

## T. E. Industrial Engineering 2012 Course

### TE (Industrial Engineering) 2012 Course structure Semester- I

Subject Code	Subject	Teaching			Examination Scheme				
		Scheme(Hrs/Week)			In Semester Assessment	Pr/TW	Or/TW	End Semester Exam	Total Marks
		Lect	Tut	Pr					
311201	Production & Operations Management	4	-	-	30	-	-	70	100
311202	Advanced Statistics & Numerical Methods	3	-	-	30	-	-	70	100
311203	Work study	4	-	-	30	-	-	70	100
311204	Metrology & QC	4	-	-	30	-	-	70	100
311205	Machine Design	3	-	-	30	-	-	70	100
311206	Computer Programming & Applications	-	-	4	-	-	50	-	50
311207	Skill Development - Work Study Practical	-	-	2	-	50	50	-	50
311208	Metrology & Quality Control Practical	-	-	2	-	50	-	-	50
311209	Production Practice- IV	-	-	2	-	50	-	-	50
	<b>Total</b>	<b>18</b>		<b>10</b>	<b>150</b>	<b>150</b>	<b>100</b>	<b>350</b>	<b>750</b>

### Semester II

Subject Code	Subject	Teaching			Examination Scheme				
		Scheme(Hrs/Week)			In Semester Assessment	Pr/TW	Or/TW	End Semester Exam	Total Marks
		Lect	Tut	Pr					
311211	Operation Research	4	-	-	30	-	-	70	100
311212	Ergonomics & Product Design	4	-	-	30	-	-	70	100
311213	Facilities Planning	4	-	-	30	-	-	70	100
311214	Management Information Systems	3	-	-	30	-	-	70	100
311215	Materials Management	3	-	-	30	-	-	70	100
311216	Operations Research Practical	-	-	2	-	-	50	-	50
311217	Ergonomics and Product Design Practical	-	-	4	-	50	50	-	50
311218	Materials Management Practical	-	-	2	-	50	-	-	50
311219	Seminar			2	-	-	50	-	50
	<b>Total</b>	<b>18</b>		<b>10</b>	<b>150</b>	<b>100</b>	<b>150</b>	<b>350</b>	<b>750</b>

## T. E. Industrial Engineering 2012 Course

### 311201 Production And Operations Management

#### **Teaching Schedule:**

[Hours / week]

Lectures: 4

#### **Examination Scheme:**

[Maximum Marks]

In Semester - 30

End Semester - 70

#### **Objectives:**

- Aim is to provide insight of the subject
- Sensitizes the students of the importance of course in real life environment

#### **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.

#### **Unit II: Operations Strategy**

Competitiveness with Operations, Competing on cost, quality, flexibility, speed, Productivity, efficiency & effectiveness.

#### **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.

#### **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.

#### **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.

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### **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.

**Outcomes:** At the end of the course student will be in a position to

1. List down the factors that influence the application of the course content in the industrial environment
2. Undertake final year project work based upon the application of the course content

### **Text book:**

1. Operations Management for Competitive Advantage: Chase, Aquilano and Jacobs, TMH

### **Reference books:**

1. Production and Operations Management by Gaither Norman & Frazier, 1999- Southwestern
2. -Purchase Management : By L.C. Jhamb-2000-Everest publication
3. -Production and Operation Management : By S.N Chary-1988- Tata Mc Graw Hill
4. -Production and Operation Management by Adams, Evereet & Ronald J, 1996, 5/e, PHI

## T. E. Industrial Engineering 2012 Course

### 311202 Advanced Statistics and Numerical Methods

#### Teaching Schedule:

[Hours / week]

Lectures: 3

#### Examination Scheme:

[Maximum Marks]

In Semester - 30

End Semester - 70

#### **Objectives:**

- To make the students understand the concepts & broad principles of contents of the course
- Develop conceptual framework of the course
- Sensitizes the students of the importance of course in real life environment

#### **Unit I**

Concept of random variable and probability distributions, discrete random variable and its distributions – Binomial, Poisson, Hypergeometric.

#### **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.

#### **Unit III**

Principles of Statistical inferences – Testing hypotheses and Inferences concerning means, variances and proportions.

#### **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.

#### **Unit V**

Numerical integration by Trapezoidal rule, Simpson's. 1/3rd and 3/8th rules. Double integration. Curve fitting : Least square criterion-1st and 2nd order.

#### **Unit VI**

Interpolation : Lagrange's formula, Inverse interpolation. Numerical solution of differential equations: Euler method, Runge-Kutta 2nd and 4th order methods. Errors and approximations Types of errors, absolute error, relative error, algorithmic errors,

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truncation error, round off error. Error propagation.

**Outcomes:** At the end of the course student will be in a position to

- List down the factors that influence the application of the course content in the industrial environment
- Undertake final year project work based upon the application of the course content

### **Text Books**

1. Numerical methods for Engineers by S. C. Chapra and R. P. Canale Published by McGraw Hill.
2. Quantitative Techniques For managerial Decision Making by V.K.Srivastva, G.V Shenoy, Wiley eastern Ltd.

### **Reference Books**

1. V. Rajaraman, Computer Oriented Numerical Methods - Prentice Hall Publication.
2. S. S. Sastry, Introductory methods of Numerical Analysis - Prentice Hall Publication.
3. Jain, Ayengar, Jain : Numerical Methods for Scientific and Engineering Computations - Wiley Eastern Publication.
4. Dr. B. S. Grewal : Numerical Methods in Engineering and Science.
5. Statistics For engineers –Richardson, TATA Mchraw Hill.

## T. E. Industrial Engineering 2012 Course

### 311203 Work Study

#### Teaching Schedule:

[Hours / week]

Lectures: 4

#### Examination Scheme:

[Maximum Marks]

In Semester - 30

End Semester - 70

#### **Objectives:**

- To make the students understand the concepts & broad principles of contents of the course
- Aim is to provide insight of the subject
- Sensitizes the students of the importance of course in real life environment

#### **Unit I: Introduction to Industrial Engineering:**

Historical background, Contribution of Taylor and Gilbreth, Productivity Improvement, Work content analysis, Definition and scope of Work Study.

#### **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.

#### **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,

#### **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

#### **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

#### **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

**Outcomes:** At the end of the course student will be in a position to

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- List down the factors that influence the application of the course content in the industrial environment
- Undertake final year project work based upon the application of the course content
- Apply the knowledge of the course in solving real life problems

### **TEXT BOOK**

1. Introduction to Work Study by ILO

### **REFERENCE BOOKS:**

1. Yoga M., Job Evaluation, NPC, New Delhi
2. Zandin K.B. - Most Work Measurement Systems
3. Hand Book of Industrial Engineering By H.B. Maynard

## T. E. Industrial Engineering 2012 Course

### 311204: Metrology and Quality Control

#### Teaching Schedule:

[Hours / week]

Lectures: 4

#### Examination Scheme:

[Maximum Marks]

In Semester - 30

End Semester - 70

#### **Objectives:**

1. To make the students understand the concepts & broad principles of contents of the course
2. Develop conceptual framework of the course
3. Sensitizes the students of the importance of course in real life environment

#### **Unit I: Introduction**

Meaning of Metrology, Precision, Accuracy, Errors in Measurement, Calibration. Linear Measurement: Standards, Line Standard, End Standard, Wavelength Standard, Classification of Standards, Precision and Non Precision Measuring instruments, Slip Gauges. Angular Measurement: Sine bar, Sine Center, Uses of sine bars, angle gauges, Auto Collimator Angle Dekkor, Constant deviation prism.

#### **Unit II: Limits, Fits and Tolerances**

Meaning of Limit, Fits and Tolerance, Cost – Tolerance relationship, concept of Interchangeability, Indian Standard System.

Design of limits Gauges: Types, Uses, Taylor's Principle, Design of Limit Gauges.

Inspection of Geometric parameters: Straightness, Parallelism, Concentricity, Scariness, and Circularity. Comparators: Uses, Types, Advantages and Disadvantages of various types of Comparators.

#### **Unit III: Surface Finish Measurement**

Surface Texture, Meaning of RMS and CLA values, Tomlison's Surface Meter, Taylor- Hobson Surface Meter, Grades of Roughness, Specifications. Screw Thread Metrology: External Screw Thread terminology, Floating Carriage Instruments, Pitch and flank Measurement of External Screw Thread. Gear Metrology: Spur Gear Parameters and their Inspection Methods. Interferometry: Introduction, Flatness testing by interferometry, NPL Flatness Interferometer. Study of Measuring Machines, Recent Trends in Engineering Metrology.

#### **Unit IV**

Introduction: 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,



## **T. E. Industrial Engineering 2012 Course**

Process Capability Index (PCI), Concept, Methods of determining PCI and uses of PCI.

### **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.

### **Unit VI**

ISO 9001-2000 Series of Standards- History and Evolution of ISO 9000 Series , importance and overview of ISO 9000- 1998 Series standards, structure of ISO 9000-2000 Series standards, clauses of ISO 9000 series standards and their interpretation and implementation, quality system documentation and audit.

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

Malcom Baldrige national quality Award and other quality awards

**Outcomes:** At the end of the course student will be in a position to

1. Undertake final year project work based upon the application of the course content
2. Identify areas for research-oriented work based on the course content
3. Apply the knowledge of the course in solving real life problems

### **Text Books:**

1. R.K. Jain, Engineering Metrology, Khanna Publication.
2. K.J.Hume, Engineering Metrology, Kalyani publication

### **Reference Books:**

1. K.W.B.Sharp, Practical Engineering Metrology, Pitman Publication.
2. J.M. Juran & F.M.Gryna , Quality Planning and Analysis.
3. Juran's Quality Control Handbook.
4. I.C.Gupta, A Text book of Engineering Metrology, Dhanpat Rai and Sons.
5. E.L.Grant & R.S. Kearenworth, Statistical Quality Control.
6. Kaoru Ishikawa, Guide to Quality Control, Asian Productivity Organisation, Tokyo.
7. ISO 9000 Quality System – S.Dalela.
8. ISO 9000 Quality Management System , International Trade Center, Geneva

## T. E. Industrial Engineering 2012 Course

### 311205 Machine Design

#### Teaching Schedule:

[Hours / week]

Lectures: 3

#### Examination Scheme:

[Maximum Marks]

In Semester - 30

End Semester - 70

#### **Objectives:**

1. To make the students understand the concepts & broad principles of contents of the course
2. Develop conceptual framework of the course
3. Aim is to provide insight of the subject
4. Sensitizes the students of the importance of course in real life environment

#### **Unit I: Spur Gears**

Introduction, Standard Proportions of Gear Systems, Gear Materials, various design considerations, Beam Strength of gear teeth- Lewis Equation, tangential loading, module Calculations, width calculations, Dynamic tooth loads, Spott's Equation, types of gear tooth failures, Spur Gear construction, Design of shaft for Spur Gears, Design of arms for 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, Stribeck's Equation, Concept of equivalent load, Load life Relationship, Selection of bearing from Manufacturer's Catalogue, Design for variable loads and Speeds, Bearings with Probability of Survival other than 90%, Lubrication and Mounting of bearings, oil Seals and packing used for bearings.

#### **Unit IV: Design for fluctuating loads**

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

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### **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.

**Outcomes:** At the end of the course student will be in a position to

1. List down the factors that influence the application of the course content in the industrial environment
2. Undertake final year project work based upon the application of the course content
3. Identify areas for research oriented work based on the course content
4. Apply the knowledge of the course in solving real life problems

### **Text Books**

1. Design of Machine Elements, Bhandari V.B., Tata McGraw Hill Publication.
2. Mechanical Engineering Design, Shigly, McGraw Hill Publication.

### **Reference Books**

1. Design of Machine Elements, M.F. Spott, Prentice Hall.
2. Design Data Book, PSG College Technolgy.
3. William C. Ortwein, Machine Component Design, West Pub.Co. and Jaico Publication House.
4. R.K. Jain, Machine Design, Khanna Publication Delhi.
5. R.S. Khurmi & Gupta J.K., A Text book of Machine Design, S.Chand and Compan

## T. E. Industrial Engineering 2012 Course

### 311206 Computer Programming and Applications

#### Teaching Schedule:

[Hours / week]

Practical: 4

#### Examination Scheme:

[Maximum Marks]

Oral / Term Work - 50

#### **Objectives:**

- To develop skills in the subject
- Verify the principles of the course

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

#### **Outcomes:** The student will

1. acquire the skills
2. improve ability to solve industrial problems on the subject
3. understand the technical writing of experiments.
4. have improved hands on skills
5. be in a position to relate theory and practice

#### **Text Books:**

1. Petroustos E Mastering Visual Basic 6.0
2. Balena F Microsoft Visual Basic 6.0

#### **Reference Books:**

1. Mcsd Visual Basic 6.0 Distributed Application Study
2. Penfold J W Microsoft Visual Basic: The Programmer's Companion

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**311207 Skill Development - Work Study Practical**

**Teaching Schedule:**

**[Hours / week]**

**Practicals: 2**

**Examination Scheme:**

**[Maximum Marks]**

**Oral – 50**

**Term Work - 50**

**Objective:**

To develop skills in the subject

- Verify the principles of the course

Any 8 of the following assignments have to be completed by a student and journal to be prepared.

List of Assignments

1. Single facility location problems – Quantitative Techniques
2. Multiple facility location problems - Quantitative Techniques
3. Case on – Facility Location
4. Assignment on Process Layout - REL Charts
5. Assignment on Product Layout - Line Balancing
6. Computerized Layout Planning
7. Assignment on Layout Evaluation Techniques
8. Comprehensive Case on – Layout Improvement 1
9. Comprehensive Case on – Layout Improvement 2
10. Comprehensive Case – Material Handling Systems Design 1
11. Comprehensive Case – Material Handling Systems Design 2
12. Industrial Visit

Text Books

1. Introduction to Work Study by ILO
2. R.L Francis and J.A White (1974), Facilities layout and location-An analytical approach, Prentice Hall Inc

Reference Books

1. Yoga M., Job Evaluation, NPC, New Delhi
2. M.E Porter (1985), Competitive Advantage, The Free Press.

**T. E. Industrial Engineering 2012 Course**

**311208 Metrology and Quality Control**

**Teaching Schedule:**

**[Hours / week]**

**Practical: 2**

**Examination Scheme:**

**[Maximum Marks]**

**Oral – 50**

**Objectives:**

- To develop skills in the subject
- Application of the theory
- Understanding of fundamentals of the subject

**List of Practical**

The Term work should be in the form of Journal consisting of following Two sections:

**Experiments: (Any seven of the following)**

1. Measurement of straightness, flatness, roundness.
2. Measurement of the Surface roughness.
3. Measurement of angle by sine bar / Sine center.
4. Measurement of Optical surface using Interferometer.
5. Measurement of Screw thread parameters using Floating Carriage Micrometer.
6. Measurement of Gear tooth thickness using Gear tooth Vernier caliper and Span Micrometer.
7. Study and Experiment on Profile Projector.
8. Study and Experiment on any type Comparator.
9. Calibration of instrument using Calibration setup.
10. Alignment Test on Lathe / Drilling / Milling Machine
11. Experiment to measure Process Capability using Statistical Process Control.

**Assignments: (Any five of the following)**

1. Design of Sampling Plan
2. Design of Control Charts
3. Assignment on Process Capability
4. Case Study on 7 QC Tools
5. Case on Constructing House of Quality for any Product

**Text Books**

1. R.K. Jain, Engineering Metrology, Khanna Publication.
2. K.J.Hume, Engineering Metrology, Kalyani publication

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**311209 Production Practice-IV**

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

**Examination Scheme:**  
**Practical: 50 Marks**

**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

## T. E. Industrial Engineering 2012 Course

### 311211 Operations Research

#### Teaching Schedule:

[Hours / week]

Lectures: 4

#### Examination Scheme:

[Maximum Marks]

In Semester - 30

End Semester - 70

#### **Objectives:**

1. Develop conceptual framework of the course
2. Aim is to provide insight of the subject
3. Sensitizes the students of the importance of course in real life environment

#### **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.

#### **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

#### **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.

#### **Unit IV: Assignment Problem & Scheduling**

Formulation of the Assignment problem, unbalanced assignment problem, various methods of job shop scheduling.

#### **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.



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### **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.

**Outcomes:** At the end of the course student will be in a position to

1. List down the factors that influence the application of the course content in the industrial environment
2. Identify areas for research oriented work based on the course content
3. Apply the knowledge of the course in solving real life problems

### **Text books:**

1. Taha H A Operation Research and Introduction, McMillian.ISBN-0-02-418940-5
2. Paneerselvam Operations Research , Prentice Hall of India
3. Philips, Ravindram and Soleberg-Principles of Operations Research – Theory and Practice, PHI

### **Reference books:**

1. Hiller and Libermann, Introduction to Operation Research, McGraw Hill 5<sup>th</sup> edn.
2. S.D. Sharma – Operations Research, Kedarnath, Ramnath &Co
3. J K Sharma, Operations Research Theory and Application, Pearson Education Pvt Ltd ,2<sup>nd</sup> Edn, ISBN-0333-92394-4
4. Kanthi Swarup & others – Operations Research, Sultan chand and Sons.

## T. E. Industrial Engineering 2012 Course

### 311212: Ergonomics and Product Design

#### Teaching Schedule:

[Hours / week]

Lectures: 4

#### Examination Scheme:

[Maximum Marks]

In Semester - 30

End Semester - 70

#### **Objectives:**

- To make the students understand the concepts & broad principles of contents of the course
- Develop conceptual framework of the course
- Aim is to provide insight of the subject

#### **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.

#### **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.

#### **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.

#### **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.

#### **Unit V**

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

#### **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.

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**Outcomes:** At the end of the course student will be in a position to

1. List down the factors that influence the application of the course content in the industrial environment
2. Undertake final year project work based upon the application of the course content
3. Identify areas for research-oriented work based on the course content
4. Apply the knowledge of the course in solving real life problems

**Text Books:**

1. Product design & Manufacturing- A.K.Chitale, R.C Gupta
2. Product Design : Fundamentals & Methods – N.F.M. Roozenburg & J.Eekels
3. Introduction to Work Study by ILO
4. Human Factor Engineering and Design by Sanders McCormick

**Reference Books:**

1. Product design & Manufacture- Jhon R Lindbeck
2. Mayall W.H., "Industrial Design for Engineers" London Liiffee Books Ltd. 1967
3. Dale Huchingson R "New Horizons for Human Factors in Design " McGraw Hill Company 19811.Industrial Design-Mayall
4. Job Evaluation – ILO
5. Yoga M., Job Evaluation, NPC, New Delhi
6. Zandin K.B. - Most Work Measurement Systems
7. Hand Book of Industrial Engineering By H.B. Maynard

## T. E. Industrial Engineering 2012 Course

### 311213 Facilities Planning

#### **Teaching Schedule:**

[Hours / week]

Lectures: 4

#### **Examination Scheme:**

[Maximum Marks]

In Semester - 30

End Semester - 70

#### **Objectives:**

- To make the students understand the concepts & broad principles of contents of the course
- Develop conceptual framework of the course
- Aim is to provide insight of the subject
- Sensitizes the students of the importance of course in real life environment

#### **Unit I**

Scope of Plant Engineering, Plant Layout – Introduction, Types of Plant Layout, Phases of Layout Planning, Plant Location, Urban v/s Rural Location.

#### **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.

#### **Unit III**

Material Handling Function, Principles of Material Handling, MH Equipment – Conveyors, MH Equipment – Cranes, MH Equipment – Trucks.

#### **Unit IV**

Systematic Handling Analysis, External Integration, Classification of Materials, Layout Considerations, Analysis of Moves, Visualization of Moves, Flow Diagram – DI Plot, Preliminary Handling Plans, Modifications & Practical Limitations, Calculation of Requirements, Evaluation of Alternatives, Installation.

#### **Unit V**

Maintenance Function, Types of Maintenance, TPM – Introduction, TPM Pillars, 5S Technique, Overall Equipment Effectiveness.

#### **Unit VI**

Computerized Layout Planning, CORELAP, CRAFT, ALDEP.

**Outcomes:** At the end of the course student will be in a position to

1. List down the factors that influence the application of the course content in the industrial environment

## **T. E. Industrial Engineering 2012 Course**

2. Undertake final year project work based upon the application of the course content
3. Identify areas for research oriented work based on the course content
4. Apply the knowledge of the course in solving real life problems

### **Text Books**

1. R.L Francis and J.A White (1974), Facilities layout and location-An analytical approach, Prentice Hall Inc.
2. J.A Tomkins and J.A White (1984), Facilities Planning, John Wiley & sons.

### **Reference Books**

1. M.E Porter (1985), Competitive Advantage, The Free Press.
2. D.K. Carr and H.J Johansson (1995), Best practices in Reengineering, McGraw Hill, Inc.
3. K.K.Humphreys (1991), Jelen's Cost and Optimization Engineering, McGraw Hill,International.
4. P.Cheekland (1981), Systems thinking, Systems Practice, John Wiley & sons.
5. B.W. Niebel (1972), Motion and Time study, Richard Irwin.
6. L.D.Miles (1971), Techniques of Value analysis and Engineering, McGraw Hill.
7. K.Hitomi (1996), Manufacturing Systems Engineering; Viva Books Pvt Ltd, India.
8. A.W. Law and W.D.Kelton (1991), Simulation Modeling and Analysis, McGraw Hill International Edition
9. G.F.Bell and J Balkwill (1998), Management in Engineering, Prentice Hall India.
10. J.M.Apple (1972), Plant Layout and Material Handling, McGraw Hill.

## T. E. Industrial Engineering 2012 Course

### 311214 Management Information System

#### Teaching Schedule:

[Hours / week]

Lectures: 3

#### Examination Scheme:

[Maximum Marks]

In Semester - 30

EndSemester – 70

#### Objectives:

- To make the students understand the concepts & broad principles of contents of the course
- Sensitizes the students of the importance of course in real life environment

#### **Unit I: Introduction**

Definitions, objective, structure, operating elements, MIS structure based on management activity, organizational function.

#### **Unit II: System concepts**

Definition, Types of systems, system decomposition, system entropy, system stress, methods of simplification, design concepts.

#### **Unit III: SDLC approach**

System development life cycle approach, system requirement specifications, entity relationship diagram, data dictionary, report generation, database administration.

#### **Unit IV: Object Oriented Analysis and Design**

Introduction, concepts of objects, class, encapsulation, various steps of OOA, methods like Booch, Rumbaugh etc. Domain Analysis, Human computer Interface, Introduction to System Testing.

#### **Unit V: Decision Support System**

Introduction to decision support system, experts systems, hardware and software acquisition, legal Issues.

#### **Unit VI: Information Management and society**

Computer security, privacy, manual versus electronic information, back up protection, user interfaces, encryption, responsibility and ethics.

**Outcomes:** At the end of the course student will be in a position to

- List down the factors that influence the application of the course content in the industrial environment

## **T. E. Industrial Engineering 2012 Course**

- Undertake final year project work based upon the application of the course content
- Apply the knowledge of the course in solving real life problems

### **Text Book**

1. Software Engineering by Joshi S.D.

### **Reference Books:**

1. Management Information System by Jawadekar W.S.
2. Management Information System by Davis G.B.
3. Management Information System by Obrien J.C.
4. Management Information System by Mc Cory Keith R
5. Software Engineering by Pressman R.S.
6. Software Engineering by Prasad R. S.

## T. E. Industrial Engineering 2012 Course

### 311215: Materials Management

#### Teaching Schedule:

[Hours / week]

Lectures: 3

#### Examination Scheme:

[Maximum Marks]

In Semester - 30

End Semester - 70

#### **Objectives:**

- To make the students understand the concepts & broad principles of contents of the course
- Develop conceptual framework of the course
- Aim is to provide insight of the subject

#### **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



## **T. E. Industrial Engineering 2012 Course**

ERP.

### **Outcomes:**

1. At the end of the course student will be in a position to
2. List down the factors that influence the application of the course content in the industrial environment
3. Identify areas for research oriented work based on the course content
4. Apply the knowledge of the course in solving real life problems

### **Text Book**

1. Inventory management by L.C. Jhamb

### **Reference Books:**

1. Material Management by Dobler Burt
2. Inventory management, Silver and Peterson, John Willey and sons

## **T. E. Industrial Engineering 2012 Course**

### **311216 Operations Research Practical**

#### **Teaching Schedule:**

**[Hours / week]**

**Practical: 2**

#### **Objective:**

To develop skills in the subject

- Verify the principles of the course

#### **Examination Scheme:**

**[Maximum Marks]**

**Term Work - 50**

Any 8 of the following assignments have to be completed by a student and journal to be prepared.

#### List of Assignments

1. Formulation of L. P. Problem
2. Solving L. P. Problem
3. L. P. problem based on redundancy and degeneration
4. Transportation problem using Vogel's approximation
5. Graphical Method or North West Corner method
6. Assignment problem
7. Unbalanced assignment problem
8. Individual Replacement
9. Group Replacement
10. Games theory

#### Text Books

1. Gupta & Hira: Operations Research, S. Chand & Co.
2. Paneerselvam Operations Research , Prentice Hall of India

#### Reference Books

4. Taha H A Operation Research and Introduction, McMillian. ISBN-0-02-418940-5
5. Hiller and Libermann, Introduction to Operation Research, McGraw Hill 5th edn.
6. S.D. Sharma – Operations Research, Kedarnath, Ramnath &Co
7. J K Sharma, Operations Research Theory and Application, Pearson Education Pvt Ltd  
,2nd Edn, ISBN-0333-92394-4
8. Kanthi Swarup & others – Operations Research, Sultan chand and Sons.

### **311217 Ergonomics and Product Design**

## T. E. Industrial Engineering 2012 Course

### **Teaching Schedule:**

**[Hours / week]**

**Practical: 4**

### **Examination Scheme:**

**[Maximum Marks]**

**Oral – 50**

**Term Work - 50**

### **Objective:**

To develop skills in the subject

- Verify the principles of the course

The following assignments have to be completed by a student and journal to be prepared.

### List of Assignments

1. Anthropometric Data collection
2. Anthropometric data analysis
3. Ergonomic Design analysis of a consumer durable
4. Ergonomic Design analysis of an engineering equipment
5. Ergonomic Design analysis of a Fast Moving Consumer Good packaging
6. Ergonomic Design analysis of a work place

### **Text Books:**

1. Product design & Manufacturing- A.K.Chitale, R.C Gupta
2. Product Design : Fundamentals & Methods – N.F.M. Roozenburg & J.Eekels
3. Introduction to Work Study by ILO
4. Human Factor Engineering and Design by Sanders McCormick

### **Reference Books:**

1. Product design & Manufacture- Jhon R Lindbeck
2. Mayall W.H., "Industrial Design for Engineers" London Liifee Books Ltd. 1967
3. Dale Huchingson R "New Horizons for Human Factors in Design " McGraw Hill Company 19811.Industrial Design-Mayall
4. Job Evaluation – ILO
5. Yoga M., Job Evaluation, NPC, New Delhi
6. Zandin K.B. - Most Work Measurement Systems
7. Hand Book of Industrial Engineering By H.B. Maynard

## **T. E. Industrial Engineering 2012 Course**

### **311218 Materials Management Practical**

#### **Teaching Schedule:**

**[Hours / week]**

**Practical: 2**

#### **Examination Scheme:**

**[Maximum Marks]**

**Oral – 50**

#### **Objectives:**

- To develop skills in the subject
- Application of the theory
- Understanding of fundamentals of the subject

#### **List of Assignments: [any 8]**

1. Assignment on Costs of Inventories, Assignment on EOQ
2. Assignment on EOQ – Practical Constraints – Quantity Discounts, Shelf Life, Packing Constraints
3. Assignment on Replenishment Systems – Deterministic Model
4. Assignment on Replenishment Systems – Probabilistic Model
5. Assignment on Selective Inventory Control
6. Assignment on Disposal of Surplus and Obsolescent stocks
7. Documentation in Materials Management
8. Case – Purchase Management
9. Case – Vendor Selection, Vendor Rating
10. Case – Warehouse Layout Planning
11. Comprehensive Case on Warehousing
12. Study of Inbound & Outbound Logistics Channels of a Any Industry

#### **Text Books:**

1. Inventory management by L.C. Jhamb, Everest Publishing House
2. Materials Management, Tony Arnold, Pearson Publication

#### **Reference Books:**

1. Material Management by Dobler Burt
2. Inventory management, Silver and Peterson, John Willey and sons

**T. E. Industrial Engineering 2012 Course**

**311219 Seminar**

**Teaching Scheme**  
**Practical: 02 Hrs/Week**

**Examination Scheme**  
**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.