FACULTY OF ENGINEERING

Syllabus for the

T. E. (Industrial Engineering)

(w. e. f. 2010-2011)

UNIVERSITY OF PUNE
### SEMESTER- I

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Teaching Scheme (Hrs)</th>
<th>Examination Scheme</th>
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<tr>
<td>311101</td>
<td>Production &amp; Operations Management</td>
<td>4 - - 100 - - 100</td>
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<tr>
<td>311102</td>
<td>Advanced Statistics &amp; Numerical Methods</td>
<td>4 2 100 50 - - 150</td>
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<td>311103</td>
<td>Work study</td>
<td>4 - 100 - - - 100</td>
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<tr>
<td>311104</td>
<td>Computer Programming &amp; Applications</td>
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<td>311105</td>
<td>Metrology &amp; QC</td>
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<td>311106</td>
<td>Machine Design</td>
<td>4 2 100 50 - - 150</td>
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<tr>
<td>311107</td>
<td>Production Practice- IV</td>
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### Semester II

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<th>Subject Code</th>
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<th>Examination Scheme</th>
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<tr>
<td>311108</td>
<td>Operation Research</td>
<td>4 2 100 50 - - 150</td>
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<tr>
<td>311109</td>
<td>Ergonomics &amp; Product Design</td>
<td>4 2 100 - 50 - 150</td>
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<td>311110</td>
<td>Facilities Planning</td>
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<td>311111</td>
<td>Management Information Systems</td>
<td>4 2 100 50 - - 150</td>
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<td>311112</td>
<td>Materials Management</td>
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<td>311113</td>
<td>Seminar</td>
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Th: Theory   Pr: Practical   Dw: Drawing   Tw: Term Work   Or: Oral

Note: Practical/Oral based on Term Work
311101 Production And Operations Management

Teaching Scheme:
Lectures: 4 Hrs/Week

Examination Scheme:
Paper: 100 Marks

Unit I: Introduction
History of Operations Management, Operations Organization. Concept of manufacturing and
operations management engineering productivity, efficiency utilization, difference between
products and service, interrelationship of profitability and productivity, productivity in
relationship to material. (8)

Unit II: Operations Strategy
Competitiveness with Operations, Competing on cost, quality, flexibility, speed, Productivity,
efficiency & effectiveness. (8)

Unit III: Products & Services Design
New product development: strategies and processes, design process, Cross functional product
design, designing for manufacture and assembly, designing for customer, concurrent design
and concurrent engineering, considerations in service design, Product design tools – QFD,
Value analysis, Modular design, Product life cycle, Taguchi methods, Process analysis,
process flow charting, types and evaluation. (8)

Unit IV: Processes & Technology
Types of production systems – Mass, Process, Job Shop, Batch, Project, etc. Process selection
types, flow structures, process re-engineering, product process matrix and virtual factory,
Technology decisions. Classification of process technologies - manual, mechanized &
automated, Process technology in service and non manufacturing operations - distribution and
transport, warehousing, point of sale system and banking operations. (8)

Unit V: Facilities Layout
Facility location analysis, basic layouts, designing process layouts, designing product layouts,
designing hybrid layouts, Locating production and services facilities: importance of location
factor affecting location decisions, Introduction to the concept of line balancing, cycle time,
determination of workstation and efficiency, sensitivity analysis of the same. (8)

Unit VI: Material Handling Systems:
As a necessary evil, indicators of poor material handling, principle of good material handling
system, different material handling equipment, Material handling function, MH principles,
MH Equipment – Cranes & Hoists, Conveyors, Industrial Trucks, AGVs, AS-RS systems, etc.
(8)
Text book:

Reference books:
311102 Advanced Statistics and Numerical Methods

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

Examination Scheme:
Paper: 100 Marks
TW: 50 Marks

Unit I
Concept of random variable and probability distributions, discrete random variable and its distributions – Binomial, Poisson, Hypergeometric. (8)

Unit II
Continuous random variable and its distributions - Uniform, Normal, Exponential, Concept of Sampling distribution and various types of it, Statistical inferences – point estimate, interval estimate, Sample size determination. (8)

Unit III
Principles of Statistical inferences – Testing hypotheses and Inferences concerning means, variances and proportions. (8)

Unit IV
Numerical Solution of algebraic and transcendental equations by half interval search method, Newton Raphson method. Numerical Solution of Linear Simultaneous equations by Gauss elimination method, Gauss-Siedel method. (8)

Unit V

Unit VI

Text Books
Reference Books
31103 Work Study

Teaching Scheme: 4 Hrs/Week

Examination Scheme: Paper: 100 Marks

Unit I: Introduction to Industrial Engineering:
Historical background, Contribution of Taylor and Gilbreth, Productivity Improvement, Work content analysis, Definition and scope of Work Study. (8)

Unit II: Method Study
Definition, Steps in method Study, need to record the activities, symbols in charting, different recording techniques – Charts and Diagrams, Questioning Technique, Principals of motion Economy. (8)

Unit III: Work Measurement
Definition of Time study, steps in time study, Allowances, application of allowances, Calculation of standard time, work sampling, advantages of work sampling, Rating. (8)

Unit IV: Predetermined Time Standards
Introduction, Different types of PMTS systems, Methods Time measurement, Introduction to Most technique, Basic, Mini and maxi MOST, General move, Control Move, Tool sequence (8)

Unit V: Job Evaluation and Merit Rating
Introduction to Job Evaluation system, necessity, Job Analysis, Job Description, Job Evaluation, Different Job Evaluation Systems like Factor Comparison, Point System etc, merit rating, Incentive plans (8)

Unit VI: Application of Work Study
Application of Work Study in manufacturing and service sector, use and application of various techniques of work study, Case studies and analysis, cost savings and indirect benefits (8)

Text Books

Reference Books:
1. Yoga M., Job Evaluation, NPC, New Delhi
2. Zandin K.B. - Most Work Measurement Systems
311104 Computer Programming and Applications

Teaching Scheme: 
Lectures: 2 Hrs/Week  
Practical: 2 Hrs/Week

Examination Scheme: 
TW: 50 Marks  
PR: 50 Marks

Any 6 of the following 10 experiments have to be performed:
1. Prepare forms for accepting database of students in Visual Basic
2. Write programs for simple calculator, alarms digital/analog clock
3. Use of various controls in VB through programming: list box, scroll, check box, option, use of array, text boxes, viewing files on the computer, etc.
4. Creation of database for accepting bio-data of students
5. Write program to integrate 1 & 4 above
6. Prepare an application for the department library
7. Prepare an application that takes care of continuous assessment of students
8. Prepare a program that can save day wise events / day planner
9. Write a programme for the Class test marks analysis system.
10. Write a programme for the Calendar

Text Books:

Reference Books:
1. Mcsd Visual Basic 6.0 Distributed Application Study
311105: Metrology and Quality Control

Teaching Scheme: Lectures: 4 Hrs/Week
Examination Scheme: Paper: 100 Marks

Unit I: Introduction

Unit II: Limits, Fits and Tolerances

Unit III: Surface Finish Measurement

Unit IV
Introduction to Quality Control
Meaning of Quality, Quality of Product, Quality of Service, Cost of Quality, Value of Quality, Difference between Inspection, Quality Control and Quality Assurance, Role of Quality in Present day environment. Introduction to Quality Control: 1) Meaning of quality Control 2) 100% Inspection and Selective Inspection 3) Statistics in Selective inspection. Introduction to Statistical Quality Control: 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. (8)

Unit V
Quality assurance systems
Total quality management (T.Q.M):- Approaches- Deming’s Approach, Juran’s Approach, Cause and Effect Diagram, Pareto Analysis, Q.F.D., Quality Circles, Taguchi’s quality engineering, Kaizen, six sigma, T.P.M. Technical Specification (T.S ) TS 16949 Standards. Reliability Engineering :- Concept. Design of experiment : meaning, objective, types of research, approaches. (8)
Unit VI
ISO Standards
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:
311106 Machine Design

Teaching Scheme:  
Lectures: 4 Hrs/Week  
Practical: - 2 Hrs/Week  

Examination Scheme:  
Paper: 100 Marks  
TW: - 50 Marks  

Unit I: Spur Gears  

Unit- II: Helical Gears:  
Introduction, Terms used in Helical Gears, Face width of Helical Gear Formative no. of teeth and minimum no. of teeth to avoid interference and undercutting, Proportion of the Helical Gears, Strength of Helical Gears, Design of Helical Gears.  

Unit III: Rolling Contact Bearings  
Types, Static and Dynamic load Capacity, Striebeck’s Equation, Concept of equivalent load, Load life Relationship, Selection of bearing from Manufacturer’s Catalogue, Design for variable loads and Speeds, Bearings with Probability of Survival other than 90%, Lubrication and Mounting of bearings, oil Seals and packing used for bearings.  

Unit IV: Design for cyclic loads  
Stress Concentration and remedies, S. N. Diagram, Endurance limit, Factors affecting Endurance Strength, Design for Finite and Infinite life under reverse stresses, Cumulative damage, Sodberg’s and Goodman’s Diagram, Design of components like shaft, bolted joints, springs etc. subjected to variable loading.  

Unit V: Design for Manufacture  
General Principles for Design for Manufacture, Principles of design for casting, Forging, Machining, Welded Joints, etc., Design for Manufacturing Assembly  
Statistical Considerations in Design: Analysis of Tolerances, Assembly of parts, Design and Natural Tolerances, Normal Distribution, Applications in Design Process.  

Unit VI: Flywheel  
Introduction, Coefficient of fluctuation of speed, Fluctuation of energy, Maximum fluctuation of energy, Energy stored in flywheel, Stresses in flywheel rim, Stresses in flywheel Arms, Design of shaft, hub and key, construction of flywheel. Optimization Techniques:- The concept of optimization, Classification of optimization problem, engineering, applications of optimization, Role of computers in optimization, Mathematical formulation of optimization problems. Johnson’s method for mechanical engineering design. Typical design equation, Classification, example.
Text Books

Reference Books
Each candidate shall be required to complete and submit the following term work. Composite job involving different machining operations.

**Part A:**

1. **Lathe:** external and internal threading (Vee, Square or Acme threads), taper turning, grooving, knurling, drilling operations on lathe.
2. **Milling:** helical or bevel gear cutting on a milling machine.

**Part B:** Journal consisting of:

1. Preparation of journal consisting of calculation and procedure for above gear cutting on milling machine.
2. Safety aspects used in the machine shop: Precautions and care to be taken while working on various machine tools e.g. lathe, milling, drilling, grinding etc.

Note: - A practical examination of 12 hours duration shall be conducted at the end of semester based on the part A
311108 Operations Research

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

Examination Scheme:
Paper: 100 Marks
TW: 50 Marks

Unit I: Introduction & Formulation Of LPP Model
OR methodology, Definition of OR, Application of OR to engineering and Managerial problems, Features of OR models, Limitation of OR, formulation LPP Models. (8)

Unit II: Linear Programming
Definition, mathematical formulation, standard form, solution space, solution – feasible, basic feasible, optimal, infeasible, multiple, optimal, Redundancy, Degeneracy. Graphical and simplex methods. Variants of simplex algorithm – Artificial basis techniques, Big M Method (8)

Unit III: Transportation Problem
Formulation of transportation model, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel’s Approximation Method) Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Variants in Transportation Problems, Applications of Transportation problems. Transshipment problems. (8)

Unit IV: Assignment Problem & Scheduling
Formulation of the Assignment problem, unbalanced assignment problem, various methods of job shop scheduling. (8)

Unit V: Replacement Analysis
Replacement of capital equipments that deteriorates with time, time value of money (a) remains same (b) changes with constant rates during period. Equipment renewal policy, group and individual replacement. Individual Replacement, Group Replacement Policies, Problems. (8)

Unit VI: Games Theory
Introduction, two -person zero sum game, minimax and maximin principle, saddle point, methods for solving game problems with mixed strategies, Graphical and iterative methods, solving game by LP Method. (8)
Text books:

Reference books:
311109: Ergonomics and Product Design

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

Examination Scheme:
Paper: 100 Marks
OR: 50 Marks

Unit I
Product methodology & the structure of Design Process, Introduction of Product methodology, methodological problems, characteristics of methods, The phases of product design process, foundations of phase models, three phase models etc. (8)

Unit II
Design materials & human factors in product design, material properties, metals, plastics, rubber, woods & factors considered while designing for metals, plastics, rubber, woods etc, Anthropometry factors, physiological factors, psychology factors, anatomy factors. (8)

Unit III
Economic factors influencing design, product value, safety, reliability & environmental considerations, economic analysis, break even analysis, profit & competitiveness, economic of a new product design. (8)

Unit IV
Value engineering in product design, introduction, historical perspective, nature & measurement of value, importance of value, value analysis job plan, creativity, steps for solving & value analysis, value analysis tests. (8)

Unit V
Ergonomics: Definition, Scope, Historical background, Human-machine system interfaces, Basic Ergonomics, Work Physiology, Measurement of work, Introduction to Environmental Ergonomics. (8)

Unit VI
Applied Anthropometry: Definition and scope, use of anthropometric data, statistical analysis, Product design and work station design using anthropometric data, Work Space design (8)

Text Books:
Reference Books:
1. Product design & Manufacture- Jhon R Lindbeck

311110 Facilities Planning

Teaching Scheme: Lectures: 4 Hrs/Week

Examination Scheme: Paper: 100 Marks

Unit I
Scope of Plant Engineering, Plant Layout – Introduction, Types of Plant Layout, Phases of Layout Planning, Plant Location, Urban v/s Rural Location. (8)

Unit II
Systematic Layout Planning, P-Q Analysis, Flow of Materials Analysis, Activity Relationship Analysis, Space Requirements & Availability, Modifying Considerations, Practical Limitations, Selection of Layout, Installation of Layout. (8)

Unit III

Unit IV

Unit V
Maintenance Function, Types of Maintenance, TPM – Introduction, TPM Pillars, 5S Technique, Overall Equipment Effectiveness. (8)

Unit VI
Computerized Layout Planning, CORELAP, CRAFT, ALDEP. (8)

Text Books

Reference Books
311111 Management Information System

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

Examination Scheme:
Paper: 100 Marks
TW: 50 Marks

Unit I: Introduction
Definitions, objective, structure, operating elements, MIS structure based on management activity, organizational function. (8)

Unit II: System concepts
Definition, Types of systems, system decomposition, system entropy, system stress, methods of simplification, design concepts. (8)

Unit III: SDLC approach
System development life cycle approach, system requirement specifications, entity relationship diagram, data dictionary, report generation, database administration. (8)

Unit IV: Object Oriented Analysis and Design
Introduction, concepts of objects, class, encapsulation, various steps of OOA, methods like Booch, Rambaugh etc. Domain Analysis, Human computer Interface, Introduction to System Testing. (8)

Unit V: Decision Support System
Introduction to decision support system, experts systems, hardware and software acquisition, legal Issues. (8)

Unit VI: Information Management and society
Computer security, privacy, manual versus electronic information, back up protection, user interfaces, encryption, responsibility and ethics. (8)

Text Book

Reference Books:
2. Davis G.B, “Management Information System”.
3. Obrien J.C., “Management Information System”.

20
311112: Materials Management

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

Examination Scheme:  
Paper: 100 Marks  
OR: 50 Marks

Unit I: Introduction to Materials Management
What are Inventories, need of inventories, objectives of an Inventory Control system, concept of Rate of Return with respect to Inventories, Symptoms of poor Inventory management, Purchase procedure.  

Unit II: Classification and Costs of Inventories
Different types of Inventories, Inventory carrying cost, procurement cost, set up cost, stock out cost, Inventory cost curve, problems based on inventory costs, EOQ concept, assumptions of EOQ model, mathematical treatment of economic buying, Extension of basic EOQ model.

Unit III: Selective Inventory Control
Concept of Selective Inventory Control, ABC analysis, VED analysis, HML analysis, SDE analysis, SOS analysis, FSN analysis, GOLF analysis, Concept of Lead time and its effects on Inventory, Internal and External lead time, Elements of lead time, Evaluation and ways to minimize lead time, Vendor development and vendor rating.

Unit IV: Replenishment Systems
Introduction, Different types of replenishment systems like Fixed order quantity system, Fixed order interval system, Combination of fixed order interval and quantity system, Tow Bin System, Safety stocks.

Unit V: Surplus and Obsolescent stocks
Introduction, Genesis of surplus materials, Disposal of surplus and obsolete materials, need of physical stock taking, method of stock taking like annual, continuous, reorder point stock taking, Inventory records.

Unit VI: Manufacturing Resource Planning
Why Inventory control is an integrated approach? Concept of Manufacturing Resource Planning (MRP), MRP I and MRP II, case studied in MRP, Introduction to ERP.

Text Books

Reference Books:
1. Dobler Burt, “Material Management”.
2. Silver and Peterson, “Inventory management”, John Willey and sons
31113 Seminar

Teaching Scheme:                  Examination Scheme:
Practical: 02 Hrs/Week             Oral: 50 Marks

a).  The objective of Seminar is to test the student on his/her ability for self-study and his/her ability to communicate - Written and oral.
b).  Seminar will be in the form of a report submitted by the student:
   It will be -
   1.  Done by a student individually, on topic of his/her choice based on literature survey/ a case study wherever applicable/possible, and approved by the staff-in-charge,
   2.  A report with 15-20 pages of A-4 size paper, 1.5 spaced typed material, and appropriately bound.
   3.  Title font/figures/graphs shall be black and white.
c)  The Oral examination will be based on the report submitted and (orally) presented.