

UNIT III DESIGN OF VESSELS **15**
 Design of Tall cylindrical self supporting process columns – Supports for short vertical vessels – Stress concentration at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of Reinforcement – Pressure Vessel Design.

UNIT IV BUCKLING AND FRACTURE ANALYSIS IN VESSELS **8**
 Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

UNIT V PIPING **4**
 Introduction – Flow diagram – piping layout and piping stress Analysis.

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of this course, the students can able to apply the mathematical fundamental for the design of pressure vessels and pipes. Further they can able to analyse and design of pressure vessels and piping.

TEXT BOOK:

1. John F. Harvey, "Theory and Design of Pressure Vessels", CBS Publishers and Distributors, 1987.

REFERENCES:

1. Henry H. Bedner, "Pressure Vessels, Design Hand Book", CBS publishers and Distributors, 1987.
2. Stanley, M. Wales, "Chemical process equipment, selection and Design". Buterworths series in Chemical Engineering, 1988.
3. William. J., Bees, "Approximate Methods in the Design and Analysis of Pressure Vessels and Piping", Pre ASME Pressure Vessels and Piping Conference, 1997.
4. Sam Kannapan, "Introduction to Pipe Stress Analysis". John Wiley and Sons, 1985.

IM8691	VALUE ENGINEERING AND PROJECT MANAGEMENT	L T P C
		3 2 0 4

OBJECTIVE:

- To give a brief account of the value analysis and engineering tool for productivity improvement through project management.

UNIT I VALUE ENGINEERING BASICS **9+6**
 Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function – Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

UNIT II VALUE ENGINEERING JOB PLAN AND PROCESS **9+6**
 Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

UNIT III PROJECT FORMULATION AND APPRAISAL **9+6**
 Project Management – An overview, Feasibility and Technical analysis, Marketing feasibility, Financial and Economic feasibility, Formulation of Detailed Project Reports (DPR).

UNIT IV PROJECT IMPLEMENTATION AND CONTROL 9+6

Project planning, Project organization, Tools and techniques of project management, Project management Information system, Human resources, Financial aspects.

UNIT V PROJECT COMPLETION AND EVALUATION 9+6

Monitoring and Control of project, Integrated project management control system, Managing transition from project to operations, project review.

TOTAL:75 PERIODS

OUTCOME:

- The Student must be able to apply the value engineering principles to plan execute and manage projects.

TEXT BOOKS:

1. Mudge, Arthur E. "Value Engineering- A systematic approach", McGraw Hill, New York, 2000.
2. Kerzner, H. "Project Management A system for approach to planning, scheduling and controlling" 2nd Rf/CBS publishers, Delhi, 2002.

REFERENCES

1. Choudhury, S. "Project Scheduling and Monitoring in Practice", South Asian Publishers, New Delhi, 2001.
2. Goodman, L.J. "Project Planning and Management – An integrated system for improving productivity", Van Norstand, New York, 2000.
3. Gopalakrishnan. P., "Text book of Project Management", Macmillan, India, 2000.

MG8791

SUPPLY CHAIN MANAGEMENT

**L T P C
3 0 0 3**

OBJECTIVE:

- To provide an insight on the fundamentals of supply chain networks, tools and techniques.

UNIT I INTRODUCTION 9

Role of Logistics and Supply chain Management: Scope and Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles.

UNIT II SUPPLY CHAIN NETWORK DESIGN 9

Role of Distribution in Supply Chain – Factors influencing Distribution network design – Design options for Distribution Network Distribution Network in Practice-Role of network Design in Supply Chain – Framework for network Decisions.

UNIT III LOGISTICS IN SUPPLY CHAIN 9

Role of transportation in supply chain – factors affecting transportations decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation.

UNIT IV SOURCING AND COORDINATION IN SUPPLY CHAIN 9

Role of sourcing supply chain supplier selection assessment and contracts- Design collaboration - sourcing planning and analysis - supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT V SUPPLY CHAIN AND INFORMATION TECHNOLOGY**9**

The role IT in supply chain- The supply chain IT frame work Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain –E-Business in supply chain.

TOTAL: 45 PERIODS**OUTCOME:**

- The student would understand the framework and scope of supply chain networks and functions.

TEXT BOOK :

1. Sunil Chopra, Peter Meindl and Kalra, “Supply Chain Management, Strategy, Planning, and operation”, Pearson Education, 2010.

REFERENCES:

1. David J.Bloomberg , Stephen Lemay and Joe B.Hanna, “Logistics”, PHI 2002.
2. James B.Ayers, “Handbook of Supply chain management”, St.Lucle press, 2000.
3. Jeremy F.Shapiro, “Modeling the supply chain”, Thomson Duxbury, 2002.
4. Srinivasan G.S, “Quantitative models in Operations and Supply Chain Management”, PHI, 2010.

RO8091 INDUSTRIAL DESIGN AND APPLIED ERGONOMICS**L T P C
3 0 0 3****OBJECTIVES:**

- To explain the general principles that governs the interaction of humans in their working environment
- To improve improving worker performance and safety.
- To know about the environmental conditions in the industry.
- To know about bio thermodynamics and bioenergetics
- To know about the human factors in industrial aspects

UNIT I INTRODUCTION**12**

Definition, human technological system, multidisciplinary engineering approach, human–machine system, manual, mechanical, automated system, human system reliability, conceptual design, advanced development, detailed design and development. INFORMATION INPUT: Input and processing, text, graphics, symbols, codes, visual display of dynamic information, auditory, tactual, olfactory displays, speech communications.

UNIT II HUMAN OUTPUT AND CONTROL**12**

Physical work, manual material handling, motor skill, human control of systems, controls and data entry devices, hand tools and devices.

WORKPLACE DESIGN:

Applied anthropometry, workspace design and seating, arrangement of components within a physical space, interpersonal aspects of work place design, design of repetitive task, design of manual handling task, work capacity, stress, and fatigue.

UNIT III ENVIRONMENTAL CONDITIONS**11**

Illumination, climate, noise, motion, sound, vibration, colour and aesthetic concepts. BIOMECHANICS: Biostatic mechanics, statics of rigid bodies, biodynamic mechanics, human body kinematics, kinetics, impact and collision.

UNIT IV BIOTHERMODYNAMICS AND BIOENERGETICS 5
Biothermal fundamentals, human operator heat transfer, human system bioenergetics, thermoregulatory physiology, human operator thermo regularity, passive operator, active operator, heat stress.

UNIT V HUMAN FACTORS APPLICATIONS 5
Human error, accidents, human factors and the automobile, organizational and social aspects, steps according to ISO/DIS6385, OSHA"s approach, virtual environments.

TOTAL : 45 PERIODS

OUTCOMES:

The Student should

- Know about ergonomic principles to design workplaces
- improve human performance
- judge the environmental conditions in the work place.
- know about biothermodynamics and bioenergetics
- implement latest occupational health and safety to the work place.

TEXT BOOK:

1. Chandler Allen Phillips, "Human Factors Engineering", John Wiley and Sons, New York, 2000.

REFERENCES:

1. Bridger R S, "Introduction to Ergonomics", Taylor and Francis, London, 2003.
2. Mayall W H, "Industrial Design for Engineers", London ILIFFEE Books Ltd., UK, 1998.
3. Mark S Sanders, "Human Factors in Engineering and Design", McGraw Hill, New York, 1993.

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MF8091

PACKAGING MATERIALS AND TECHNOLOGY

**L T P C
3 0 0 3**

OBJECTIVE:

- To study the fundamentals of packaging, manufacturing process, packaging materials and package testing.

UNIT I FUNDAMENTALS OF PACKAGING 9

Definition, functions of packaging, types and selection of package, Packaging hazards, interaction of package and contents, materials and machine interface, Environmental and recycling considerations - life cycle assessment Package Design - Fundamentals, factors influencing design, stages in package development, graphic design, Structural design – simulation softwares

UNIT II PACKAGING MATERIALS 9

Major Plastic packaging materials viz. Polyolefins, Polystyrene, Polyvinylchloride, Polyesters, Polyamides (Nylons), Polycarbonate and newer materials such as High Nitrile Polymers, Polyethylene Napthalate (PEN), Nanomaterials, biodegradable materials – properties and applications, recycling; Wood, Paper, Textile, Glass, Metals - Tin, Steel, aluminum, Labelling materials, Cushioning Materials – properties and areas of application.

UNIT III CONVERSION TECHNOLOGY 9

Extrusion – Blown film, cast film, sheet, multilayer film & sheet, Lamination, Injection moulding, Blow moulding, Thermoforming; Cartoning Machinery, Bottling, Can former, Form Fill and Seal machines, Corrugated box manufacturing machineries, Drums – types of drums, moulded pulp containers, Closures, Application of Robotics in packaging.

Surface treatment for printing, Printing processes – offset, flexo, gravure and pad printing.

UNIT IV SPECIALITY PACKAGING**9**

Aerosol packaging, Shrink and Stretch wrapping, Blister packaging, Anti-static packaging, Aseptic packaging, Active packaging, Modified Atmospheric Packaging, Ovenable package; Cosmetic packaging, Hardware packaging, Textile packaging, Food packaging; Child resistant and Health care packaging, Export packaging, Lidding, RFID in packaging.

UNIT V TESTING**9**

Package Testing – Drop test, Impact test, Vibration Test, Stacking and Compression test, Packaging Materials Testing: Mechanical – Tensile, tear burst, impact, compression test, Elongation, barrier properties - WVTR test, Adhesion test, Optical – Gloss, haze and clarity; Chemical Resistance test – solvents and chemicals, solubility test, burning test, solvent retention; Hardness and corrosion test for metals; Clarity and brittleness test for glass.

TOTAL :45 PERIODS**OUTCOMES**

- Ability to effectively use diffuse packing materials.
- Ability to test packaging materials.

TEXT BOOKS

1. Aaron L.Brody & Kenneth S.Marsh, “Encyclopedia of Packaging Technology”, John Wiley Interscience Publication, II Edition, 1997.
2. Athayle. A.S., “Plastics in Flexible Packaging”, Multi-tech Publishing Co., First Edition, 1992.
3. Daniel Lu and C P Wong, “Materials for Advanced Packaging” Springer,2008
4. Paine. F.A., “Fundamentals of Packaging”, Brookside Press Ltd., London, 1990.
5. S. Natarajan, “Fundamentals of Packaging Technology” Kindle Edition. 2009

REFERENCES:

1. Anne Emblem, “Packaging Technology: Fundamentals, Materials and Processes” (Woodhead Publishing in Materials) ,2012
2. Arthur Hirsch, “Flexible Food Packaging”, Van Nostor and Reinhold, New York, 1991.
3. Bill Stewart, “Packaging Design Strategies”, Pira International Ltd, 2nd Edition 2004.
4. Danger. E.P., “Selecting Colour for Packaging”, Grover Technical Press, 1987.
5. Gunilla Johnson, “Corrugated Board Packaging”, PIRA International, 1993.
6. Mark J.Kirwar, “Paper and Paperboard Packaging Technology”, Blackwell Publishing, 2005
7. “Handbook of Package Design Research”, Water stem Wiley Intrascience, 1981.
8. Paine, “Packaging Development”, PIRA International, 1990.
9. Susan E.M.Salke & et al, Plastics Packaging, Hansar, 2nd edition 2004.

IE8791**DESIGN OF EXPERIMENTS****L T P C
3 0 0 3****AIM:**

- This course aims to introduce students how to statistically plan, design and execute industrial experiments for process understanding and improvement in both manufacturing and service environments

OBJECTIVES:

- To demonstrate knowledge and understanding of Classical Design of Experiments (DOE)
- To demonstrate knowledge and understanding of Taguchi’s approach
- To develop skills to design and conduct experiments using DOE and Taguchi’s approach
- To develop competency for analysing the data to determine the optimal process parameters that optimize the process.

UNIT I FUNDAMENTALS OF EXPERIMENTAL DESIGNS 9

Hypothesis testing – single mean, two means, dependant/ correlated samples – confidence intervals, Experimentation – need, Conventional test strategies, Analysis of variance, F-test, terminology, basic principles of design, steps in experimentation – choice of sample size – Normal and half normal probability plot – simple linear and multiple linear regression, testing using Analysis of variance.

UNIT II SINGLE FACTOR EXPERIMENTS 9

Completely Randomized Design- effect of coding the observations- model adequacy checking - estimation of model parameters, residuals analysis- treatment comparison methods- Duncan's multiple range test, Newman-Keuel's test, Fisher's LSD test, Tukey's test- testing using contrasts- Randomized Block Design – Latin Square Design- Graeco Latin Square Design – Applications.

UNIT III FACTORIAL DESIGNS 9

Main and Interaction effects - Two and three factor full factorial designs- Fixed effects and random effects model - Rule for sum of squares and Expected Mean Squares- 2^K Design with two and three factors- Yate's Algorithm- fitting regression model- Randomized Block Factorial Design - Practical applications.

UNIT IV SPECIAL EXPERIMENTAL DESIGNS 9

Blocking and Confounding in 2^K Designs- blocking in replicated design- 2^K Factorial Design in two blocks- Complete and partial confounding- Confounding 2^K Design in four blocks- Two level Fractional Factorial Designs- one-half fraction of 2^K Design, design resolution, Construction of one-half fraction with highest design resolution, one-quarter fraction of 2^K Design- introduction to response surface methods, central composite design.

UNIT V TAGUCHI METHODS 9

Design of experiments using Orthogonal Arrays, Data analysis from Orthogonal experiments- Response Graph Method, ANOVA- attribute data analysis- Robust design- noise factors, Signal to noise ratios, Inner/outer OA design- case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- To understand the fundamental principles of Classical Design of Experiments
- To apply DOE for process understanding and optimisation
- To describe the Taguchi's approach to experimental design for process performance robustness
- To apply Taguchi based approach to evaluate quality

TEXT BOOK:

1. Douglas C. Montgomery, "Design and Analysis of Experiments", John Wiley & sons, 2012.

REFERENCES:

1. Krishnaiah K, and Shahabudeen P, "Applied Design of Experiments and Taguchi Methods", PHI, India, 2011.
2. Phillip J. Ross, "Taguchi Techniques for Quality Engineering", Tata McGraw-Hill, India, 2005.
3. Box, G. E., Hunter, W.G., Hunter, J.S., Hunter, W.G., "Statistics for Experimenters: Design, Innovation, and Discovery", 2nd Edition, Wiley, 2005.