

**SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY, TUMKUR**  
**DEPARTMENT OF INDUSTRIAL ENGG. & MANAGEMENT**  
**Curriculum for the year 2020-21**  
**V Semester**

Sl. No	Course Code	Course Title	Hours/week			
			L	T	P	C
1.PC	18IM501	Engineering Economics	3	1	0	4
2.PC	18IMI502	Facilities Planning & Design	3	0	2	4
3.PC	18IM503	Statistics for Engineers	3	1	0	4
4.PC	18IM504	CAD / CAM	3	0	0	3
5.PE	18IM5PE5x	Professional Elective I	3	0	0	3
6.OE	18ME5OE6x	Open Elective I	3	0	0	3
7.PC	18IM507	Production Technology Lab	0	0	2	1
8.PC	18IM508	Manufacturing Systems Lab	0	0	2	1
9.HS	18SK501	Skill Development-III	0	0	2	1
		Total	18	02	08	24

**Professional Elective(PE) I**

Sl No	Course Code	Course Title
1	18IM5PE51	Maintenance & Safety Engineering
2	18IM5PE52	Artificial Intelligent manufacturing

**Open Elective(OE) I**

Sl No	Course Code	Course Title
1	18ME5OE61	Industrial Design & Ergonomics
2	18ME5OE62	Engineering Economics

# 18IM501: ENGINEERING ECONOMICS

Credits: 3-1-0-4      CIE: 50      SEE:50      Total Marks:100

## Course objectives

1. To carry out or make economic analyses in the decision making process.
2. To prepare engineering students to analyze cost/revenue data.
3. To justify or reject alternatives/projects on an economic basis.
4. To select the best alternative projects among the many.

## Unit I

10 hrs

**Introduction to Engineering Economics:** Decision Makers, Problems solving, Decision making, Law of Demand and supply, Law of returns, Interest rate, simple interest and Compound interest factors, Cash-flow diagrams, Exercises and Discussion.

## Unit II

10 hrs

**Present Worth Comparisons:** Condition for present worth comparisons, Basic present worth comparisons, present worth equivalence, Net Present worth, Assets with unequal lives, Infinite lives, Future worth comparisons, Exercises, Discussions and problems.

## Unit III

12 hrs

**Equivalent Annual Worth Comparison:** Methods, Situations for Equivalent Annual Worth Comparison, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method, problems. Rate of return, Minimum acceptable rate of return, IRR, ERR, Problems on Rate of return calculation.

## Unit IV

10 hrs

**Depreciation:** Causes, Basic methods of computing depreciation charges, Straight line method of depreciation, Declining and double declining balance method, Sum of year's digits method and Sinking fund method, Introduction to breakeven analysis, Calculation of BEQ, BEP and problems.

## Unit V

10 hrs

**Replacement Analysis:** reasons for replacement, Individual Replacement of machinery or equipment with/without value of money, Group Replacement Policies, Problems. Components of cost such as direct material cost, Direct Labour cost, Fixed over-heads, Factory cost, Administrative over heads, First cost, Marginal cost, Selling price.

## Course Outcomes

- CO1. Identify the role of engineering economy in the decision-making
- CO2. Compare two or more competing alternative choices with equal, unequal and infinite project lives
- CO3. Apply the Rate of Return concept in selection of the best alternative projects
- CO4. Apply the replacement analysis technique to identify when to replace the assets and do costing.

## Text Books

- 1. Engineering Economy, Riggs J.L, McGraw Hill, 2002
- 2. Engineering Economics, R. Paneerselvam, PHI, Eastern Economy, 2<sup>nd</sup> Edition, 2013

## Reference books

- 1. Engineering Economy, Tarachand, O.P Khanna, industrial engineering and management Dhanpat rai & sons
- 2. Engineering Economy, PAUL DEGARMO, Macmillan Pub Co, 2001
- 3. Engineering Economy, THUESEN H.G, PHI, 2002

## **18IMI502: FACILITIES PLANNING AND DESIGN**

Credits: 3-0-2-4      CIE: 50      SEE: 50      Total Marks: 100

## Course Objectives

- 1. Exploring the basic concepts & fundamentals of facilities planning and design
- 2. Exposing the different types of facilities
- 3. Explain the different types of Planning and design
- 4. Exploring the analysis and presentation of facilities planning and design

## Unit I

8hrs

**Plant location:** Factors influencing, Theories and locational economics, Objectives, Principles, types, merits and demerits. Facilities design function, Objectives, Types of Layout Problems, construction materials, floor covering, partition, ventilation, air conditioning and lighting projection. Plant Design, Layout procedures, Immer, Nadler, Muther, Apple James and Reed's approaches.

- Unit II 8 hrs  
**Designing material flow:** Factors, conventional techniques, assembly chart, operation process chart, multiproduct process chart, string diagram, flow diagram, travel chart. Production and physical plant services, Receiving, storage, warehousing, shipping, tool room and tool crib, handling equipment storage.
- Unit III 7 hrs  
**Quantitative techniques:** Analyzing material flow, Advantages of quantitative techniques, transportation problem, and queuing theory.
- Unit IV 8 hrs  
**Space determination and area allocation:** Factors for consideration in space planning, offices, receiving, storage, production, shipping, other auxiliary service actions, establishing total space requirement, area allocation factors to be considered, expansion, flexibility, aisles, column, area allocation procedure, the plot plan.
- Unit V 8 hrs  
**Material handling:** Objectives and principles of MH, Unit load concept, classification of MH equipment basic handling systems, different types of material handling equipments. Constructing the layout, Methods and constructing the layout, evaluating layout, efficiency indices, presenting layout to management, implementing layout, Computerized Layout Planning.

### Course outcomes

- CO1. Identify the fundamental concepts of Facilities Planning and Design.
- CO2. To design basic plant facilities
- CO3. Develop basic relationship between various facilities
- CO4. Identify the possible causes and solutions for relevant facilities planning

### Text books

1. Plant layout and material handling - James M Apple - John Wiely India Pvt Ltd - 2nd Edition.
2. Facility Layout and location - Francies R.L and White J A - Mc Graw Hill - 2nd Edition

### Reference books

1. Facilities Design -Sunderesh Heragu - PWS Publishing Company- ISBN-534-95183.

2. Plant Layout Design -James M Moore - Mac Millon Co. -1962 – LCCCN61- 5204
3. Facility Planning - Tompkins White - Wiley India Pvt Ltd - 3rd Edition.

### **Integrated Lab:**

1. Design and construction of product Layout
2. Design and construction of process Layout
3. Measurement of distance moved by workers by constructing a string diagram
4. Measurement of distance moved by materials or equipment during sequence of activities or operation
5. Development of From-To-Chart (Travel Chart)

### **18IM503: STATISTICS FOR ENGINEERS**

Credits: 3-1-0-4      CIE: 50      SEE:50      Total Marks:100

### **Course Objectives**

1. To understand the data collection, representation and display techniques
2. To learn discrete and continuous random variables, probability distributions, measure of centre tendency and measure of dispersion
3. To understand the hypothesis testing
4. To understand the concept of Regression and correlation

### **Unit I**

12 hrs

**Role of Statistics in Engineering:** Data Summary and Presentation, Statistical Thinking, Collecting data, Statistical Modeling Frame work, Designing experimental investigation, Importance of Data summary and Display, Tabular and Graphical display: Stem and Leaf Diagram, Frequency Distribution and Histograms, Box plots and Time sequence plots.

**Concepts of Probability:** Sample spaces and spaces, Interpretation of probability, Addition rules, conditional probability, multiplication and total probability rules, independence, Baye's theorem, Random variables.

## Unit II

12 hrs

**Discrete Random Variables:** Probability Distributions and Probability mass function, Cumulative Distribution functions, Means and Variance of Discrete Random Variable, Discrete Uniform distribution, Binomial distribution, Hyper Geometric distribution, Poisson distribution and their applications.

**Continuous random variables:** Probability distribution and Probability density functions, Cumulative distribution functions, Mean and Variance of a continuous uniform Distribution, Normal distribution, Normal approximation to Binomial and Poisson distribution, Exponential Distribution and their applications.

## Unit III

09 hrs

**Joint Probability Distributions:** Two discrete random variables, Two continuous random variables, Covariance and Correlation

**Estimation Theory:** Statistical Inference, Random Sampling, Properties of Estimators, Method of Maximum of Likelihood, Sampling distribution, Sampling distribution of means, Introduction to confidence intervals.

## Unit IV

10 hrs

**Statistical Inference for a Single sample :** Hypothesis testing, inference on the mean of a normal population (variance known and unknown), Inference on the variance of a normal population, Testing for Goodness of Fit, Contingency Table tests, Numerical problems.

## Unit V

09 hrs

**Simple Linear Regression and Correlation:** Empirical models, Simple Linear Regression, Properties of Least Square Estimators and Estimation of Variance, Common abuses of regression, Prediction of New observations, Assessing the adequacy of regression models, Transformation to a straight line, Correlation.

## Course outcomes

- CO1. Report data set using data analysis, presentation and interpretation techniques
- CO2. Apply various statistical processing techniques to handle a set of data to estimate probabilities.
- CO3. Apply an appropriate statistical tool and analyse a specific set of data to estimate and draw conclusions about population parameters
- CO4. Draw inferences about population parameters and relations between variables based on analysis of sample data.

## Text Books

1. Applied statistics and probability for engineers- Douglas C Montgomery. George C Runger, 4<sup>th</sup> Edn, John Wiley and Sons, ISBN-978-81-265-2315-3.
2. Statistics for management, Richard I Levin, David S Rubin, 6<sup>th</sup> Edn, Prentice hall India, ISBN-81-203-0893-X

## Reference Books

1. Probability and Statistics in Engineering, William W Hines, Douglas C Montgomery, 2<sup>nd</sup> Edn, John Wiley and sons.
2. Business Statistics for management and Economics, Daniel, Terrell, 6<sup>th</sup> Edn, Houghton Mifflin Company, ISBN-0-395-62835-0

## 18IM504: CAD / CAM

Credits: 3-0-0-3      CIE: 50      SEE:50      Total Marks:100

## Course Objectives

1. Provide basic foundation in computer aided design / manufacturing
2. Understand the fundamentals used to create and manipulate geometric models
3. Get acquainted with the basic CAD software designed for geometric modeling
4. Learn working principles of NC machines CNC control and part programming

## Unit I

8 hrs

**Computers in design and manufacturing:** Influence of computers in manufacturing environment, product cycle in conventional and computerized manufacturing environment. Introduction to CAD and CAM, Advantages and disadvantages, Hardware of CAD, Basic hardware structure, working principles, usage and types of hardware for CAD-input devices, output devices, memory, CPU, hardcopy and storage devices.

## Unit II

8 hrs

**Computer graphics:** Software configuration of a graphic system, function of graphics package, construction of geometry, wire frame and solid modeling, CAD/CAM integration. Desirable modeling facilities introduction to exchange of modeling data –basic features of

IGES, STEP, DXF, DIMS. Introduction to finite element analysis, basic concepts, discrimination, element types, nodes and degrees of freedom mesh generation, constraints, loads, preprocessing application to static analysis.

### Unit III

7 hrs

**NC, CNC, DNC Technologies:** NC, CNC, DNC, modes, NC elements, advantages and limitations of NC, CNC functions of computer in DNC. CNC Tooling, turning tool geometry, milling tooling system, tool presetting, ATC holding.

### Unit IV

8 hrs

**CNC Machine Tools:** overview of different CNC machining centers, CNC turning centers, high speed machine tools, MCU. CNC Programming, part program fundamentals, steps involved in development of a part program. Computer assisted part programming for milling and turning

### Unit V

8 hrs

**Computer aided Process Planning:** Planning functions, Approaches, benefits of CAPP, Machinability Data Systems. Introduction to Robotics, robot configuration, robot motion, programming of robots, end effectors work cell, control and interlock, robot sensor, robot applications. Overview of FMS, Virtual manufacturing, Smart manufacturing

## Course Outcomes

- CO1. Describe basic structure of CAD workstation, memory types, input/output devices and display devices and computer graphic
- CO2. Acquire the knowledge of geometric modeling and execute the steps required in CAD software
- CO3. Explain fundamental and advanced features of CNC machines
- CO4. Illustrate Robotics, CAPP and CIM concepts.

## Text Books

1. CAD\CAM principles and application, P.N.Rao TATA McGraw hill.
- 2.CAD\CAM, M.P.Groover, Tata McGraw hill.

## Reference Books

1. Introduction to the design and analysis of Algorithms- S.E. Goodman, S.T. Headetmiemi, McGraw Hill Book, 1988



2. Principles of Interactive Computer Graphics by Newman and Sproull, Tata McGraw Hill, 1955.
3. NC Machine Programming and Software Design- Chno-Hwachang, Michel.A.Melanoff, Prentice Hall, 1989.
4. Numerical control and CAM, Pressman RS and Williams UE, John Wiley.

### *Professional Elective I*

#### **18IM5PE51: MAINTENANCE & SAFETY ENGINEERING**

Credits: 3-0-0-3      CIE: 50      SEE:50      Total Marks:100

#### **Course objectives**

- 1 To Introduce the students to the field of maintenance & safety Engineering
- 2 To enable effective use of maintenance planning & scheduling concepts in handling maintenance projects
- 3 To facilitate the students the importance of pollution control devices that are used to control pollution & noise
- 4 To enable the students the significance of industrial safety

#### **Unit I**

8 hrs

**Introduction:** Definition, scope, objective, function and importance of maintenance system, types of maintenance system, Breakdown Maintenance System, Preventive maintenance, Predictive maintenance, design out maintenance, corrective maintenance, Planned maintenance, total productive maintenance and condition monitoring

#### **Unit II**

7 hrs

**Economics in Maintenance:** Repair, Replacement, Repair complexity, Finding outmost optimal preventive main tenance frequency

#### **Unit III**

8 hrs

**Maintenance Planning & Scheduling:** Planning of maintenance, junctures, man power allocation, long range planning, Short range planning.Planning techniques and procedures, Estimation of maintenance work, Maintenance control.

## Unit IV

8 hrs

**Industrial Safety:** Economic importance of accidents, Types of safety organizations, Analysis of accident records, accident investigations, Analysis of accident Safety standards for Mechanical equipment. Electrical equipment and Systems, Chemical hazards, Material handling, Plant house Keeping, 5S concept, building, Aisles, passages, floors, tool cribs, washrooms, canteens.

## Unit V

8 hrs

**Industrial Pollution Control:** Dust control Fiber collectors, mechanical dust collectors, wet type collectors, Electro Static precipitators, Noise pollution Control, Noise measurement and control, Industrial vibration and its control. Computers in Maintenance Engineering: Features and benefits of Computer aided maintenance, Application of computers to maintenance work.

## Course Outcomes

- CO1. Understand the objectives and functions of maintenance & safety Engg.,
- CO2. Describe the various categories of maintenance & safety system
- CO3 Understand & justify the maintenance planning & scheduling
- CO4. Understand the importance of safety Engg., & to introduce various industrial safety devices

## Text Books

1. Maintenance Engineering and Management by RC. Mishra and K.Pathak, Prentice Hall of India, 2002
2. Maintenance Engineering Handbook by Morrow.

## Reference Books

1. Hand Book of Maintenance anagement, Frank Herbaty
2. Hand Book of Industrial Engg & Mgmt, W. Grant Lreson & Eugene L-Grant
3. Industrial Pollution Control Handbook : LUND4
4. Industrial Management, H P Garg
5. Maintenance Engineering Hand Book by Lindrey Higgins, McGraw Hill, 6<sup>th</sup> edition 2003

# 18IM5PE52: ARTIFICIAL INTELLIGENT MANUFACTURING

Credits: 3-0-0-3      CIE: 50      SEE:50      Total Marks:100

## Course Objectives:

1. Aims to give students an understanding of the main abstractions and reasoning techniques used in AI.
2. To represent and inference first-order logic; modern deterministic and decision
- 3.To learn theoretic planning techniques and basic supervised learning methods
- 4.To aquent with modern machining methods.

## Unit I

8 Hrs

**Artificial Intelligence:** Introduction, definition, underlying assumption, important of AI, AI & related fields State space representations, defining a problem, production systems and its characteristic, search and control strategies Introduction, preliminary concepts, examples of Search problems.

## Unit II

7 Hrs

**Uniformed or Preliminary Concepts:** Examples of search problems, Uniformed or Blind Serach, Informed Search, Or Graphs, Heuristic Search techniques Generate and Test, Hill climbing, best first search, problem reduction, constraint satisfaction, Means Ends Analysis.

## Unit III

8 Hrs

**Knowledge Representation Issues:** Representations and Mapping, Approaches, Issues in Kr, Types of Knowledge procedural Vs Declarative, Logic programming, Forward Vs Backward reasoning, Matching, Non monotonic reasoning and logic.

**Use of Predicate Logic:** Representing simple facts, Instance and is a relationships, Syntax and Semantics for Propositional logic, FOPL, and properties of Wffs, conversion to causal form, Resolution, Natural deduction.

## Unit IV

8 Hrs

**Statistical and Probabilistic Reasoning:** Symbolic reasoning under uncertainly, Probability and Bayes' theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster Shafer Theory, Fuzzy Logic.

**Expert Systems:** Introduction, Structure and uses, Representing and using domain knowledge, Expert System shells. Pattern recognition, introduction, Recognition and classification process, learning classification patterns, recognizing and understanding speech.

## Unit V

8 Hrs

**Introduction to Knowledge Acquisition:** Types of learning, General learning model, and performance measures.

**Typical Expert Systems:** MYCIN, Variants of MYCIN, PROSPECTOR, DENDRAL, PUFF etc.

**Introduction to Machine Learning:** Perceptrons, Checker Playing examples, Learning, Automata, Genetic Algorithms, Intelligent Editors.

### Course outcomes

- CO1. Use various symbolic knowledge representations to specify domains and reasoning tasks of a situated software agent.
- CO2. Use different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
- CO3. Understand the conceptual and computational trade-offs between the expressiveness of different formal representations.
- CO4. Communicate scientific knowledge at different levels of abstraction.

### Text Books

1. Artificial intelligence Elaine Rich & Kevin Knight, M/H 1983.
2. Artificial intelligence in business, Science & Industry Wendry B.Ranch, Vol II application, Ph 1985.

### Reference Books

1. A guide to expert systems waterman, D.A., Addison wesley inc. 1986.
2. Building expert systems Hayes, Roth, Waterman, D.A (ed), AW 1983.
3. Designing expert systems weis, S.M. and Kulliknowske, London Champion Hull 1984.

*Open Elective I*

**18ME5OE61: INDUSTRIAL DESIGN & ERGONOMICS**

Credits: 3-0-0-3      CIE: 50      SEE:50      Total Marks:100

**Course objectives:**

1. To understand the methods and procedures of designing the industrial products
2. To design the man machine systems ergonomically.
3. To eliminate unnecessary work for effective utilization of men and machines
4. To study the most effective procedures of Industrial Design in Practice

Unit-I 8 Hrs

**Industrial design:** Elements of design structure for industrial design in engineering application in modern manufacturing systems. Ergonomics and Industrial Design: Introduction -general approach to the man-machine relationship- workstation design-working position.

Unit-II 8 Hrs

**Control and Displays:** Shapes and sizes of various controls and displays multiple, displays and control situations -design of major controls in automobiles, machine tools etc. Applied Anthropometry and Work Space: Anthropometry, Use of anthropometric data, work space and its design, science of seating, work place design,

Unit-III 7 Hrs

**Visual Effects of Line and Form:** The mechanics of seeing- psychology of seeing, general influences of line and form, elements of visual design

Unit-IV 7 Hrs

**Colour and light:** Colour and objects- colour and the eye colour consistency- colour terms- reactions to colour and colour continuation - colour on engineering equipments.

Unit-V

9 Hrs

**Aesthetic Concepts:** Concept of unity- concept of order with variety - concept of purpose style and environment- Aesthetic expressions. Style components of style- house style, observation style in capital goods. Industrial Design in Practice: General design -specifying design equipments- rating the importance of industrial design - industrial design in the design process, working with specialists, ways of using industrial engineers.

### **Course Outcomes:**

- CO1: Learn the concept of industrial design and the ergonomics.
- CO2: Design the various controls and displays by knowing the anthropometric data.
- CO3: Learn the psychology of visuals effects & colour combinations for optimal design of engineering equipments.
- CO4: Realize the importance of environmental factors and aesthetics in industrial design.

### **Text Books**

1. Industrial Design for Engineers - Mayall W.H. London Hiffee books Ltd. -1988
2. Human Factors in Engineering design - Sanders & McCormick – McGraw Hill – 6<sup>th</sup> Edition, 2012

### **Reference Books**

1. Applied Ergonomics Hand Book - Brain Shakel (Edited) - Butterworth scientific. London - 1988.
2. “Work study and ergonomics”- S.Dalela and Sourabh- standard book house.

## 18ME50E62: ENGINEERING ECONOMICS

Credits: 3-0-0-3      CIE: 50      SEE:50      Total Marks:100

### Course objectives

1. Ability to understand and explain problem solving & decision making process in Engineering Economy
2. Ability to apply Engineering Economy tools to compare alternative proposals
3. Ability to analyze alternative proposals using Engineering Economy tools
4. Ability to evaluate alternative proposals using Engineering Economy tools

### Unit I

8hrs

**Introduction:** Principles of Engineering Economy, Engineering Decision- Makers, Engineering and Economics, Decision Makers and Decision making, Problems solving, Intuition and Analysis, Tactics and Strategy.

**Interest and Interest Factors:** Interest rate, simple interest, Compound interest, Cash-flow diagrams, Exercises and Discussion.

### Unit II

7hrs

**Present Worth Comparisons:** Condition for present worth comparisons, Basic present worth comparisons, present worth equivalence, Net Present worth, Assets with unequal lives, Infinite lives, Future worth comparisons, Pay-back comparisons, Exercises, Discussions and problems.

Unit III 8hrs

**Equivalent Annual Worth Comparisons:**

Equivalent Annual Worth Comparison methods, Situations for Equivalent Annual Worth Comparison, Consideration of asset life, Comparison of asset with equal and unequal lives, Use of shrinking fund method, Annuity contract for guaranteed income, exercises, problems.

Unit IV 8Hrs

**Replacement Analysis:** Introduction, Reasons for replacement, Individual Replacement of machinery or equipment with/without value of money, Group Replacement Policies, Problems

**Break Even Analysis:** Basic concepts, Assumptions of BE, Graphical methods of reducing BEP, Profit-Volume ratio, Problems on BEP.

Unit V 8hrs

**Depreciation and Effect of Inflation:** Causes of depreciation, basic methods of computing depreciation charges, Causes, consequences and control of inflation. After tax actual cash flow comparisons, Lease/Buy decisions.

**Estimating and Costing:** Components of costs such as Direct Material Cost, Direct Labor Cost, Fixed Over-Heads, Factor Cost, Administrative Over-Heads, First Cost, Marginal Cost, Selling price, Estimation for simple components.

**Course Outcomes:**



CO1. Students will be able to perform and evaluate present worth, future worth and annual worth analyses

CO2. Perform and evaluate payback period and capitalized cost on one or more economic alternatives.

CO3. Carry out and evaluate benefit/cost and life cycle

CO4. Draw Breakeven analyses on one or more economic alternatives

### **Text Books**

1. Engineering Economy, Riggs J.L, McGraw Hill, 2002
2. Engineering Economy, THUESEN H.G, PHI,2002

### **Reference books**

1. Engineering Economy, Tarachand
2. Industrial engineering and management O.P Khanna, Dhanpat rai & sons
3. Financial management I M Pandey, Vikas publishing house
4. Engineering Economy, PAUL DEGARMO, Macmillan Pub Co,2001

## **18IM507: PRODUCTION TECHNOLOGY LAB**

Credits: 0-0-2-1      CIE: 50      SEE:50      Total Marks:100

### **Course Objectives:**

To provide an insight into different sand preparation and foundry equipments, forging tools and practically demonstrate precautions to be taken during casting and hot working.

### **Part – A**

#### **Testing of Moulding sand and Core sand:**

1. Preparation of sand specimens and conduction of the following tests:

Compression, Shear and Tensile tests on Universal Sand Testing Machine.

2. Permeability test
3. Core hardness & Mould hardness tests.
4. Sieve Analysis to find Grain Fineness number of Base Sand
5. Clay content determinations in Base Sand
6. Moisture content test

### **Part – B**

#### **Foundry Practice:**

1. Use of foundry tools and equipments.
2. Preparation of moulds using two moulding boxes using patterns or without Patterns. (Split pattern, Match plate pattern and Core boxes).
3. Preparation of one casting (Aluminum or cast iron-Demonstration only)

#### **Course Outcomes**

Students will be able to demonstrate the knowledge and necessary skills to perform sand testing and preparation of moulds.

#### **Reference Book:**

1. Foundry Technology, O P Khanna

#### **Scheme of Examination:**

One question is to be set from Part-A =15 marks

One question is to be set from Part-B = 25 marks

Viva-Voce = 10 marks.                      Total = 50 Marks

## **18IM508: MANUFACTURING SYSTEMS LAB**

Credits: 0-0-2-1    CIE: 50    SEE:50    Total marks:100

### **Course Objective**

The students should be able to understand the concept of manual part programming using ISO codes for machining.

#### **Part - A**

Writing and execution of manual part programming using ISO codes for machining of simple parts- turning, taper turning, form turning and thread cutting. Use of radius compensation, canned cycles, macros and etc.

#### **Part- B**

1. CNC milling- Writing and execution of part program for contour milling and etc.
2. Simulation of Cutting / Milling operations on a computer using CAM packages.

Note: Minimum 10 part programs from each part.

### **Course outcomes**

The students will be able to write and execute the programming codes using CAM packages.

### **Reference book:**

1. M.P. Groover Automation and Computer Integrated Manufacture Ibrahim Zeid CAD/CAM

### **Scheme of Examination:**

One Question from Part A : 15 Marks

One Question from Part B : 25 Marks

Viva Voce : 10 Marks

## **18SK601: SKILL DEVELOPMENT-III**

Credits: 0-0-2-1    CIE: 50    SEE:50    Total marks:100

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**Department: Placement and Training department**  
**Semester: V**

**Subject Name: Skill development III (Communication Skills and Professional ethics)**

**Subject Code: 18SK501**

**L-T-P-C: 0-0-2-1**

**Course Objectives:**

SI.No	Course Objectives
1	Understand their own communication style, the essentials of good communication and develop their confidence to communicate effectively
2	Manage stress by applying stress management skills
3	Ability to give contribution to the planning and coordinate Team work
4	Ability to analyze make problem solving decisions related to ethics

Unit	Description	Hours
I	<b>Communication Skills:</b> Basics, Method, Means, Process and Purpose, Basics of Business Communication, Written & Oral Communication, Listening. Communication with Confidence & Clarity- Interaction with people, the need the uses and the methods, Getting phonetically correct, using politically correct language, Debate & Extempore.	06
II	<b>Assertive Communication-</b> Concept of Assertive communication, Importance and applicability of Assertive communication, Assertive Words, being assertive. Presentation Skills- Discussing the basic concepts of presentation skills, Articulation Skills, IQ & GK, How to make effective presentations, body language & Dress code in presentation, media of presentation.	04

III	<p><b>Team Work-</b> Team Work and its important elements Clarifying the advantages and challenges of team work Understanding bargains in team building Defining behavior to sync with team work Stages of Team Building Features of successful teams.</p> <p><b>Body Language &amp; Proxemics</b> - Rapport Building -Gestures, postures, facial expression and body movements in different situations, Importance of <i>Proxemics, Right personal space to maintain with different people.</i></p>	06
IV	<p><b>Motivation and Stress Management:</b> Self-motivation, group motivation, leadership abilities, Stress clauses and stress busters to handle stress and de-stress; Understanding stress - Concept of sound body and mind, Dealing with anxiety, tension, and relaxation techniques. Individual Counseling &amp; Guidance, Career Orientation. Balancing Personal &amp; Professional Life</p>	06
V	<p><b>Professional Practice</b> - Professional Dress Code, Time Sense, Respecting People &amp; their Space, Relevant Behavior at different Hierarchical Levels. Positive Attitude, Self Analysis and Self Management.</p> <p><b>Professional Ethics</b> - values to be practiced, standards and codes to be adopted as professional engineers in the society for various projects. Balancing Personal &amp; Professional Life</p>	06
<p><b>Note: The respective departments should discuss case studies and standards pertaining to their domain</b></p>		

### Scheme of Continuous Internal Examination (CIE):

#### Evaluation will be carried out in TWO Phases.

Phase	Activity	Weightage
I	Test 1 is conducted in V Sem for 50 marks after completion of 2.5 units for 14 hours of training sessions.	50%
II	Test 2 is conducted in VSem for 50 marks after completion of half of III unit and complete of unit IV and V for 14 hours of training sessions.	50%

**At the end of the Vsem Marks of Test 1 and Test 2 is consolidated for 50 marks and grading is done.**

**Reference books**

<b>Sl No</b>	<b>Text Book title</b>	<b>Author</b>	<b>Volume and Year of Edition</b>
<b>1</b>	"The 7 Habits of Highly Effective People"	Stephen R Covey	Free Press, 2004 Edition, ISBN: 0743272455
<b>2</b>	"How to win friends and influence people"	Dale Carnegie	General Press, 1 <sup>st</sup> Edition, 2016, ISBN: 9789380914787
<b>3</b>	"Crucial Conversation: Tools for Talking When Stakes are High"	Kerry Patterson, Joseph Grenny, Ron Mcmillan	McGraw-Hill Publication, 2012 Edition, ISBN: 9780071772204
<b>4</b>	Aptimithra: Best Aptitude Book	Ethnus	Tata McGraw Hill, 2014 Edition, ISBN: 9781259058738



**SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY, TUMKUR**  
**DEPARTMENT OF INDUSTRIAL ENGG. & MANAGEMENT**

**Curriculum for the year 2020-21**

**VI Semester**

Sl. No	Course Code	Course Title	Hours/week			
			L	T	P	C
1. PC	18IM601	Operations Management	3	1	0	4
2. PC	18IMI602	Work Study & Ergonomics	3	0	2	4
3. PC	18IM603	Simulation Modelling & Analysis	3	1	0	4
4. PE	18IM6PE4x	Professional Elective II	3	0	0	3
5.OE	18ME6OE5x	Open Elective II	3	0	0	3
6.PC	18IM6MP01	Mini Project	0	0	4	2
7.PC	18IM607	Industrial Engineering Lab	0	0	2	1
8.PC	18IM608	Simulation Lab	0	0	2	1
9.HS	18SK601	Skill Development-IV	0	0	2	1
Total			15	02	12	23

Professional Elective II

Sl No	Course Code	Course Title
1	18IM6PE41	Materials Management
2	18IM6PE42	Marketing Management

Open Elective II

Sl No	Course Code	Course Title
1	18ME6OE51	Product Design and development
2	18ME6OE52	Energy Management
3	18ME6OE53	Operations Research



## 18IM601: OPERATIONS MANAGEMENT

Credits: 3-1-0-4      CIE: 50      SEE:50      Total Marks:100

### Course objectives:

1. To understand Historical developments of O.M
2. To expose the students with an view of the decision-making process in the major areas of Operations Management
3. To study the importance of operations planning
4. To understand production controlling activity in shop floor

### Unit I

12 hrs

**Operations Management Concepts:** Introduction, Historical development. The trend: Information and Non-manufacturing systems, Operations management, the environment of operations, Production systems decisions- a look ahead, frame work for managing operations, a strategic roll of operations, role of models, Factors affecting productivity. Operations Decision Making, Management as a science, Characteristics of decisions, Framework for decision making, Decision methodology, Decision support systems, Economic models, Statistical models.

### Unit II

8 hrs

**Forecasting Demand:** Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods. Time series methods, Exponential smoothing, Regression and correlation methods, Application and control of forecasts.

### Unit III

10 hrs

**Aggregate Planning and Master Scheduling:** Introduction- planning and scheduling, Objectives of aggregate are planning, Aggregate planning methods, Master scheduling objectives, Master scheduling methods.

### Unit IV

12 hrs

**Material and Capacity Requirements Planning:** Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities. Scheduling and Production Controlling Activities, Objectives and Data requirements. Scheduling strategy and guidelines, Scheduling methodology, priority control, capacity control.

Unit V

10 hrs

**Machine Scheduling:** Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule. Flow –shop scheduling, Johnson’s rule for ‘n’ jobs on 2 and 3 machines, CDS heuristic. Job-Shop Scheduling, Types of schedules, Heuristic procedure, scheduling 2 jobs on ‘m’ machines.

**Course Outcomes**

- CO1. Students will be able to understand the operations Management for different scenario.
- CO2. Students are able to forecast the market demand, capacity requirement and material requirement.
- CO3. Students are able to analyse and take decision regarding capacity related problems
- CO4. Students are able to plan aggregate planning, MRP and short scheduling.

**Text Books**

- 1. Productions & operations management - Adam & Ebert.5<sup>th</sup> edition PHI, 1998
- 2. Production and Operations Management -Pannerselvam. R., 2<sup>nd</sup> edition PHI. learning private ltd. 2<sup>nd</sup> ed. 2008

**Reference Books**

- 1. Modern Production/Operations Management -Buffa, Wiely Eastern Ltd., 4<sup>th</sup> edition
- 2. Production and Operations Management- Chary, S.N., Tata-McGraw Hill., 3<sup>rd</sup> edition
- 3. Operations management - James Dilworth. PHI, 3<sup>rd</sup> edition
- 4. Operations Management -Lee J Karjewski and Larry P Ritzman,– strategy and Analysis, 6<sup>th</sup> Edn, Pearson Education Asia

## 18IMI602: WORK STUDY AND ERGONOMICS

Credits: 3-0-2-4      CIE: 50      SEE:50      Total Marks:100

### Course Objectives:

1. To understand the concept of Productivity
2. To study the elements of Workstudy
3. To study the procedures which are most effective and procedures which require the least effort
4. To design the man machine systems

### Unit I

8 hrs

**Productivity & Work study:** Basic needs, Quality of life and Productivity, Definition of productivity, Productivity in the individual enterprise, The task of Management, Definition of Work study, How the total time of a job is made up, Interrelationship of the various methods used to reduce ineffective time, Work study as a valuable tool, Techniques and Basic procedure of work study, direct means of raising productivity.

### Unit II

8 hrs

**Method study:** Definition, Procedure, Selection of work, Process chart symbols, Outline and flow process charts, critical examination, Flow and string diagrams, Multiple activity chart, Travel chart, Principles of motion economy, classification of movements, Two-handed process chart, SIMO chart, and micro motion study, other recording techniques, Development of improved methods, define, install and maintain.

### Unit III

10 hrs

**Work measurements:** Definition, purpose, uses, procedure, techniques. Work sampling: Need, determination of sample size, procedure for selecting random observations, conduction of study with the simple problems, Time study: Definition, time study equipment, selecting the job, basic steps in time study, Recording the information, breaking the jobs into elements, types of elements, determination of sample size, timing elements by stop-watch, rating and standard rating, factors affecting rate of working, scales of rating, determination of basic time, allowances and standard time

determination, Predetermined time standards, Definition, advantages and criticisms, Applications, motion time study- Methods Time Measurement (MTM).

Unit IV

6 hrs

**Introduction to Ergonomics:** Introduction, Consequences of not using Ergonomics, areas of study covered under ergonomics, system approach to ergonomics models, Man-Machine system, characteristics of Man-Machine system, work capabilities of industrial worker, Functions performed by Man and Mechanism involved, General principles for carrying out the physical activities, development of stress in human body and their consequences.

Unit V

7 hrs

**Design of Man-machine system:** Fatigue in industrial workers, quantitative, qualitative representation and alphanumeric displays, controls and their design criteria, control types, relation between controls and displays, layouts of panels and machines, design of work place, influence of climate on human efficiency, influence of noise, vibration and light.

**Course Outcomes:**

- CO1. The Students will be able solve the practical problems in methods, Engineering work measurement and ergonomics
- CO2. The Students will be able solve the practical problems in methods, Engineering work measurement and ergonomics
- CO3. The Students will be able solve the practical problems in methods, Engineering work measurement and ergonomics
- CO4. The students will realize the importance of environmental factors on the worker performance

**Text books**

1. Introduction to work study-ILO, 3<sup>rd</sup> revised edition. 1981
2. S.Dalela and Sourabh, "Work study and ergonomics", Standard book house

### Reference books

1. "Motion and time study", R.M. Barnes. John Wiley International, 8<sup>th</sup> edition.
2. "Human factors in Engineering design", M.S.Sunders and E.J.Mckormic, 5<sup>th</sup> edition, Mcgraw Hill.
3. Engineering work measurements, D .Kharger and F.H.Bahya; Weldon, ELBS

### Integrated Lab:

1. To construct Flow diagram
2. To draw Outline Process chart & Flow process chart
3. To draw Man-Machine chart
4. Fatigue parameters using Walking simulator & Ergometer
5. Effect of Noise & Light on Human Efficiency

### 18IM603: SIMULATION MODELING & ANALYSIS

Credits: 3-1-0-4      CIE: 50      SEE:50      Total Marks:100

### Course objectives:

1. To apply knowledge of mathematics and engineering to discrete event simulation problems
2. To provide accurate description to the random number generation, input modeling and output analysis.
3. To understand the comparison of alternative system design.
4. To determine appropriate simulation models to solve real world problems

### Unit I

08 hrs

**Introduction to simulation:** Simulation, advantages, Disadvantages, areas of application, System environment, components of a system, Model of a system, types of models, steps in a simulation study.

- Unit II 12 hrs  
**Simulation Principles:** Simulation of Queuing systems, Simulation of Inventory system. Concepts in discrete – events simulation, event scheduling/ Time advance algorithm, simulation using event scheduling
- Unit III 10 hrs  
**Random numbers:** Properties, Generation methods, Tests for random number- Frequency test, Runs test, Autocorrelation test, gap test, poker test.
- Unit IV 12 hrs  
**Random Variate generation:** Inverse transform technique, exponential, uniform, weibull, triangular distributions, convolution methods, Erlang distributions, Acceptance- rejection techniques- Poisson distributions, gamma distribution. Analysis of simulation data, Input Modeling, Data collection, Identification and distribution with data, Goodness of fit tests.
- Unit V 10 hrs  
**Verification and validation of model** – model building, verification, calibration and validation of models. Optimization via simulation, meaning, difficulty, robust heuristics, random search. Simulation software, selection of simulation software, simulation packages, experiment and statistical analysis tool, trend in simulation software

### Course outcomes

- CO1. Understand the capabilities of discrete event simulation and apply simulation modeling to solve simple real-world situations
- CO2. Generate and test random numbers, variates and apply them to develop simulation models
- CO3. Test for statistical distribution to input data
- CO4. Evaluate the suitability of available simulation packages in relation to particular requirements, analyse and validate

### **Text Books**

1. Discrete Event system simulation- Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol, III Edition, Pearson Education, Asia, ISBN-81-7808-505-4.
2. Systems Simulation with Digital Computer – Narsingh Deo; PHI Publication (EEE), ISBN-0-87692-028-8

### **Reference Book**

1. Simulation Modeling & Analysis- Averill M Law, W David Kelton, McGraw Hill International Editions - Industrial Engineering series, ISBN-0-07-100803-9.

## ***Professional Elective II***

### **18IM6PE41: MATERIALS MANAGEMENT**

Credits: 3-0-0-3      CIE: 50      SEE:50      Total Marks:100

### **Course objective:**

1. To Explore the concept & fundamentals of materials management
2. To understand the price-cost analysis learning curve and demonstrate the vendor rating.
3. To Visualize the concept of budget and statistics and scope of purchasing and trace the different ways of policies and procedures of purchasing.
4. To Analyze and compute EOQ models.

### **Unit I**

8 hrs

**An Overview of Materials Management(MM):** Objectives and Functions of MM, MM at Micro-level and Macro-level, Inventories of Materials, Total Concept-Definition, Benefits of Integrated system approach. Materials Planning, Definition, Materials planning factors at Micro-level and Macro-level, Materials Cycle and Flow Control System, Materials Budget.

Unit II

7 hrs

**Purchasing:** Fundamental Objectives and Functions of Purchasing, Purchasing Principles, Procedures and Practices, Supplier's evaluation and Selection, Purchasing Policy and Procedures - Purchase Budgets, Centralized and decentralized purchasing, Purchasing through DGSD rate contracts.

Unit III

8 hrs

**Stores Keeping:** Organization for stores, Functions of store keeping, Receipt, Inspections, LIFO, FIFO, Average cost and other methods of accounting and issue. Two-bin systems of inventory control, Control of damage, Detritions pilferage and obsolescence of goods, Stores Location and Layout, Centralization and Decentralization of Stores, Standardization and Variety Reduction, The Codification systems, Merits and Demerits of Codification system.

Unit IV

9 hrs

**Inventory Management:** Need, Scope and importance of inventory, Objectives and Functions of inventory management, Lead time analysis and safety stock planning with respect to procurement policy. Inventory costs, Materials planning in JIT, ERP, Selective Inventory control (ABC, FSN and VED only). Deterministic Inventory Models, Classification of inventory models, Economic Order Quantity(EOQ), Models of Instantaneous and finite rate of replenishment with and with out shortage, Models with price brake and quantity discount

Unit V

7 hrs

**Materials Management Information System and Computer:** MIS - Management and MM, Computer MIS - Management and MM, Computer System for MIS and MM, In-process Materials and Management Control. Supply Chain Management in MM, Supply Chain Concept, Supply Chain Metrics, Organizational Implications.



### Course outcomes:

- CO1. Identify the fundamental concepts of materials management, purchasing, storing, and inventory
- CO2. Design a basic purchasing system
- CO3. Develop basic inventory policies, relationship between Vendor and Vendee.
- CO4. Identify the fundamental concepts of MIS and SCM

### Text Books

- 1. Materials Management - A.K. Datta - PHI Pvt. Ltd, New Delhi - 2009.
- 2. Introduction to Materials Management - Steve Chapman & Tony Arnold-, Pearson, 2016.

### Reference Books

- 1. Handbook of Materials Management - P.Gopalakrishnan - PHI Pvt. Ltd, New Delhi - 2002.
- 2. Principles of Operations Research Theory and Practice - Philips, Ravindran and Soleberg – Wiley, India Pvt., Ltd.
- 3. Operations Research - S.D. Sharma ,4<sup>th</sup> edition, 2009

## 18IM6PE42: MARKETING MANAGEMENT

Credits: 3-0-0-3      CIE: 50      SEE: 50      Total Marks: 100

### Course Objectives

- 1. Make students have an understanding of the concepts of marketing and the marketing system
- 2. Make students understand evolution of marketing and the emphasis on each stage
- 3. Make students understand the marketing system, and marketing environment
- 4. Make students have clear understanding of the marketing mix and functions

### Unit I

8 Hrs

**Introduction:** Historical development of marketing management, Definition of Marketing, Core marketing concepts, Marketing Management philosophies, Micro and

Macro Environment, importance of marketing in the India Socio economics system. Marketing Information Systems and Research: Components of marketing information system benefits & uses marketing research system, marketing research procedure, measurement of market demand.

Unit II

8 Hrs

**Consumer Markets and Buying Behavior:** Characteristics affecting Consumer behavior, Types of buying decisions, buying decision process, Classification of consumer products, Market Segmentation. Marketing of Industrial Goods: Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behaviour, characteristics of industrial market demand. Determinants of industrial market demand Buying power of Industrial users, buying motives of Industrials users, the industrial buying process, buying patterns of industrial users

Unit III

7 Hrs

**Product Planning and Development:** The concept of a product, features of a product, classification of products, product policies product planning and development, product line, product mix factors influencing change in product mix, product mix strategies, meaning of New product; major stages in new product development, product life cycle.

Unit IV

8 Hrs

**Pricing, Branding, Labelling and Packaging:** Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions. Branding, Labeling and Packaging: Branding, Reasons for branding, functions of branding, features and types of brands, kinds of brand name. Labeling: Types, functions, advantages and disadvantages. Packaging: Meaning, growth of packaging, function of packaging, kinds of packaging.

Unit V

8 Hrs

**Distribution:** Marketing channels functions, types of channels of distribution, number of channel levels. Physical distribution importance, total systems concept, strategy, use of physical distribution. Advertising and Sales Promotion: Objectives of advertisement function of advertising, classification of advertisement copy, advertisement media kinds of media, advantages of advertising. Objectives of sales promotion, advantages sales promotion. Personal Selling: Objectives of personal selling,

establishing the Sales force objectives, sales force strategy, sales force structure and size, salesmanship, qualities of good salesman, types of salesman, major steps in effective selling. Overview of Digital marketing.

### **Course Outcomes**

- CO1. Differentiate between the various elements in the various stages of the marketing evolution.
- CO2. Know the functions performed by marketing in the economy
- CO3. Know the marketing strategies to achieve profitability
- CO4 Know how to control the marketing mix variables in order to achieve organisational goals

### **Text Books**

1. Marketing Management - Philip Kotler , Prentice Hall, 12<sup>th</sup> Edn.
2. Marketing Management - Michael R Czinkota, , 2<sup>nd</sup> Edition, Vikas Publishing House, ISBN 981-240-366-3

### **Reference Books**

1. Principles of Marketing - Philip Kotler , Prentice Hall. 11<sup>th</sup> Edn
2. Fundamentals of Marketing - William J Stanton, McGraw Hill, 1994
3. Marketing Management - S.A Sherlaker, ”, 1999.
4. Marketing Management Text & Cases. Rajagopal, - Vikas Publishing House, ISBN 81-259-0773-4

*Open Elective II***Department: MECHANICAL ENGINEERING****Semester: VI****Subject Name: PRODUCT DESIGN AND DEVELOPMENT****Subject Code: 18ME6OE51****L-T-P-C: 3-0-0-3**

SI.No	Course Objectives	
1	Competence with a set of tools and methods for product design and development.	
2	Confidence in your own abilities to create a new product.	
3	Awareness of the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, engineering, production).	
4	Ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective and enhance team-working skills.	
UNIT	DESCRIPTION	HOURS
<b>I</b>	<b>Introduction:</b> Characteristics of successful product development, Design and development of products, duration and cost of product development, the challenges of product development. Development Processes and Organizations, the front-end process, adopting the generic product development process, the AMF development process, product development organizations, the AMF organization.	<b>08</b>
<b>II</b>	<b>Product Planning:</b> The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process. <b>Identifying Customer Needs:</b> Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process.	<b>08</b>

III	<p><b>Product Specifications:</b> What are specifications, when are specifications established, establishing target specifications, setting the final specifications.</p> <p><b>Concept Generation:</b> The activity of concept generation, clarifies the problem, search externally, search internally, explore systematically, and reflect on the results and the process. Concept Selection, Overview of methodology, concept screening, and concept scoring,</p>	08
IV	<p><b>Concept Testing:</b> Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, reflect on the results and the process.</p> <p><b>Industrial Design:</b> Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process and assessing the quality of industrial design</p>	08
V	<p><b>Design for Manufacturing:</b> Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors. Prototyping, Prototyping basics, principles of prototyping, technologies, planning for prototypes.</p>	08

### Question paper Pattern:

Two questions to be set from each unit and student have to answer any one question from each unit. Totally 5Q need to be answered by the students.

### Course Outcomes:

Course outcome	Descriptions
CO1	Understand the product design and development process.
CO2	Apply creative thinking skills for idea generation.
CO3	Translate conceptual ideas into products.
CO4	Present ideas using various types of model.

**Text Books:**

<b>Sl No</b>	<b>Text Book title</b>	<b>Author</b>	<b>Volume and Year of Edition</b>
1	Product Design and Development	Karl.T.Ulrich, Steven D Eppinger - Irwin	McGrawHill – 2012, Fifth Edition.

**Reference Books:**

<b>Sl No</b>	<b>Text Book title</b>	<b>Author</b>	<b>Volume and Year of Edition</b>
1	Product Design and Manufacturing	A C Chitale and R C Gupta	PH1, - 3rd Edition, 2003.
2	New Product Development -	TimjonesButterworth Heinmann	Oxford. UCI - 1997
3	Product Design for Manufacture and Assembly	Geoffery Boothroyd,	Peter Dewhurst and Winston Knight – 2002

**Department: MECHANICAL ENGINEERING**

**Semester: VI**

**Subject Name: ENERGY MANAGEMENT**

**Subject Code: 18ME6OE52**

**L-T-P-C: 3-0-0-3**

Sl.No	Course Objectives	
1	To impart knowledge in the domain of energy conservation.	
2	To bring out Energy Conservation Potential and Business opportunities across different user segments under innovative business models.	
3	To inculcate knowledge and skills about assessing the energy efficiency of an entity/ establishment.	
UNIT	DESCRIPTION	HOURS
I	<p><b>Energy Management Principles:</b> General energy problem, Energy use patterns and scope of conservation, Need, Organizing, Initiating and managing an energy management program.</p> <p><b>Energy Auditing:</b> Elements and concepts, Types of energy audits, Instruments used in energy auditing.</p>	08
II	<p><b>Economic Analysis:</b> Cash flows, Time value of money, Formulae relating present and future cash flows - single amount, uniform series.</p> <p><b>Financial appraisal methods:</b> Payback period, Net present value, Benefit-cost ratio, Internal-rate of return &amp; Life cycle costs/benefits.</p>	08
III	<p><b>Thermodynamics of energy conservation:</b> Energy conservation in Boilers and furnaces, Energy conservation in Steam and condensate system.</p> <p><b>Cogeneration:</b> Concepts, Types of cogeneration systems, Performance evaluation of a cogeneration system</p>	08
IV	<b>Heat Recovery:</b> Potential, benefits, waste heat	08

	recovery equipments. SpaceHeating, Ventilation Air Conditioning (HVAC) and water heating of building, Transfer of heat, Space heating methods, Ventilation and air conditioning, Heat pumps, Insulation, Cooling load, Electric water heating systems, Electric energy conservation methods.	
<b>V</b>	<b>Industrial Insulation:</b> Insulation materials, Insulation selection, Economical thickness of insulation. <b>Industrial Heating:</b> Heating by indirect resistance, direct resistance heating (salt bath furnace), Heat treatment by induction heating in the electric arc furnace industry	<b>07</b>

### Question paper Pattern:

Two questions to be set from each unit and student have to answer any one question from each unit. Totally 5Q need to be answered by the students.

### Course Outcomes:

<b>Course outcome</b>	<b>Descriptions</b>
<b>CO1</b>	The students will be able to become efficient energy managers.
<b>CO2</b>	The students will be able to know different energy auditing methods and the implementation procedures.
<b>CO3</b>	The students will be able to plan for the energy requirement and management by adopting appropriate energy saving devices.



**Text Books:**

Sl No	Text Book title	Author	Volume and Year of Edition
1	Electric Energy Utilization and Conservation	S. C. Tripathy	TMG Delhi, 1991.
2	Energy Management Handbook	Wayne C. Turner	Wiley Interscience Publication, NY, 1982.

**Reference Books:**

Sl No	Text Book title	Author	Volume and Year of Edition
1	Industrial Energy Conservation	D. A. Reay	Pergamon Press. 1980.
2	Thermal Energy Recovery	T. L. Boten	MIT Press.

**18ME60E53: OPERATIONS RESEARCH**

Credits: 3-0-0-3      CIE: 50      SEE:50      Total Marks:100

**Course Objectives:**

1. To equip the students with the knowledge based on OR models for problem solving and decision making situations in organizations.
2. To develop mathematical model for interactive decision making situations, where competitors are involved under conditions of conflict.
3. To design & develop OR models for real life situations.
4. To construct the Network activities in an efficient manner.

- Unit – I 8 Hours  
**Introduction:** Definition & Methodology of OR, Historical development, Phases of OR study, Models of OR, Application to Engineering & Managerial problems, Features and Limitation of OR.  
**Linear programming:** Definition, mathematical formulation, standard form, Solution space, Types of solution – feasible, basic feasible, optimal, infeasible, multiple, Redundancy, Degeneracy, Graphical method.
- Unit – II 7 Hours  
**Simplex Method:** Variants of simplex algorithm – Artificial basis techniques, Big-M method
- Unit – III 8 Hours  
**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, Applications of Transportation problems.
- Unit – IV 8 Hours  
**Assignment problem:** Formulation of the Assignment problem, unbalanced assignment problem, Variants in assignment problem, Traveling salesman problems.  
**Game theory,** Formulations of games, Strategies, Two-person-zero sum game, games with and without saddle point, Dominance property, Graphical solutions ( $2 \times n$ ,  $m \times 2$  games).
- Unit-V 8 Hours  
**Project management using network analysis:** Network construction, Rules for drawing network, common errors, CPM, Determination of critical path and duration, Floats. Project Evaluation & Review Technique- Estimation of probability of project duration, variance, Optimum duration and cost of Project.

**Course outcomes:**

CO1: Understand the various optimization models and their areas of application.

CO2: Understand the mathematical tools that are needed to solve optimization problems.

CO3: Explain the process of formulating & solving problems using OR methods

CO4: Develop & analyse the models for real life problems using OR techniques.

**Text Books**

1. Operation Research an introduction- Taha H A, PHI 8<sup>th</sup> Edition, 2009, ISBN: 0130488089.
2. Introduction to Operation Research- Hiller and Libermann, Nag, Basu, Tata McGraw Hill 9<sup>th</sup> edn, 2012, ISBN 13 : 978-0—07-133346-7.

**Reference Books**

1. Operations Research – Kanthi Swarup & others, Sultan chand and Sons. 2002
2. Operations Research, S.D. Sharma, Kedarnath, Ramnath &Co, 1996
3. Operations Research Theory and Application- J K Sharma, Pearson Education Pvt Ltd ,4<sup>th</sup> Edn, 2009, ISBN- 13: 978-0-23-063885-3.
4. Principles of Operations Research- Philips, Ravindram and Soleberg– Theory and Practice, PHI, 2<sup>nd</sup> Edition, 2007, ISBN 13: 978-81-265-1256-0.

## **18IM6MP01: MINIPROJECT**

Credits: 0-0-4-2      CIE: 50      SEE:50      Total Marks:100

### **Course Objectives**

Students should be able to apply Industrial Engineering concepts and techniques in design and development of conceptual models.

The students come out with an conceptual model idea and in group of minimum two and maximum of four members. They should design, develop and fabricate the conceptual model.

### **Course Outcomes**

The students will be able to identify the fundamental concepts of conceptual model design, development and fabrication/manufacturing methods and techniques and enhance their practical knowledge.

Project Report, Presentattion, Demonstration and quality of work-	30 Marks
Viva-Voce	- 20 Marks
Total	- 50 Marks



## **18IM608: SIMULATION LAB**

Credits: 0-0-2-1      CIE: 50      SEE:50      Total Marks:100

### **Course Objectives**

To understand the concepts of simulation packages and build the models for material handling systems

1. Features of Simulation Packages and building simulation models for inventory, Layout, Line balancing, Scheduling and other such shop floor activities. 6 exercises
2. Building simulation models for service activities like banking transactions, Food world chains Material handling systems like conveyors and transporters 3 exercises
3. Obtaining of probability distributions for given data using input analyzer. 1 exercise
4. Statistical analysis of simulation models 2 exercises

### **Suggested Packages**

Arena/Quest/Promodel/Witness/SPSS

### **Course outcomes**

The students will be understand the simulations models and their applications in industries.

### **Reference Books**

1. Simulation Modeling & Analysis-Averill M Law,W David Kelton

### **Scheme of Examination**

One question from each part- 20 marks

Viva -10 marks

Total -50 marks

**18SK601: SKILL DEVELOPMENT IV**

Credits: 0-0-2-1      CIE: 50      SEE:50      Total Marks:100

**Department: TRAINING & PLACEMENT DEPARTMENT****Semester: VI****Subject Name: SKILL DEVELOPMENT IV (Employability skills and professional development of engineers)****Subject Code: 18SK601****L-T-P-C: 0-0-2-1**

<b>Sl.No</b>	<b>Course Objectives</b>
1	Improve qualitative and quantitative problem solving skills
2	Apply critical and logical thinking process to specific problems

<b>UNIT</b>	<b>DESCRIPTION</b>	<b>HOURS</b>
I	<i>Aptitude Test Preparation- Importance of Aptitude tests, Key Components, Quantitative Aptitude – Problem Solving, Data Sufficiency, Data Analysis - Number Systems, Math Vocabulary, fraction decimals, digit places etc. Reasoning and Logical Aptitude - Introduction to puzzle and games organizing information, parts of an argument, common flaws, arguments and assumptions. Analytical Reasoning, Critical Reasoning,</i>	06

II	<p><i>Verbal Analogies - What are Analogies, How to Solve Verbal Analogies &amp; developing Higher Vocabulary, Grammar, Comprehension and Application, Written Ability. Non- Verbal Reasoning, Brain Teasers. Creativity Aptitude.</i></p> <p><b>Group Discussion-</b> Theory &amp; Evaluation : Understanding why and how is the group discussion conducted, The techniques of group discussion, Discuss the FAQs of group discussion, body language during GD</p>	06
III	<p><i>Resume Writing- Writing Resume, how to write effective resume,</i> Understanding the basic essentials for a resume, Resume writing tips Guidelines for better presentation of facts.</p> <p><b>Technical Documentation–</b> Introduction to technical writing- Emphasis on language difference between general and technical writing, Contents in a technical document, Report design overview &amp; format Headings, list &amp; special notes, Writing processes, Translating technical information, Power revision techniques, Patterns &amp; elements of sentences, Common grammar, usage &amp; punctuation problems.</p>	06
IV	<p><i>Interview Skills</i> -a) Personal Interviews , b) Group Interviews , c) Mock Interviews - <i>Questions asked &amp; how to handle them, Body language in interview, Etiquette, Dress code in interview, Behavioral and technical interviews, Mock interviews</i> - Mock interviews with different Panels. Practice on stress interviews, technical interviews, General HR interviews etc</p>	06
V	<p><i>Interpersonal Relations - Optimal Co-existence, Cultural Sensitivity, Gender sensitivity Adapting to the Corporate Culture- Capability &amp; Maturity Model, Decision Making Analysis, Brain Storm. Adapting to the Corporate Culture</i></p>	06
<p><b>Note: The respective departments should discuss case studies and standards pertaining to their domain</b></p>		



**Question paper Pattern:**

Two questions to be set from each unit and student have to answer any one question from each unit. Totally 5Q need to be answered by the students.

**Scheme of Continuous Internal Examination (CIE)**

Evaluation will be carried out in TWO Phases.

Phase	Activity	Weightage
I	Test 1 is conducted in VI Sem for 50 marks after completion of 2.5 units for 14 hours of training sessions.	50%
II	Test 2 is conducted in VI Sem for 50 marks after completion of half of III unit and complete of unit IV and V for 14 hours of training sessions.	50%
At the end of the VI sem Marks of Test 1 and Test 2 is consolidated for 50 marks and grading is done.		

**Reference Books:**

SI No	Text Book title	Author	Volume and Year of Edition
1	"The 7 Habits of Highly Effective People"	Stephen R Covey	Free Press, 2004 Edition, ISBN: 0743272455
2	"How to win friends and influence people"	Dale Carnegie	General Press, 1 <sup>st</sup> Edition, 2016, ISBN: 9789380914787

<b>3</b>	“Crucial Conversation: Tools for Talking When Stakes are High”	Kerry Patterson, Joseph Grenny, Ron Mcmillan	McGraw-Hill Publication, 2012 Edition, ISBN: 9780071772204
<b>4</b>	“Aptimithra: Best Aptitude Book”	Ethnus	Tata McGraw Hill, 2014 Edition, ISBN: 9781259058738