>
</tr>
</tbody>
</table>
End Semester Examination - 30

Unit I - Basics of Automation and Industrial Hydraulics: [7]
Basic concepts of automated system, Advanced automated functions, levels of automation, Principles of hydraulics, hydraulic fluids, filtration technology, hydraulic pumps, hydraulic valves, and hydraulic actuators.

Unit II - Design of Hydraulic Circuits: [7]
Basic hydraulic circuits such as regenerative circuits, sequencing circuit, meter in and meter out circuit, standards in circuit diagram representation, power pack design layout, design of pumps, reservoir, accumulators and intensifiers, selection of standard components, hydraulic servo mechanism, proportional valves.

Unit III - Pneumatic Systems: [7]
Operational principles and application, air compressors, pneumatic cylinders and air motors, pneumatic valves, Design of pneumatic circuits, hydro-pneumatic, control in pneumatic system.

Unit IV - Programmable Automation: [7]
Microprocessor, microprocessor instrumentation system for process control, logic gate and control, programmable logic control, computer process controls.

Unit V - Control System: [7]
Electric control: - features and design principles of electrical circuits in drives, PLC, data conversion (ADC/DAC), interfacing circuits, actuating signals, relays, contactors, types of control systems, linear feedback control system, optimal control system.

Unit VI - Factory Automation: [7]
Transfer systems-Continuous, intermittent, Indexing mechanisms, vibratory bowl feeders, non-vibratory feeders, hopper feeders, rotary disc feeder, centrifugal, revolving feeder, assembly systems, automated assembly, design for automated assembly, synchronous and non synchronous material transfer, industrial robots, Automated Guided Vehicles and FMS, automated warehouse.

Term Work:
The term work shall consist of record of any eight assignments on following topics.
1. Study of control valves, actuators, accumulators and pumps.
2. Study of hydraulic circuits: - hydraulic press, machine tools, automobile systems, etc
3. Performance analysis of positive displacement pumps.
4. Comparative studies on hydraulic circuit design for suitable industrial applications.
5. Study of pneumatic circuits.
6. Study of automation in material handling system.
7. Use of microprocessors: applications in manufacturing engineering.
8. Study and experiments in programmable logic controllers: ladder logic programming
9. Study of displacement, level and pressure controls
10. Measurement and design circuits for speed and temperature measurement.

Note: Oral shall be based on the above term work and practical.
Text Books:
2. Peter Rohrer, “Industrial hydraulic control”, Wiley

Reference Books:
7. Vickers manual on hydraulics
Subject Code: 411213 – Elective III - IV

Process Planning and Manufacturing Engineering

Teaching Schedule:
[Hours / week]
Lectures: 03

Examination Scheme:
[Maximum Marks]
In Semester Examination - 70
End Semester Examination - 30

UNIT I – Introduction:

Types of Production - Standardization, Simplification - Production design and selection - Process planning, selection and analysis - Process planning, selection and analysis - Steps involved in manual experience based planning and computer aided process planning - Retrieval, generative - Selection of processes analysis - Breakeven analysis.

UNIT II – Resource Planning:

Resource Planning & Production Control: Overview of production control, Forecasting, Master production schedule, Materials requirements planning, Evolution from MRP to MRP II, Evaluation of MRP approach, Order release, Shop floor control.

Job Sequencing and Operations Scheduling: Introduction- Job sequencing-n jobs, One machine-n jobs, Two machine-n jobs, Three machines-n jobs- two jobs, M machines—n jobs, M machines-sequencing jobs on parallel machines, Minimization of setup costs.

UNIT III - Production smoothing:

Production planning, Production smoothing, Adaptability to demand fluctuations, Sequencing method for the mixed model assembly line to realize smoothed production of goal.


UNIT IV - Product Engineering:


Process Engineering - Organizational activities, functional activities, relation with other departments, classification of processes, manufacturing operations, operational elements - machining, handling, setting, inspection and approach for selecting and planning a process: determining machining sequences - criteria, classification of operations and manufacturing sequence, criteria for analysis for selection of best process.
UNIT V - Selection of Equipment:

Process capability of Equipments, prime accuracies and producible accuracies of Equipments, Factors influencing make or buy decisions, relation between Process selection and Machine selection, basic factors in machine selection in terms of cost and design factors, Determining machining conditions and computing manufacturing times.

Selection of Tooling - Factors affecting selection of Tooling, commercial tooling, special tooling, selection of Tools: jigs, fixtures, gauges, form tool in relation to process selected. Use of multi-tooling set up, tooling economics as applied to Process Engineering. Stock preparations and blank selection with material estimates.

UNIT VI - Process Sheet design:

Study of the parts to be processed, Logical design of a process plan, stock preparations, blank selection with material estimates, Selection of datum features, identification of machining surfaces, incorporation of dimensions including tolerance analysis, selection of machining methods with time estimates and time standard for each operation, Process Picture sheet including process symbols, processing dimensions. Process plan sheet design for complete manufacturing part.

Practicals:
One assignment each on every unit mentioned above.

Text Books:

Reference Books:
Subject Code: 411214 – Elective IV - II

Plastics Engineering

Teaching Schedule:
[Hours / week]
Lectures: 03

Examination Scheme:
[Maximum Marks]
In Semester Examination - 70
End Semester Examination - 30

Unit I – Basics:  [7]
Basic chemistry for plastic material, Structure, Organic structure, polymarisation, addition, condensation, Classification of plastic, additives of the plastic, common alloys & blends, colouring of plastics,

Unit II – Injection Moulding:  [7]
Injection moulding: equipment, mould ability features, injection moulding cycle, effect of processing on mechanical properties, Injection mould designs considerations, functions of register ring, sprue bush, cavity & core inserts, ejection of mould& cooling of Injection moulds.

Unit III – Extrusion:  [7]
Extrusion: twin screw extruders, blown film, coextruded multiplayer films, dwell lip air ring, typical extruded dimensions, special features of extrusion dies, extrusion coating & lamination, extruder maintenance & safety, extrusion problems.

Unit IV – Blow Moulding:  [7]
Blow moulding: classification of blow molding processes, comparison of injection blow & extrusion blow molding processes, basic design considerations in blow molding, bottle design concept, surface treatment of container, rotary injection blow molding, stretch blow molding.

Unit V – Thermoforming:  [7]
Thermoforming: major thermoforming processes, process factors in thermoforming, straight vacuum forming technique, plug assist-forming thermoforming of PP sheets, problems in thermoforming, twin sheet thermoforming, and maintenance.

Unit VI – Finishing:  [7]
Finishing and machining of Plastic: Filing, tumbling, ashing, buffing and polishing of thermosetting and thermoplastic. Machining of plastic- principle considerations, guidelines for tool geometry, drilling and reaming, tapping and trading, turning and milling, sawing, piercing, trimming and routing of thermosetting and thermoplastic.

Text Books:


Reference Books:

Subject Code: 411214 – Elective IV - III

Manufacturing Strategies

Teaching Schedule:  
Examination Scheme:  

<table>
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<th>Hours / week</th>
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<td>Lectures: 03</td>
<td>In Semester Examination - 70</td>
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<td>End Semester Examination - 30</td>
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</tbody>
</table>

UNIT I - Product Design and Development: [7]


UNIT II – Benchmarking: [7]

Product tear down and experimentation, benchmarking and establishing engineering specification. Product portfolios and portfolio architecture. 
Tear down process, tear down methods, post teardown reporting, benchmarking approach, support tools, setting specifications, portfolio architecture, types, platform, functional architecting, optimization selection. Product modularity, modular design.

UNIT III - Concepts and Modeling: [7]

Generation of concepts, information gathering and brain storming, directed search, morphological analysis, combining solutions. Decision making, estimation of technical feasibility, concept selection process, selection charts, measurement theory, numerical concept scoring, design evaluation scheme, concept embodiment, geometry and layout, system modeling, modeling of product metrics, selection of model by performance specifications, physical prototyping, informal and formal models.

UNIT IV - Design materials & human factors in product design: [7]

Material properties, metals, plastics, rubber, woods & factors considered while designing for metals, plastics, rubber, woods etc, Anthropometry factors, physiological factors, psychology factors, anatomy factors. 
Economic factors influencing design, product value, safety, reliability & environmental considerations, economic analysis, break even analysis, profit & competitiveness, economic of a new product design.

UNIT V:– Value engineering in product design: [7]

Introduction, historical perspective, nature & measurement of value, importance of value, value analysis job plan, creativity, steps for solving & value analysis, value analysis tests 
Principal stress trajectories( force flow lines), balanced design, criteria & objective of design, material toughness, resilience, designing for uniform strength.
UNIT VI:- Modern Approaches to Product Design:


TEXT BOOKS:

REFERENCE BOOKS:
Quality Management

**Teaching Schedule:**
[Hours / week]
Lectures: 03

**Examination Scheme:**
[Maximum Marks]
In Semester Examination - 70
End Semester Examination - 30

**UNIT I – TQM Principles:**

**UNIT II – Introduction:**
Total Quality Management, Methods of Quality Management – Acceptable Quality Level, Arrow Diagram, Cost Benefit Analysis, Deming Wheel [PDCA], Error Proofing [Poka Yoke], Gantt Chart, Pareto Analysis, Quality Circle, Team Work, TPM, Zero Defect, etc.

**UNIT III – Analytical Methods & Idea Generation:**

**UNIT IV - TQM Tools:**

**UNIT IV – Statistical Quality Control:**
The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

**UNIT V – Other Aspects of Quality:**
Quality of Service, Cost of Quality, Value of Quality, Difference between Inspection, Quality
Control and Quality Assurance, Role of Quality in Present day environment. Meaning of quality Control, 100% Inspection and Selective Inspection, Statistics in Selective inspection. Control Charts, X, R, P and C Charts, Sampling inspection, OC Curves and Sampling Plan, Process Capability Index (PCI), Concept, Methods of determining PCI and uses of PCI.

UNIT VI – Quality Standards: [7]


ISO 14000:- environmental management concepts, and requirement of ISO 14001, benefits of environmental management Systems

Malcom Baldrige national quality Award and other quality awards

Text Books:


Reference Books:

Reliability Engineering

Teaching Schedule:

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<th>[Hours / week]</th>
<th>[Maximum Marks]</th>
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<tr>
<td>Practical: 02</td>
<td>Oral – 50</td>
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</table>

During the practical students should be asked to solve real life 8 cases on the topics. On each of the following topics at least one assignment should be there.

1. Introduction to Reliability
2. System safety analysis
3. Reliability in design and Life Cycle costing
4. System reliability and redundancy
5. Loads, capacity, maintainability and availability
6. Reliability testing and Failure Interactions
Subject Code: 411216

Energy Management

Teaching Schedule:
[Hours / week]
Practical: 02

Examination Scheme:
[Maximum Marks]
Oral – 50

During the practical students should be asked to solve real life 8 cases on the topics. On each of the following topics at least one assignment should be there.

2. Physical Aspects of Energy
3. Legal Provisions
4. Demand Side Management
5. Energy Audit and Energy Saving
6. Energy Audit
7. Legal Provisions relating to Conservation of Energy
Subject Code: 411217

Elective III

Teaching Schedule:
[Hours / week]
Practical: 02

Examination Scheme:
[Maximum Marks]
Oral – 50

During the practical students should be asked to solve real life cases on each of the Unit in the syllabus for the related subject and have 8 assignments in total.
Subject Code: 411218

Elective IV

Teaching Schedule:
[Hours / week]
Practical: 02

Examination Scheme:
[Maximum Marks]
Oral – 50

During the practical students should be asked to solve real life cases on each of the Unit in the syllabus for the related subject and have 8 assignments in total.