UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025

REGULATIONS - 2009

CURRICULUM I TO IV SEMESTERS (FULL TIME)

M.E. PRINTING AND PACKAGING TECHNOLOGY

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA9105	Probability and Statistical Methods	3	1	0	4
2.	PR9111	Fundamentals of Packaging	3	0	0	3
3.	PR9112	Package Design	3	0	0	3
4.	PR9113	Print Production Process	3	0	0	3
5.	PR9114	Security Printing	3	0	0	3
6.	E1	Elective I	3	0	0	3
PRACTICAL						
7.	PR9115	Package Design Laboratory	0	0	4	2
		TOTAL	**18**	**1**	**4**	**21**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PR9121	Packaging Performance and Testing	3	0	0	3
2.	PR9122	Plastics Packaging	3	0	0	3
3.	PR9123	Printing Inks and Coatings	3	0	0	3
4.	PR9124	Packaging Machinery and Distribution	3	0	0	3
5.	E2	Elective II	3	0	0	3
6.	E3	Elective III	3	0	0	3
PRACTICAL						
7.	PR9125	Package Testing Laboratory	0	0	4	2
		TOTAL	**18**	**0**	**4**	**20**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	E4	Elective IV	3	0	0	3
2.	E5	Elective V	3	0	0	3
3.	E6	Elective VI	3	0	0	3
PRACTICAL						
4.	PR9131	Project work Phase I	0	0	12	6

5.	PR9132	Industrial Training*	0	0	0	1
		TOTAL				16

* 4 Weeks of Industrial Training during earlier semester vacations

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1.	PR9141	Project Work – Phase II	0	0	24	12
		Total				12

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE: 69

ELECTIVES FOR M.E. PRINTING AND PACKAGING TECHNOLOGY

Sl. No.	Code No.	Course Title	L	T	P	C
1.	PR 9150	Paper and Board Packaging	3	0	0	3
2.	PR 9162	Glass, Wood and Metal Packaging	3	0	0	3
3.	PR 9152	Package Attributes – Shelf Life	3	0	0	3
4.	PR 9153	Food Packaging	3	0	0	3
5.	PR 9154	Healthcare Packaging	3	0	0	3
6.	PR 9155	Packaging Laws and Regulations	3	0	0	3
7.	PR 9156	Offset Printing Technology	3	0	0	3
8.	PR 9157	Packaging Economics	3	0	0	3
9.	PR 9158	Brand Management	3	0	0	3
10.	PR 9159	Packaging and Environment	3	0	0	3
11.	PR 9160	Flexo, Gravure and Screen Printing	3	0	0	3
12.	CI 9158	Design for Manufacturing	3	0	0	3
13.	FD 9114	Principles of Food Processing & Preservation	3	0	0	3
14.	IE 9169	Project Management	3	0	0	3
15.	CI 9167	Information System Analysis and Design	3	0	0	3

16.	PR 9161	Ergonomics in Packaging	3	0	0	3
17.	IE 9124	Supply Chain Management	3	0	0	3
18.	IE 9167	Industrial Safety and Hygiene	3	0	0	3
19.	PD 9152	Creativity in Design	3	0	0	3
20.	IE 9159	Decision Support Systems	3	0	0	3
21.	BA 9127	Business Research Methods	3	0	0	3
22.	QE 9156	Lean Six Sigma	3	0	0	3
23.	IE 9155	Total Quality Management and System	3	0	0	3

MA 9105 PROBABILITY AND STATISTICAL METHODS **L T P C**
3 1 0 4

UNIT I ONE DIMENSIONAL RANDOM VARIABLES 9

Random variables-Probability function- moments- moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and normal distributions – Functions of a Random variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY 9

Unbiased Estimators – Method of moments – Maximum likelihood Estimation – Curve fitting by principle of least squares – Regression lines.

UNIT IV TESTING OF HYPOTHESIS 9

Sampling distributions- Type I and Type II errors – Tests based on normal, t, χ^2 and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V MULTIVARIATE ANALYSIS 9

Covariance matrix – Correlation Matrix – Multivariate Normal density function – Principal components – Sample variation by principal components – Principal components by graphing.

TOTAL : 60 L+T: 45+15

REFERENCES

1. Richard Johnson, Miller & Freund's Probability and statistics for Engineers, 7th Edition, Prentice –Hall of India, Private Ltd., New Delhi (2007).
2. Richard A.Johnson and Dean W, Wichern, Applied Multivariate Statistical Analysis, 5th Edition, Pearson Education, Asia (2002).
3. Gupta, S.C and Kapoor, V.K. "Fundamentals of Mathematical Statistics, Sultan and Sons, New Delhi (2001).
4. Jay L.Devorer, Probability and Statistics for Engineering and the Sciences, Thomson and Duxbbury, Singapore (2002).
5. Dallas E Johnson et al., Applied multivariate methods for data analysis, Thomson and Duxbbury Press, Singapore (1998).

PR 9111 FUNDAMENTALS OF PACKAGING **L T P C**
3 0 0 3

AIM

To provide an overview of packaging needs, types, technologies

OBJECTIVE

- To introduce the need and importance of packaging
- To impart knowledge about types of packaging, packaging materials, machineries

UNIT I OVERVIEW OF PACKAGING **7**

Definition, Need, Packaging Functions, Types, Standards, Package Development, Package specifications, Package Distribution, Pre-shipment testing, Quality control, Laws and Regulations, Environmental issues

UNIT II PACKAGING MATERIALS AND PROCESSES **9**

Packaging materials, Container types, Conversion Processes, Specialty Packaging, Packaging Line, Machinery selection, Selection of packaging material and type, Economics

UNIT III FMCG PACKAGING **12**

Requirements for FMCG packaging: Cosmetics, Textile, Footwear, Toiletries, Glassware, Consumer electronics, Hardware packaging, Electrostatic Discharge Protective Packaging

UNIT IV BULK PACKAGING **10**

Bulk packaging requirements, types; Industrial packaging - Steel containers, Fibre Drums, Plastic Drums, Corrugated boxes, Wooden crates, Sacks, Export packaging, Hazardous materials packaging

UNIT V PACKAGE FINISHING **7**

Lamination, Hot foil stamping, Die-cutting, Varnishing, Coatings, Labels – types, substrates, adhesives; Caps and seals, Security in packaging - Need, Materials, Techniques

TOTAL : 45

TEXT BOOKS

1. Walter Soroka, “Fundamentals of packaging technology”, 3rd Edition, Institute of packaging professionals, Naperville, Illinois, USA, 2002.
2. Joseph F. Hanlon, Robert J. Kelsey, and Hallie Forcinio, “Handbook of Package Engineering”, Third Edition, CRC press, 1998

REFERENCES

1. Aaron L. Brody and Kenneth S. Marsh, “The Wiley Encyclopedia of Packaging Technology”, 1997

PR 9112 PACKAGE DESIGN L T P C

3 0 0 3

AIM

To give an overview of package development process and package designing

OBJECTIVE

- To provide information on basic concepts in package designing, design considerations and design workflow.
- To learn about the package design and performance simulation softwares

UNIT I INTRODUCTION 9

Packaging and Modern Merchandising, Marketing Requirements, Brand Management, Product Lifecycle, Planning for change, Basic considerations of package development – structural development, packaging coordination, graphics, packaging line engineering, cost of development; Economic considerations: package cost vs. product cost

UNIT II PACKAGE DEVELOPMENT 9

Managing the Packaging Function, Project Scope, Consumer Research, Behavioral Measures, Eye Tracking and the features of a package, Optimizing Package Design, Package Development Process, Specifications, Benchmarks, Package Designer's Checklist, Introduction of testing and evaluation methods.

UNIT III GRAPHIC DESIGN 9

Demographics and Psychographics, The Retail Environment, Fundamental Messages, Equity and Brand Names, Role of Graphics, Text, Color, Graphic Design Basics, Package Design and Marketing Studies, Package Aesthetics, Decoration Aspects, Layout and Feature Selection.

UNIT IV STRUCTURAL DESIGN 12

Predicting package performance, Role of Structure, Structural Design – folding cartons, cans, glass containers, plastic containers, bags and pouches; Die-making, Drawing, Moulds, Prototypes, Samples, etc.

UNIT V SOFTWARES FOR DESIGNING 6

CAD software for Package Designing, drafting, mould design; Simulation software for package performance and manufacturing.

TOTAL : 45

TEXT BOOKS

1. Marianne R. Klimchuk and Sandra A. Krasovec, "Packaging Design: Successful Product Branding from Concept to Shelf", Wiley, 2006,
2. Walter Soroka, "Fundamentals of packaging technology", 3rd Edition, Institute of packaging professionals, Naperville, Illinois, USA, 2002

REFERENCES

1. Aaron L. Brody and Kenneth S. Marsh, "The Wiley Encyclopedia of Packaging Technology", 1997
2. Giles Calver, "What is Packaging Design?: Essential design handbook", Rotovision, 2004
3. Steven DuPuis, John Silva,"Package Design Workbook: The Art and Science of Successful Packaging", Rockport Publishers, 2008

PR 9113 PRINT PRODUCTION PROCESS L T P C
3 0 0 3

AIM

To impart the fundamentals of printing and digital printing process.

OBJECTIVE

- To provide information about various activities in the prepress & Press and their sequence
- To understand the different digital printing process, workflow and its applications
- To provide an overview about the print finishing processes and materials.

UNIT I FUNDAMENTALS OF PRINT PRODUCTION PROCESS 10

Conventional prepress – typography, graphic design, page make-up, platemaking, color theory; Relief process – letterpress, flexography; Planographic process – lithography, offset; Gravure process and Screen printing process; Printing presses – types.

UNIT II DIGITAL PREPRESS AND WORKFLOW 10

Digital prepress – scanner, digital screening processes; Digital images, Pixel based images, digitization of images, Digital work flow, Halftoning, Image and type rendering, colour gamut, image quality, spatial and tonal resolution of images, visual thresholds. Document formats for printing. Automation, Order Processing, Preflighting and Data Optimization, Versioning, Impositioning, Ripping and Calibration, PDF vs PS, Proofing, PDF – standards and Versions, Creation of PDF – within application, from acrobat, Crossmedia PDF; Screening – AM, FM, Hybrid, Rational and Irrational; Color management, Archiving.

UNIT III SETTING FOR PRESS AND POSTPRESS FOR DIGITAL ENVIRONMENT 5

Data Optimization in Prepress – Preparing files for ink optimization; Ink zone settings; Settings in output profile – TIL, GCR; Make-ready Optimization in Pressroom, Make-ready Optimization in Postpress, Process control – RIP, CTP, Proof, CPC Press.

UNIT IV IMPACT AND NON IMPACT PRINTING TECHNOLOGIES 15

Perspective, plotters, wire matrix printers, other impact printing technologies,Principles of electrophotographic, magneto and ionographic printing, sublimation, thermal, inkjet and other non impact printing technologies; Variable data, variable graphics printing; Designing and generation of variable contents.

UNIT V PRINT FINISHING PROCESSES AND MATERIALS 5

Print finishing – Classification, Steps – cutting, die-cutting, folding, gathering, securing, case-making, casing-in, edge decoration; Production flow – Newspaper mailroom, mailroom for magazine, finishing short print runs, Bag production systems; Ribbons, inks, toners, paper requirements.

TOTAL : 45

REFERENCES

1. Helmut Kipphan, “Handbook of Print Media”, Springer Publications, 2004
2. J. Michael Adams, Penny Ann Dolin, “Printing Technology”, Delmar Publishers, 2002.
3. Kaj Johansson, Peter Lundberg, Robert Ruberg, “ A Guide to Graphic Print Production”, Wiley, 2002
4. Robert C.Durbect, “Output Hardcopy Devices”, Academic Press, Inc, USA, 1988.
5. Frank Cost, “Pocket Guide to Digital Printing”, Delmar Publishers Inc, New York, 1997.
6. H.M.Fenton & F.J.Romano, “On Demand Printing”, GATF 1998.

PR 9114 **SECURITY PRINTING** **L T P C**
3 0 0 3

AIM

To familiarize various security features.

OBJECTIVE

- To get an understanding of various security features, materials and methods involved in Security Printing.

UNIT I CURRENCY PRINTING **10**

Creation & Graphics, Making of a bank note, Applications of Computers in Designing Currency, Signatures & numbering, Manufacture of Bank notes, Paper Specifications, Watermark & Other Protective devices, Digital Watermark Currency, Circulation & Bank maintenance, special issues counterfeiting.

UNIT II CHEQUE PRINTING, NUMBERING AND BAR CODING **15**

Introduction, Pre-Encoding and Post Encoding, Printing Tolerances, Testing equipment, E13B Characters, RBI Specifications, Principles of Cheque Design. Numbering with MICR Ink on Rotary presses, Trouble Shooting, Modulus Systems, Weighted & Unweighted. Introduction, Principles of Bar Coding, Types of Coding, EAN 13 Code, Code 39 ACA etc., Typical Bar Code Machines & Print wheels, Scanners and their functions.

UNIT III COMPUTER FORMS **5**

Paper Characteristics, Form Construction & Specification, Form Label Combination Intelligent Electronic forms, Form automation, Form Manufacture & Printing.

UNIT IV HOLOGRAMS, CREDIT CARDS & PASSPORTS **11**

Introduction, Manufacturing Process, Holographic Recording & Master Origination, Finishing Process, Types of Holograms, Security holograms, clickograms, sterogram, Anigram etc. Introduction, Materials used of specifications, Embossing, Magnetic Strip Recording and Specifications, Manufacturing techniques.

UNIT V SECURITY INKS & SUBSTRATES **4**

Introduction, UV curing, photochromic inks, Monochromic Inks, Invisible Phosphorescent inks, Water resistant inks. Thermochromic inks, Solvent Sensitive inks, optically variable ink, Magnetic inks, Biometric ink, Fugitive ink, Secondary fluorescing ink, Watermarks, Security Fibres, Planchettes, Fluorescent Hilites, Iridescent coating, Security threads, Holographic foil, Coloured centre paper.

TOTAL : 45

REFERENCES

1. Martin Monestics, “The Art of Paper Currency”, Quarlet Books Ltd., 1983.
2. Leibinger, “Numbering Machines and Systems”, Leibinger Numbering Systems, 2000.
3. William H.Erdei, “Bar Codes – Design, Printing and Quality Control”, McGrawHill inc., 1998.
4. R.Narayanan, “Computer Stationery and MICR – Cheque Production”, Association for Research and Development in Printing, 1998.

PR 9115	PACKAGE DESIGN LABORATORY	L	T	P	C
		0	0	4	2

LIST OF EXERCISES

1. Create Graphics Design for Folding cartons
2. Create Graphics Design for Glass containers
3. Create Graphics Design for Plastic containers
4. Create Graphics Design for Bags & Pouches
5. Create Graphics Design for Tin cans
6. Create Dieline layouts for folding cartons and their multiple ups
7. Create 3D Modelling and Package Performance Simulation for folding cartons
8. Create 3D Modelling and Package Performance Simulation for Glass containers
9. Create 3D Modelling and Package Performance Simulation for Plastic containers
10. Create 3D Modelling and Package Performance Simulation for Bags & Pouches
11. Create 3D Modelling and Package Performance Simulation for Tin cans

TOTAL : 45

LABORATORY SOFTWARE REQUIREMENTS

1. Adobe Photoshop CS3
2. Adobe Illustrator CS3
3. ProE

PR 9121 PACKAGE PERFORMANCE AND TESTING L T P C
3 0 0 3

AIM

To provide knowledge on hazards in transport and storage environment and to suitably design a protective package

OBJECTIVE

To describe in detail

- On transportation hazards like shock, vibration, compression, etc.,
- On quantification of the extent of damage by using suitable testing methods
- On steps in developing a protective packaging

UNIT I HAZARDS 6

Package Delivery System, Manual Handling, Warehouse handling equipments, Hazards - Transportation, Handling, Warehousing, Climatic, Others; Transportation Recorders, Defining Package Distribution environment, Simulation of Distribution Environment, Integrity Tests, Simulation tests

UNIT II SHOCK 9

Shock - Spring/mass model of product on cushion, Shock transmission, Damage boundary curve, Typical shock damage, Measure of shock fragility, Accelerometers/shock indicators, Environmental data recorders; Handling statistics - drop heights, carriers; Shock pulse analysis, Drop testing machines - shock table, incline tester, cushion tester; Pallet marshalling, railcar coupling, horizontal impact tester;

UNIT – III VIBRATION 9

Transportation environment, Vibration damage - Natural frequency, Vibration magnification and resonance; Vibration measurement and testing - Transportation surface profile, Random vibration testing, Replication/simulation; Geometric stability of unitized loads - banding, stretch wrap; Abrasion, Coefficient of friction; Electrostatic Discharge and vibration, Electrostatic Discharge protective materials.

UNIT IV COMPRESSION AND OTHER HAZARDS 9

Compression - Package compression strength, Compression testing, Warehouse /transportation factors, Stack height calculations, Clamp truck damage; Climatic Effects - Temperature, Pressure, Humidity, Light, Dust, Rain; Temperatures inside trailers - heat transfer, Insulating packages; Biological Hazards – Microorganisms, insects, Rodents; Contamination by other goods – adjacent packs, radioactivity;

UNIT V CUSHIONING SYSTEM AND PROTECTIVE PACKAGING 12

Cushions - materials, manufacture, solid vs loose fill, foam-in-place, Cushion properties - open vs closed cell, relation to ideal spring, Corrugated as a cushioning material, Selection of cushioning material, Cushion design, Determining cushion thickness

Steps in Design of protective packaging - Optimum Product/Package system, Prototype packages, Damage simulation; International standards for performance testing of shipping containers and units (ASTM, ISTA, ISO), Testing protocols.

TOTAL : 45

TEXT BOOK

1. Brandenburg, Richard K., Lee, Julian June-Ling, “Fundamentals of packaging dynamics”, 4th ed., L.A.B. Equipment, 2001

REFERENCES

1. Joseph F. Hanlon, Robert J. Kelsey, Hallie Forcinio, “Handbook of Packaging Engineering”, 3rd edition, CRC Press, 1998
2. Sek M. and Kirkpatrick J. , “Corrugated Cushion Design Handbook”, VUT, 2001

PR 9122 **PLASTICS PACKAGING** **L T P C**
3 0 0 3

AIM

To impart knowledge on polymeric packaging materials and their processing technologies

OBJECTIVE

- Explain the properties of a polymer material based on the structure and chemistry of the material
- Select suitable polymer material and technology for manufacturing of a particular type of packaging

UNIT I INTRODUCTION TO POLYMERS **9**

Basic concepts and definition, Interatomic, intermolecular forces in polymers, Cohesive energy, Polymerization techniques, Additives, Polymer structure and properties, Polymer properties and testing – Thermal, Mechanical, Barrier, Surfaces and Adhesion, Optical characteristics.

UNIT II MAJOR PLASTICS IN PACKAGING **12**

Polyethylene (HDPE, LDPE, LLDPE, Others), Polypropylene (Homopolymer, copolymer, OPP), Polystyrene, Polyvinyl chloride, Polyethylene terephthalate, PETG, Polyvinylidene chloride, Polyvinyl acetate, Polyvinyl alcohol, Ethylene vinyl alcohol, PEN, Nylon, Polycarbonate, Polytetrafluoroethylene, Polyacrylonitrile, Cellophane, Cellulose Acetate and cellulosics, Fluoropolymers, Styrene-Butadiene copolymers, Acrylonitrile copolymers, Liquid crystal polymers, Conductive polymers, Foaming Materials - Polystyrene foams, Styrene copolymer foams, Polyolefin foams, Polyurethane foams, Starch based foams, Thermoset – Phenol, Acrylic and urea formaldehyde.

UNIT III FLEXIBLE PACKAGING **8**

Polymer film and sheet, Extrusion – Introduction, principles, classification of extruders; Cast, Blown, Stretch and shrink films, Film and Sheet Coextrusion, Flexible Packaging - Bags, Pouches, Bag-in-box, Retort pouch, Collapsible tubes; Heat sealing – Methods, Material testing.

UNIT IV THERMOFORMING **7**

Heating Sheet – Temperature selection, Radiative heating; Forming – Drape, Vaccum, Pressure; Thermoforming variations- Skin, shrink, blister, Plug assist, billow, vacuum snap-back, matched mold, Types of molds, Scrapless, twin-sheet, spin-welding, Thermoforming of foams, Pallets/bulk containers, Material testing

UNIT V RIGID PACKAGING **9**

Injection molding, Injection blow molding, Extrusion blow molding, Compression molding, Continuous, Intermittent, Die shaping, Programmed parison, Stretch blow molding, Coextrusion blow molding, Plastic/composite tubes, Coinjection blow molding, Aseptic blow molding, In-mold labeling, Drums, Rotational molding, Design features, Plastic Closures, Injection Molds and Closure Design and Material testing

TOTAL : 45

TEXT BOOKS

1. Selke, S. E. M., Culter, J. D. and Hernandez, R. J., “Plastics Packaging: Properties, Processing, Applications and Regulations”, Carl Hanser Verlag, USA, 2004.

REFERENCES

1. Aaron L. Brody and Kenneth S. Marsh, “The Wiley Encyclopedia of Packaging Technology”, 2nd Edition, Wiley, 1997
2. Walter Soroka,”Fundamentals of packaging technology”, 3rd Edition, Institute of packaging professionals, 2002
3. A.S. Athayle, “Handbook of packaging plastics”, Multi Tech publishing co, First edition, 1999

PR 9123 PRINTING INKS AND COATINGS L T P C
3 0 0 3

AIM

To provide knowledge on printing inks used for different package printing process and coating methods.

OBJECTIVE

- To explain the properties of raw materials selected for printing inks used for different printing process and testing methods.
- To give the importance of coatings for different materials used for package printing and over view about Specialty coatings

UNIT I RAW MATERIALS 7

Colorants , Binder, Oils, and Additives – types, preparation , property requirements- offset inks, flexo inks, gravure inks and specialty inks.

UNIT II OFFSET INKS 9

Sheet fed inks- formulation, properties- viscosity, tack, color, drying characteristic, rub resistance, light fastness, finess of grind gauge, and testing.

UNIT III FLEXO, GRAVURE AND SCREEN INKS 12

Solvent based inks- Formulations- Material selection, properties, drying mechanisms.
Water based inks – Formulations- Pigments & dyes, acrylic binders, low voc solvents & additives. Ink properties- viscosity, pH, surface tension, testing, and drying mechanisms
UV based inks- Composition- pre polymer, photo initiators, diluents, colorants, and additives – formulations, properties, testing, light source-Selection & drying mechanisms.

UNIT IV COATINGS 10

Paper coatings- coating materials- methods-properties, lamination- types, materials used Metals- treatment, methods, corrosion-protection and coating types. Metallization- manufacturing process and properties. wood- varnishing types- matt &gloss finish and coatings. Plastics- surface treatment- chemical, plasma, corona –methods. Lamination and coatings.

UNIT V SPECIALTY COATINGS 7

Peelable medical coatings -types. Adhesives-pressure sensitive adhesives, self seal adhesives, Radiation curable coatings- Ultra violet and electron beam coatings, Hybrid coatings, Embossing, and special effects.

TOTAL : 45

REFERENCES

1. R.H.Leach," The printing Ink Manual," 5th edition, Chapman & Hall, London 2002
2. Nelson R.Eldred," What the Printer should know about Inks,"3rd edition, GATF press, 2001
3. Ronald E..Tood," Printing Inks – Formulations, Principles, Manufacture, and Quality control Testing," PIRA International1996
4. D. Satas and Arthur A. Tracton," Coating Technology- Handbook,2nd Edition, Marcel Dekker, Inc,2001
5. Lothar Gottschhing& Heikki Pakarinen,' Paper making science and Technology, FapetOY Publishing,2000

PR 9124 PACKAGING MACHINERY AND DISTRIBUTION L T P C
3 0 0 3

AIM

To understand about the different types of packaging machineries and to contribute to the productivity of packaging operations involved in various markets

OBJECTIVE

- Identify unit operations that comprise common packaging lines
- Specify operating requirements of individual packaging machines in order to allow groups of packaging machines to function as a coherent system.
- Understand the relationships between products, packages, machines, and personnel.

UNIT I INTRODUCTION 9

Types of packaging machinery, Packaging line layout and design principles, Impact of end-use markets on machine needs and specifications - biotech/pharmacy/medical devices/food/drinks/chemicals, Machine and line components & controls - PLC, HMI, Servo motors, Smart machines, SCADA systems, Displays, Sensors.

UNIT II PAPERBOARD AND FLEXIBLE PACKAGING MACHINE 9

Paperboard Packing Machinery – Cutting & Creasing, Embossing, Hot foil stamping, Folding & gluing machines, Cartoners, Case formers, Tray formers, Case/tray packer,; Flexible packaging machines – Bag former, Form-Fill-Seal - VFFS, HFFS, Rotary; Thermoform, Shrink/stretch wrapping and bundling, Types of Filling Machines, Wrapping Machines.

UNIT III RIGID PACKAGING MACHINERY 9

Orienter, Liquid fillers: Volumetric, Level or cosmetic fill, Aerosol, Carbonated; Dry fillers: Augur, Volumetric, Weight, Tablet fillers; Cappers, Tube filling, Can former, Labeling Machines – Stick on, Shrink sleeves, Capping - Induction Sealing

UNIT IV PACKAGING LINE 9

Conveyors, accumulators and unscramblers, Container cleaning - Air blast, Ionized air blast, Water rinse, Wash and rinse, Aggressive wash and rinse; Sterilization, Coding and marking, Scales and check weighing, Robots, Placers/dispensers Techniques for measuring line capacity and efficiency, On line – end of line systems, shrink and stretch wrapping, cartooning, Case erector, case packing; Product identification & verification – Barcodes, RFID Vision/inspection, Metal detectors and x-ray inspectors

UNIT V DISTRIBUTION PACKAGING 9

Distribution Packaging: A Systems Approach,Tracking Distribution Losses, Warehouse - Storage Types, Damage Control, Warehousing and Handling Equipments; Retailing, Break Bulks and Unit Load Devices, Case Packaging Machinery, Palletisation - Palletizing and depalletizing, Containerisation Packaging.

TOTAL : 45

TEXT BOOK

1. Davis, C.G., “Introduction to Packaging Machinery”, Packaging Machinery Manufacturers Institute, 1997

REFERENCES

1. A. L. Brody, K. S. Marsh, “The Wiley Encyclopedia of Packaging Technology”, 2nd Edition, Wiley, New York, USA, 1995
2. Luciano, R., “How to Write Packaging Machinery Specifications”, Institute of Packaging Professionals, Herndon, VA. 1995.
3. Zepf, P.J., “Improving Packaging Line Performance”, Institute of Packaging Professionals, Herndon, VA, 1996.

PR 9125 **PACKAGE TESTING LABORATORY**

L	T	P	C
0	0	4	2

LIST OF EXPERIMENTS

1. Determination of Tensile/compression strength of various packaging materials
2. Determination of Burst strength of various packaging materials
3. Determination of Crush strength of various packaging materials
4. Determination of Plybond strength of various packaging materials
5. Determination of Stiffness of various packaging materials
6. Determination of Scuff resistance of various packaging materials
7. Determination of Heat sealability of various packaging materials
8. Determination of gloss & haze of various packaging materials
9. Measure the color of a packaging material and compute color differences between different batches
10. Determination of permeability of various packaging materials
11. Determination of leaching of various packaging materials
12. Measure the surface pH of packaging materials
13. Determine the package performance by conducting Drop test
14. Determine the package performance by conducting Compression test
15. Determine the package performance by conducting Vibration test
16. Determine the package performance by conducting Impact test

TOTAL : 45

LABORATORY EQUIPMENT REQUIREMENTS

1. Universal Testing Machine
2. Burst tester
3. Ring Crush Tester
4. Plybond tester
5. Stiffness tester
6. Scuff tester
7. Heat Seal tester
8. Glossmeter
9. Hazemeter
10. Spectrophotometer
11. Permeability tester
12. Leak tester
13. pH meter
14. Drop tester
15. Compression tester
16. Vibration tester
17. Impact tester

PR 9132 INDUSTRIAL TRAINING

L	T	P	C
0	0	0	1

In order to expose the students the latest technology and to make them to understand the workflow in the Industry, training in the Industry forms a compulsory and significant aspect. Students will be trained in industry for a period of 4 weeks during the earlier semester vacations**.** Their performance will be periodically assessed by the staff in charge from the department and a coordinator Industry. After completion of the training period the student will submit a report. There will be a viva-voce at the end of the training and grades will be awarded. The areas of training during these periods will be in different branches of printing and packaging.

PR 9150	PAPER AND BOARD PACKAGING	L	T	P	C
		3	0	0	3

AIM

To impart knowledge on paperboard packaging materials and their processing technologies

OBJECTIVE

- To explain the properties of paper and paperboard and their effect in package performance
- To explain in detail about the various types of paper and paperboard packages and their manufacturing processes

UNIT I MANUFACTURING & APPEARANCE PROPERTIES 10

Sources, Paper and Paperboard Manufacturing process, Paper and board Coating, Appearance properties – Colour, Surface smoothness, surface structure, gloss, opacity, printability and varnishability, Surface strength, Ink and varnish absorption and drying, Surface pH, Surface tension, Rub resistance.

UNIT II PERFORMANCE PROPERTIES 10

Basis Weight, Thickness, Moisture Content, Tensile strength, Stretch or elongation, Tear Strength, Burst strength, Stiffness, Compression strength, Crush strength, Creasability and foldability, Ply bond strength, Flatness and dimensional stability, Porosity, Water absorbency, Gluability/Sealing, Taint and odour neutrality,

UNIT III PAPER AND PAPERBOARD - TYPES 7

Paper - Tissues, Greaseproof, Glassine, Vegetable Parchment, Label paper, Bag papers, sack craft, Impregnated Papers, Laminating papers; Paperboard – Folding box board, white lined chipboard, solid bleached board, solid unbleached board, Liquid packaging board, Container boards, Specialty boards

UNIT IV CONVERSION PROCESS 11

Flexible packaging manufacturing; Paper bags – types, manufacture, Composite cans – manufacturing, applications; Fibre drums, Multiwall paper sacks - types, manufacture; Rigid boxes, Folding Cartons – Design, Manufacturing; Solid fibreboard packaging, Paperboard based liquid packaging, Moulded pulp containers.

UNIT - V CORRUGATED BOARD 7

Corrugated Board construction - Flutes/Single, Double, Triple Wall, Board grades, Manufacture, Adhesive Bond, Specifications, Flat Crush/Edge Crush Tests Box Certificates, Box Layout, Types, Manufacture/Scoring Allowances, Optimization, Economy. Compression Test, McKee Formula/ECT, Inserts/Partitions, Stack Height, Pallet Patterns, Banding/Strapping/Taping, Corrugated Board Pallets, Corrugated Board Cushions.

TOTAL : 45

TEXT BOOKS

1. Twede, D. and Selke, S. E. M., “Cartons, Crates and Corrugated Board – Handbook of Paper and Wood Packaging Technology”, DEStech Publications, 2005.
2. Walter Soroka, “Fundamentals of packaging technology”, 3rd Edition, Institute of packaging professionals, Naperville, Illinois, USA, 2002.

REFERENCES

1. A. L. Brody, K. S. Marsh, “The Wiley Encyclopedia of Packaging Technology”, 2nd Edition, Wiley, New York, USA, 1995
2. R. E. Mark, C. C. Habeger, Jr., J. Borch and M. B. Lyne, “Handbook of Physical Testing of Paper”, 2nd Edition, Marcel Dekker, 2002
3. Kenneth W.Britt, “Handbook of Pulp and Paper Technology”, CBS Publishers, 1984

PR 9162 GLASS, WOOD AND METAL PACKAGING

L	T	P	C
3	0	0	3

AIM

To impart knowledge on glass metal wood packaging and the material used for closures.

OBJECTIVE

- To study the types of glass, wood and metal packages in detail.
- To enhance the knowledge of materials used for closures for various packaging systems.

UNIT - I GLASS PACKAGING 11

Glass, Definition, Composition, Raw materials, Additives, Other types of glass, borosilicate, Lead, Leaching, Glassmaking, Furnace, Melter, Regenerator, Refiner, Forehearth, Container manufacture, Press and blow, Blow and blow, Centrifugal casting, Ribbon machine, Drawn ware, Annealing, Coating, Nomenclature, Strength/Performance, Brittle failure, Internal pressure, Impact, Top load, Hydrodynamic failure, Thermal shock, Stress concentration, Defects, Specifications, Labelling

UNIT - II CLOSURES 7

Selection Considerations, Container and Closure Dimensioning, Types, Screw, lug, friction, roll-on, snap-on, Child-resistant, Torque, Application, Removal, Liners, Fitments, Dispensing closures, Special Closures and Functions; Closure Seals, Seam – types, Applications.

UNIT - III PACKAGING METALS 9

Steel, stainless, aluminium, tinplate - Manufacturing, properties; Cans - Three-piece can, Two-piece cans (DI and DRD), Composite cans, Can stresses, Compression/ Buckling, Drums – Manufacturing, Properties; Sheet – Manufacturing, Properties.

UNIT - IV METAL PACKAGING 10

Metal drums and pails, Metal foil packaging, Metal Strapping/ Banding, Metal Tubes, Aerosols, Uses, Two and three phase systems, Valves and dip tubes, Principles of operation; Propellants - fluorocarbons, hydrocarbons, compressed gases; Special aerosols - piston type, co-dispensing; Pumps.

UNIT - V WOOD PACKAGING 8

Wood Classification, Nominal Dimensioning, Board Footage, Moisture Content, Psychrometer, Shrinkage/Expansion, Anisotropy, Moisture Stresses, Mechanical Properties, Pallets – wood, design/performance, Wood design principles - Nails, types and holding capacity, Crates/Boxes/Bin Pallets, Wirebound Boxes, Plywood, Particleboard, Fiberboard, Regulations

TOTAL : 45

REFERENCES

1. A. L. Brody, K. S. Marsh, “The Wiley Encyclopedia of Packaging Technology”, 2nd Edition, Wiley, New York, USA, 1995
2. Walter Soroka, “Fundamentals of packaging technology”, 3rd Edition, Institute of Packaging professionals, Naperville, Illinois, USA, 2002.
3. Joseph F. Hanlon, Robert J. Kelsey, and Hallie Forcinio, “Handbook of Package Engineering”, Third Edition, CRC press, 1998

PR 9152 PACKAGE ATTRIBUTES – SHELF LIFE

L	T	P	C
3	0	0	3

AIM

To assimilate the various factors governing the shelf life of a package.

OBJECTIVE

- To understand the mechanics of shelf life with respect to packages.
- To comprehend the various relationship between the product and the package.

UNIT - I SHELF LIFE AND KINETICS OF PRODUCT DETERIORATION 9

Introduction, factors influencing shelf life, types of deterioration – physical, chemical, microbiological; measuring shelf life, predicting shelf life – predictive models, software systems; sensory evaluation methods, accelerated shelf-life tests – initial rate approach, kinetic model approach, Design of shelf life experiments, Extending shelf life

UNIT - II BASIC PRINCIPLES OF MASS TRANSFER 9

Basic concepts of mass transfer, Mechanism of permeation, Sorption, diffusion, Permeability, Factors affecting permeability, Migration Interactions - volumetric method, gravimetric method, differential method, determination of solubility; Gas chromatograph

UNIT - III DIFFUSION OF GASES AND VAPOURS 9

Diffusion - Fick's law of diffusion, film permeation, dimension of transport parameters, diffusion into film, Permeation of gases and vapors in polymers - basic equations and calculation, temperature and concentration dependence – sorption, Mass transfer through micro holes, Knudsen diffusion; Hydrodynamic flow of gases.

UNIT - IV PERMEABILITY 9

Introduction, importance of permeation – effect of time and temperature, effect of moisture, effect of oxygen, choice of materials; Rate of transmission – variables of the polymer, effect of permeating species, temperature and pressure, wall thickness; Measurement of permeability- WVTR, GTR; multilayer structures, application of permeability to material selection and shelf life estimation, Cycling conditions, Computer models, calculations, predictions

UNIT - V OTHER INTERACTIONS

Product fragrance and packaging material interactions, Migration of packaging material with product/solvents, Effect of irradiation of polymeric packaging materials in formation of volatile compounds, Flavour/Active ingredient absorption with packaging material

TOTAL : 45

REFERENCE

1. M. Mathlouthi, "Food Packaging and Preservation"**,** Springer 1 edition, 1994
2. Otto G. Piringer, A. L. Baner, "Plastic Packaging: Interactions with Food and Pharmaceuticals", 2 edition, Wiley-VCH, 2008

PR 9153 **FOOD PACKAGING**

L	T	P	C
3	0	0	3

AIM

To provide an overall knowledge about food packaging materials and technologies

OBJECTIVE

- To explain about the deteriorative reactions in food and factors stimulating it
- To describe about the various technologies used in packaging of food to extend its shelf life
- To discuss about the specific requirements of various types of food products

UNIT - I FACTORS AFFECTING SHELF LIFE OF FOOD 9

Deteriorative reactions in food, Rate of reactions, Extrinsic factors – temperature, water activity, gas, light; Shelf life of food – shelf life, package/product interaction, Influence of light transmittance; Testing of food packages – Sensory evaluation (taste, color, fragrance, texture), Leak tests, seal integrity tests, migration tests.

UNIT – II FOOD PACKAGING TECHNOLOGIES 12

Aseptic Packaging – Principle, sterilization of food contact surfaces, Aseptic packaging systems; Microwave oven-able packaging – Principle, materials; Active Packaging – Sachets and pads, active packaging materials, self-heating & self-cooling packages, changing gas permeability properties, widgets; Intelligent Packaging – quality indicators, time-temperature indicators, gas concentration indicators, thermochromic inks, microwave doneness indicators; CAP, MAP – principles, gases used, methods, equipments; Edible films and coatings.

UNIT - III PACKAGING OF FOOD PRODUCTS 12

Requirements, Materials, packaging techniques for : Flesh foods – Red meat, Cured cooked meats, poultry, sea food; Horticultural products – Fruits, vegetables, flowers; Dairy products – Liquid Milk, Fermented products, Butter and spreads, Cheese, Milk powders; Food grains – wheat, flour, rice, grams; Spices, Edible Oils, Vanaspathi, Ghee; Processed foods – Ready to eat food, jams, ketchup, pastes, pickles;

UNIT - IV PACKAGING OF SNACK FOOD 7

Requirements, Materials, packaging techniques for : Cereals & Snack foods - Breakfast cereals, Pastas, Bakery products, Biscuits, Cookies, Crackers, Nuts, Pretzels, Popcorn, Rice-based snacks, Meat snacks, Fast foods, Fruit based snacks, Chips; Confectionery – Candies, chocolates.

UNIT - V PACKAGING OF BEVERAGES **5**

Requirements, Materials, packaging techniques: Beverages – Water, Coffee, Tea, Juices, Carbonated soft drinks, Alcoholic beverages

TOTAL : 45

TEXT BOOK

1. Gordon L. Robertson, “Food Packaging: Principles and Practice”, Second edition, CRC Press, 2006

REFERENCES

1. Jung H. Han, “Innovations in Food Packaging”, Food Science and Technology International, 2005
2. Richard Coles, Derek McDowell, and Mark J. Kirwan, “Food Packaging Technology”, Sheffield Packaging Technology, 2003
3. Frank A. Paine and H.Y. Paine, “Handbook of Food Packaging”, CRC Press, 1993

PR 9154 HEALTHCARE PACKAGING

L	T	P	C
3	0	0	3

AIM

To provide an overall knowledge about pharmaceutical and medical packaging materials and technologies

OBJECTIVE

- To explain about special requirements of pharmaceutical and medical products
- To provide knowledge about licensing and legislative requirements
- To describe about the various types of packaging for pharmaceutical and medical products

UNIT - I INTRODUCTION TO PHARMACEUTICAL PRODUCT 9

Types of pharmaceutical products & packages, Ethical medicines, Proprietary medicines, other classifications, Drug delivery systems, Inhalation therapies, Product spoilage mechanisms, Selection of containers, Unit dose packaging, Healthcare Package requirements: Solid preparations, Powders, Semi-solid preparations, aqueous oral preparations, aqueous non-oral preparations, Non-aqueous liquid preparations, Inhalers, Medical devices.

UNIT - II DEVELOPING PACKAGING FOR MEDICAL PREPARATIONS 10

Materials & its Sterilization, Package structure, Packaging line engineering, Line efficiency, Labeling - Text and graphics requirements, Bar codes, RFID Features, Expanded Content Labels, Package Inserts; Legislative requirements for packaging of medical preparations, Statutory requirements, General manufacturing considerations, Packaging Specification. Licensing considerations - Sources of official guidance, Influence of pharmacopoeias, License application procedure; Stability tests on finished product, Medicinal formulation/packaging compatibility, Stresses from manufacturing process, Toxicological investigations, Environmental issues, Labeling, Variations, Medical devices, Case studies

UNIT - III PRIMARY PHARMACEUTICAL CONTAINERS 12

Blister Packaging - Materials, OTC Drug Packs, Ethical Drug Packs, Clinical Trial & Sample Drug Packs, Plastic Containers – Standard containers, Dispensing Bottles, Cans, Jars; Pouches & Strip Packs; Prefillable Inhalers - Metered Dose, Dry Powder; Prefillable Syringes – Injectors, Cartridges; Tubes - Composite Tubes, Plastic Tubes, Metal Tubes; Parental Vials & Ampoules; Containers - Semi-Rigid Containers, Mini-Bags; Medical Packages – Disposable gloves, Syringes, needles, catheters, dressings, sutures, surgical devices; Glass Containers; Aerosol Containers.

UNIT - IV SECONDARY CONTAINERS AND PHARMACEUTICAL MACHINERY 7

Secondary Containers - Paperboard Containers; Prescription Dispensing Containers - Plastic Vials, Blister Packs, Glass Vials, Others; Shipping Containers - Corrugated Boxes, Folding Cartons, Trays, etc;

Pharmaceutical machinery – Filling & Sealing machines for injection, infusion and screw neck bottles; ampoules; prefilled syringes and cartridges, Machinery for blister packaging

UNIT - V PHARMACEUTICAL CAPS & CLOSURES 7

Standard Pharmaceutical Closures - Plastic, Metal; Child-Resistant Pharmaceutical Caps & Closures; Dispensing Closures – Disc, Pump-Type, Turret, Plastic Dropper, Squeeze Tops; Parental Stoppers, Flip-Top Closures, Paper, Foil & Laminated Lids, Top seal, Induction seal , wads & wading systems, Other Pharmaceutical Caps & Closures.

TOTAL : 45

REFERENCES

1. Max Sherman, “Medical Device Packaging Handbook”, 2nd edition, CRC, 1998
2. H. Lockhart, Frank Albert Paine, “Packaging of Pharmaceuticals and Healthcare Products”, Springer, 1996
3. Otto G. Piringer, A. L. Baner, “Plastic Packaging: Interactions with Food and Pharmaceuticals”, 2nd edition, Wiley-VCH, 2008

PR 9155 PACKAGING LAWS AND REGULATIONS

L	T	P	C
3	0	0	3

AIM :

To have a knowledge about the various International and National laws and regulations with respect to packaging.

OBJECTIVE:

- To understand the various rules and regulations with respect to packaging in India
- To comprehend the International laws with relation to various forms of Packaging

UNIT - I INDIAN REGULATORY SYSTEM 11

Introduction, The Standards of weights and Measures Act (SWMA), Standard Units, Laws, Regulations and Ministries involved, Essential Commodities Act, Agricultural Produce (Grading and Marketing) Act, Prevention of Food Adulteration Act, Codex Standard Act, Export (Quality Control and Inspection) Act, Bureau of Indian Standards

UNIT - II DECLARATIONS ON PACKAGED COMMODITIES 10

Declarations for Interstate Trade and Commerce, Standard Packages, Maximum Permissible Error, Label Declarations, Standard Quantity specifications for various products, Symbols and Units used

UNIT - III INTERNATIONAL LAWS AND VIOLATION OF LAW 6

Uniform Weights and Measures Law, Uniform Packaging and Labeling Regulation (UPLR), Uniform Unit Pricing Regulation (UPR), Details of Violations, offences, Penalties under various sections, EU-REACH Regulations in packaging.

UNIT - IV PACKAGING STORAGE REQUIREMENTS 6

Various storage requirements of Products, Specifications of Raw Materials used, IS Specifications with respect to packaging and Packaging Materials

UNIT - V PACKAGING REQUIREMENTS AND PFA 12

Packaging requirements under PFA, Declaration and Labeling, Specification of Display panels, Statutory Requirements on Packages, PFA Enforcement methods, Fruit Products Order (FPO) Meat Food Products Order (MFPO) Agricultural Grading and Marking Rules (AGMARK), Edible Oil Packaging (Regulatory) Order

TOTAL : 45

REFERENCES

1. G C P Range Rao," Modern Food Packaging, Packaging Laws and Regulations", CFTRI Mysore , IIP Publications, 2005
2. The Standards of Weights and Measures act, (1976) & Standards of Weights and Measures (Packaged Commodities) Rules (1977), Rule Book, Govt. Of India.
3. BIS Rule Book, Govt. Of India.

PR 9156 OFFSET PRINTING TECHNOLOGY L T P C

3 0 0 3

AIM

To impart a good understanding of Offset Printing Technology

OBJECTIVE

- To introduce the principles of offset lithographic printing.
- To create an awareness on different types of machines and materials.

UNIT – I PRINCIPLES OF OFFSET AND SHEET FEEDING 10

Principles of lithography, wetting of a solid surface by a liquid, emulsification of ink and fountain solution, fluid behavior in a nip. Basic configuration of offset machine. Sheet feeding and controls: Types of feeders, sheet control, drives, suction head mechanism, double sheet and no sheet detectors, side lays and front lays. Non-stop feeders. Sheet insertion and transfer systems, working principle, relative merits.

UNIT – II PRINTING UNIT CONFIGURATION 12

Cylinders: Various configurations, design, requirements, plate and blanket clamping mechanisms, pressure setting, packing, print length variation, equal diameter, true rolling principles. Cylinder drives. Sheet transfer and reversal systems, perfecting, delivery grippers, settings, quick delivery mechanisms. Anti set-off spray device. Feeders, delivery and other system components for metal printing.

UNIT – III BLANKETS, ROLLERS 10

Blanket types, requirements, manufacture, performance attributes. Rollers, types, properties, behavior. Basic inking and dampening system configuration. Fountain solution requirements, composition, re-circulation system and dosing units, Ink/water balance.

UNIT – IV PRINTING AND INLINE OPERATIONS 7

Make-ready operations, multi colour printing, automatic plate fixing, computer controls in printing, automatic blanket wash, roller wash systems. Spot varnishing, coating, numbering. Metal printing UV Dryers, Hot air and IR Drying systems. Print problem identification and quality control.

UNIT – V QUALITY CONTROL 6

Standards, Print Control Targets, Test Forms, In-line print quality measurement, inspection and control.

TOTAL : 45

REFERENCES

1. John MacPhee, “Fundamentals of Lithographic Printing”, Vol.1 Mechanics of Printing, GATF Press, 2002.
2. A.S.Porter, “A Manual of Lithographic Press Operation”, Lithographic Training Services, London, 1998.
3. Helmut Kippan, “Handbook of Printmedia”, Springer publications, 2004.

PR 9157 PACKAGING ECONOMICS

L	T	P	C
3	0	0	3

AIM

To assimilate and apply the concepts of Economics in Packaging.

OBJECTIVE

- To understand the concepts of costing and estimation in packaging.
- To comprehend the needs for quality management and wastage control in packaging.

UNIT – I INTRODUCTION 10

Cost Systems, Marginal costing and Profit Analysis, elements of packaging costs Cost Estimation of Packaging costs, Cost Classification, Factors influencing finished costs

UNIT – II PACKAGING ECONOMICS 9

Basics, Appreciation of future trends and developments with the cost confines of packaging, Economic issues in packaging as they relate to policies of the firm and government.

UNIT – III ECONOMIC POLICY AND SOCIETAL ISSUES 8

Relationship of economic policy and societal issues, Understanding and managing packaging costs

UNIT – IV COST EFFECTIVE PACKAGING 9

Guidelines, Techniques in Preventing unnecessary costs in Supply Chain , Factors required for successful packaging from a cost perspective

UNIT – V QUALITY MANAGEMENT 9

Quality Management in Packaging, Defect Prevention Techniques, Various Statistical tools used in maintaining Quality, 6 Sigma, ISO, Total Productive Maintenance

TOTAL : 45

REFERENCES

1. M.Bakker, “Wlley Encyclopedia of Packaging Technology”, Joh Wiley & Sons Ltd., 2008
2. Jim Mc Dermott, Anne Emblem, “Packaging: The facts”, Institute of Packaging, USA, 2006
3. Edmund A Leonard, “Introduction to Economics of Packaging”, Morgan-Grampion Publishers, University of Wisconsin – Madison, 2007

PR 9158 **BRAND MANAGEMENT**

L	T	P	C
3	0	0	3

AIM

To understand the role of buyer behavior and branding in packaging design and technology.

OBJECTIVES

- To explain the role and philosophy of Brand Management in the strategic marketing process and the resulting effects of the environment on Packaging decisions.
- To develop the attitudinal and conceptual basis necessary to apply a customer oriented approach for strategic marketing and business decisions and to help develop winning brands.

UNIT – I CONCEPT OF BRAND MANAGEMENT 9

Introduction to the concept of Brand Management as an active working principle within the sales and marketing department, within the overall organization, Case Studies.

UNIT – II STRATEGIC PROCESS 9

The strategic process, environment and analysis, segmentation and positioning for building brands. Brand information systems and the application of brand Management using marketing principles, Case Studies

UNIT – III BUYER BEHAVIOR 7

Consumer and Industrial Buyer Behavior, Models, Behavioral Applications in Branding, Case Studies

UNIT – IV BRAND MANAGEMENT PLANNING 10

Application of analytical and logical marketing techniques required to solve Brand Management problems, and develop creative skills necessary to their success, Case studies Brand Affordability, Role of pricing in branding. Revenue – cost - profit relationships and their application to Brand Management. Revenue management and control, Case Studies

UNIT – V BRAND LAUNCHING 10

Brand Acceptance, Product innovation, development, management and control. Packaging and product design factors, product portfolio management , Brand Awareness promotional planning and control, rules of selling, advertising, PR and other specialist promotional tools, brand availability Physical distribution processes and channel decisions, Case Studies

TOTAL : 45

REFERENCES

1. Kapferer - Jean Noel., Kogan, “Strategic Brand Management”, Page Publishers, 2008
2. Kevin Lane Keller, „Strategic Brand Management“ , Pearson Education Ltd., 2008

PR 9159 PACKAGING AND ENVIRONMENT

L	T	P	C
3	0	0	3

AIM

To create awareness about the effect of packages on environment

To contribute towards optimization of packaging materials and aid in reuse and recycling of packages

OBJECTIVE

- To provide information about environmental pollution and how packaging contributes to it
- To teach methods to minimize the wastages by optimization and recycling
- To analyze about various international approaches in tackling environmental pollution

UNIT – I INTRODUCTION 9

Components of environment; Environmental pollutions, its measurements and management; Air pollution and its control; Water pollution and its control; Solid wastes; Microorganisms as components of the environment; microorganisms as indicators of environmental pollution; bioorganic pollution; microbial toxicants and pollutants their bio-degradation; biodegradation of plastics, biofouling; bioremediation. Packaging – Concerns on Environmental Pollution

UNIT – II STORAGE & DISPOSAL OF WASTE 9

Types of waste generated; Non- degradable & biodegradable wastes, Solid waste storage and disposal methods- land-filling, burial, incineration, recycling; Biological treatment of food, medical, consumer goods, pharmaceutical, industrial wastes, storage and disposal of liquid and gaseous waste; legal aspects related to storage and disposal; environmental laws; pests & their control.

UNIT – III WASTE MINIMIZATION 9

Life Cycle Analysis, Optimization of packaging materials, Source Reduction and reuse, Biodegradable materials, Case Studies

UNIT – IV RECYCLING **9**

Waste - Collection, Sorting, Cleaning; Recycling Rate; Recycling techniques – Paper/Paperboard, Plastics, Metals, Glass.

UNIT – V ENVIRONMENTAL POLICIES **9**

Environmental policies of India, Packaging Code of Practice, New Zealand Approach, German Approach - Green Dot; EU Packaging Directive; other international approaches.

TOTAL : 45

REFERENCES

1. Sugan E.M.Solke, "Packaging and the Environment, Alternatives, Trends and Solutions", Technomic Publication, Revised Edition, 1994.
2. John Scheirs, "Polymer Recyling", Wilye Series in Polymer Science, 1997.
3. Albertsson, "Degradable Polymer, Recycling Plastic Waste Management",
4. Prof.Francecco La Mantia, "Handbook of plastic Recycling", published, 2002
5. R.Mckinney, "Technology of paper Recycling", Blackie Academic and professional, 1997.
6. Herbert F.Lund, " McGraw-Hill Recycling Handbook", 2nd Edition, 2001.

PR 9160 FLEXO, GRAVURE AND SCREEN PRINTING

L T P C
3 0 0 3

AIM

To provide an overall knowledge about flexo, gravure & screen process Printing**.**

OBJECTIVE

- To understand the principle of flexo, gravure & screen process Printing.
- To gain knowledge about the press work of flexo, gravure & screen process Printing.
- To know the recent development and applications of flexo, gravure & screen process Printing.

UNIT – I FLEXOGRAPHIC MACHINES **5**

Theory and practice of flexographic printing; uses and development of flexography in the field of Packaging; plate and press requirements; press principles and operation; printing on a wide variety of surfaces.

UNIT – II FLEXOGRAPHIC PRESS WORK 10

Flexographic inking system and the anilox roller; composition of flexographic inks and solvents used; alcohol-based inks and water based inks and their uses; varieties of papers, films and foils that can be printed by flexography and their working problems. Recent developments and applications for newspaper printing.

UNIT – III GRAVURE MACHINES 10

Principles of photogravure process; suitability of photogravure for various classes of work; principles of sheet-fed and web-fed photogravure printing machines; drying equipment; automatic controls; apparatus for examining work on the run; folders and other ancillary attachments.

UNIT – IV GRAVURE PRESSWORK 10

Composition of photogravure inks; solvents used for various kinds of work; solvent recovery, precautions against fire; characteristics of the materials printed upon by the photogravure process; special techniques in the use of metallic inks; various types of rollers and methods of setting.

UNIT – V SCREEN PROCESS PRINTING 10

Screen process terminology; applications of the process; frames and mesh materials, their identification, advantages and limitations; stencil systems; screen cleaning and recovery methods; types of screen cleaning equipment; care and storage of screen frames; drying equipments; types of inks and solvents, thinners, cleaners and retarders in common use; automatic machinery used for screen printing; design appreciation with special reference to screen printing.

TOTAL : 45

REFERENCES

1. "Flexography: Principles & Practices", 5th Edition, FTA, 2000.
2. "FIRST: Flexographic Image Reproduction Specifications & Tolerances", 3rd Edition, FTA, 2003.
3. “Gravure: Process and Technology”, Gravure Education Foundation, 2003
4. Kaj Johansson, Peter Lundberg, Robert Ruberg, “A Guide to Graphic Print Production”, Wiley, 2002
5. Samuel B. Hoff, “Screen Printing – A Contemporary Approach”, Delmar Publishers, 1997.
6. Ingram, Samuel, “Screen Printing Primer”, GATF press, 2nd Edition, 1999.

CI 9158 DESIGN FOR MANUFACTURING

L	T	P	C
3	0	0	3

AIM

The aim is to impart the students with knowledge of the general design principles of manufacturing and to provide complete information's for further study.

OBJECTIVE

At the end of this course the student should be able to understand the design principles of casting, welding, forming, machining and assembly, by considering various manufacturing constraints.

UNIT – I INTRODUCTION 6

Economics of Process selection – General design principles of manufacturability – Proper material selection – Strength and Mechanical factors- Application of form design.

UNIT – II CASTING DESIGN AND WELDMENT DESIGN 10

Factors affecting casting design- Strength aspects – Sand casting and die casting design-Factors affecting weldment design-Gas and arc welding design.

UNIT-III FORMED METAL COMPONENTS AND NON METALLIC PARTS DESIGN 10

Design considerations for the manufacture of extruded, cold headed metal parts – Tube and section bends – Powder metal parts-Thermo setting plastic parts-Reinforced – Plastic/Composite parts.

UNIT – IV MACHINED COMPONENTS DESIGN 10

Design considerations for the manufacture of Turned parts-drilled parts-milled parts, planned, shaped and slotted parts-Ground parts-parts produced by EDM.

UNIT – V DESIGN FOR ASSEMBLY 9

Types of assembly – DFA –Index – evaluation of assembly – assembly cost reduction – case of assembly – impact on quality – related software usage – case studies.

TOTAL : 45

TEXTBOOK

1. James G. Bralla – "Handbook of product design for manufacture", McGraw Hill Book Co., 1986.

REFERENCES

1. Henry Peck – "Designing for manufacture", Sir Isaac Pitman & Sons Ltd., 1973.
2. Matousek – "Engineering Design", Blackie & sons, 1956.

FD 9114 PRINCIPLES OF FOOD PROCESSING & PRESERVATION

L	T	P	C
3	0	0	3

AIM

To introduce about industrial food processing and preservation technologies

OBJECTIVES

To provide knowledge on storage, preservation and processing technologies of fresh food, processed food, horticultural products, etc.,

UNIT – I PRINCIPLES OF FRESH FOOD STORAGE 9

Nature of harvested crop, plant and animal; Product storage; Effect of cold storage and quality- storage of grains; Principles of refrigerated gas storage of food- Gas packed refrigerated foods; Sub atmospheric storage; gas atmospheric storage of foods.

Principles of food freezing: development of frozen food Industry, the freezing point of foods, freezing of bakery products. Psychrometric chart, freezing and cold storage. freeze concentration, dehydro-freezing, freeze drying, IQF; calculation of refrigeration load, design of freezers and cold storages.

UNIT – II PRINCIPLES OF CANNING AND DRYING 12

The art of appertizing; categories of foods for canning; spoilage of canned foods, storage of canned foods; Influence of canning on the quality of food; improvement in canning technology.Transport phenomena with respect to foods; Factors affecting heat and mass transfer; Study of heat transfer and its application in the design of thermal processes; calculation of process time temperature-schedules.

Drying – A natural process: artificial drying, adiabatic driers, influence of drying on pigments and enzymes; Dehydration of fruits, vegetables, milk, animal products etc.
Rate of drying for food products; design parameters of different type of dryers; properties of air-water mixtures.

Newer methods of thermal processing- batch and continuous; application of infra-red microwaves; ohmic heating.

UNIT – III PRINCIPLES OF FOOD CONCENTRATES 6

Control of water activity; preservation by concentration and dehydration; osmotic methods; High solid- high acid foods; Pectin and gel formation; Use of sugar and Invert sugar, jelly making, other food products,

UNIT – IV NON-THERMAL METHODS 9

Chemical preservatives - Food additives, functional chemical additives applications. Chemical preservatives and antibiotics; Preservation by ionizing radiations- technology aspects of the radiations, pasteurization of foods; public health aspects, microbiology of irradiated foods; Ultrasonics, high pressure, fermentation, curing, pickling, smoking, membrane technology. Hurdle technology.

UNIT – V FOOD PACKAGING **9**

Packaging– Concepts, definition, Significance, classification; Packaging– Development, Retail/Unit ; Packaging of foods –fresh and processed;Basic packaging materials, types of packaging, packaging design, packaging for different types of foods, retort pouch packing, vacuum packaging; MAP, costs of packaging and recycling of materials.

TOTAL : 45

TEXT BOOKS

1. Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.
2. Desrosier, N.W. and Desrosier, J.N. “The Technology of Food Preservation”, 4th Edition, CBS, 1987.
3. Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005.

REFERNCES

1. Vaclavik, V.A. and Christian, E.W. “Essentials of Food Science”, 2nd Edition, Springer, 2003.
2. Majumdar, A.S. “Dehydration of Products of Biological Orgin” Oxford / IBH, 2004.
3. Gopala Rao, Chandra “Essentials of Food Processing Engineering”, BS Publications, 2006.
4. Singh, M.K. “Food Preservation”, Discovery Publishing, 2007.
5. Rauganna, S. “Handbook of Canning and Aseptic Packaging” Vol. I, II & III, Tata McGraw – Hill, 2000.

IE9169 PROJECT MANAGEMENT **L T P C**
3 0 0 3

UNIT I STRATEGIC MANAGEMENT AND PROJECT SELECTION 9

Project selection models, Project portfolio process, Analysis under uncertainty, Project organization**,** Matrix organization

UNIT II PROJECT PLANNING 9

Work breakdown structure, Systems integration, Interface coordination, Project life cycle, Conflict and negotiation,

UNIT III PROJECT IMPLEMENTATION 12

Estimating Project Budgets, Process of cost estimation, Scheduling: Network Techniques PERT and CPM, Risk analysis using simulation, CPM- crashing a project, Resource loading, leveling, and allocation

UNIT IV MONITORING AND INFORMATION SYSTEMS 9

Information needs and the reporting process, computerized PMIS, Earned value analysis, Planning-Monitoring-Controlling cycle**,** Project control**:** types of control processes, design of control systems, control of change and scope

UNIT V PROJECT AUDITING 6

Construction and use of audit report, Project audit life cycle, Essentials of audit and evaluation, Varieties of project termination, the termination process, The Final Report – A project history

TOTAL: 45 PERIODS

REFERENCES:

1. Project Management – A Managerial Approach, by Jack R. Meredith, and Samuel J. Mantel Jr., John Wiley and Sons, 2006
2. Project Management – A Systems Approach to Planning, Scheduling and Controlling, by Harold Kerzner, John Wiley and Sons, 2006

CI 9167 INFORMATION SYSTEM ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

AIM

To impart knowledge in the key areas of information systems analysis and design.

OBJECTIVE

To provide knowledge in the concept of information system processing, decision making, analysis and design, quality assurance and knowledge based systems.

UNIT I COMPUTER BASED INFORMATION SYSTEM 7

Concept of information and system – system classification – The challenge of information system – Computers and information processing – managing data resource – organizing data in a traditional file environment – a modern database environment – designing database.

UNIT II. MANAGEMENT INFORMATION SYSTEM 10

Concepts – Design and implementation of MIS – Information system for decision making, types and levels of decision making – MIS as a technique for making programmed decisions – Decision – Assisting information systems – Conceptual system design – detailed system design.

UNIT III OVERVIEW OF SYSTEM DEVELOPMENT 10

System analysis – System Design – Completing the system development process the traditional system life cycle – Stages and limitations of life cycle approach – case study.

UNIT IV QUALITY AND SERVICES 10

Traditional tool and Methodologies for quality assurances – New approaches to quality – Information system failure causes – the concept of implementation – controlling risk factor.

UNIT V KNOWLEDGE – BASED SYSTEMS 8

Decision Support Systems – Group DSS – ESS – Artificial Intelligence – Expert System – Other intelligent technique – Neural network, Genetic Algorithm, Fuzzy Logic.

TOTAL : 45

TEXT BOOKS:

1. Kenneth C.Laudon and Jane P.Laudon, “Management Information Systems”, Prentice Hall of India Pvt. Ltd., 10th Edn., 2007.
2. Robert G.Mudrick, Joel E.Ross and James R.Clagget, “Information System for Modern Management”, Prentice Hall of India Pvt. Ltd., 1995.
3. Chung.P.W.H and Lovegrove G., “Industrial and Engineering Application of Al and Expert systems”, Gardon Breach Science Publication, 1993.

REFERENCES

1. Davis.G.B. MIS, “Conceptual Foundation, Structure and Development” McGraw-Hill Publishing Co., 1985.

WEB REFERENCE:

1. www.dis.uniromal.it
2.

PR 9161 ERGONOMICS IN PACKAGING L T P C

3 0 0 3

AIM

To understand, comprehand and apply the various human factors involved in packaging technology.

OBJECTIVES

- Various concepts on human factors through procedures of analysis
- Understanding of the processes of design as applied to the medium;
- Conceptualize and create product/package designs and/or interface designs based on sound human factors.

UNIT- I ERGONOMICS 9

Definition of human factors; Application of human factors data; Human activities: their nature and effects; Man-machine system and physical environment; Human performance and system reliability; Information input and processing

UNIT- II HUMAN CONTROL SYSTEMS 10

Visual displays: process of seeing, visual discrimination, quantitative and qualitative visual display; Alphanumeric and related displays, visual codes and symbols; Auditory, tactual and olfactory human mechanism; Applied anthropometry, physical space and arrangement

UNIT- III INTRODUCTION TO DESIGN 10

What is Visual Communication in Design What is the importance of scientific knowledge in design Introduction to the Human Factors in Design Physical human factors Psychological or sociological human factors, Organizational human factors Principles of

Form and Function and the various Elements and Principles of Design and its relation to Human Factors , Principles of Package Design and its affect the visual stimulation of the audience. Case Studies

UNIT- IV PACKAGE DESIGN 6

Form, color, symbols, user specific criteria; Material, technology and recyclability; Packaging; Multiple utility oriented approach to product and package design Element of general design for the physically and mentally impaired.

UNIT- V DEMOGRAPHICS AND PSYCHOGRAPHICS OF THE TARGET AUDIENCE 10

Understanding target audience when designing, Demographics and psychographics of a target audience, Demographic survey/study for a specific package and analyze psychographics differences within the target market's demographic group. Package and Market Research Studies.

TOTAL : 45

REFERENCES

1. Michal J.Burke, "Applied Ergonomics Handbook", Lewis Publishers, 2007
2. Wesley E.Woodson, Peggy Tillman & Bary Tillman, "Human Factors Design Handbook", Wiley publishing co., 2006
3. Gavriel Salvendy, "Handbook of Human Factors & Ergonomics", Wiley publishing co., 2007
4. Nigel Thoobald, "Packaging closures & Sealing systems", CRC Publishers, 2006

IE 9124 SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

AIM

To impart knowledge on logistics, supply chain network design, selection and coordination of supply chain.

OBJECTIVE

At the end of this course the student should be able to understand

1. Importance of supply chain
2. logistics management
3. design factors of supply chain
4. sourcing and revenue management
5. managing the supply chain

UNIT - I INTRODUCTION 6

Definition of Logistics and SCM: Evolution, Scope, Importance& Decision Phases – Drivers of SC Performance and Obstacles.

UNIT - II LOGISTICS MANAGEMENT 10

Factors – Modes of Transportation - Design options for Transportation Networks- Routing and Scheduling – Inbound and outbound logistics- Reverse Logistics – 3PL- Integrated Logistics Concepts- Integrated Logistics Model – Activities - Measuring logistics cost and performance – Warehouse Management - Case Analysis

UNIT - III SUPPLY CHAIN NETWORK DESIGN 10

Distribution in Supply Chain – Factors in Distribution network design –Design options- Network Design in Supply Chain – Framework for network Decisions - Managing cycle inventory and safety.

UNIT - IV SOURCING, AND PRICING IN SUPPLY CHAIN 9

Supplier selection and Contracts - Design collaboration - Procurement process. Revenue management in supply chain

UNIT - V COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN 10

Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work. E Business & SCM. Metrics for SC performance – Case Analysis

TOTAL : 45

REFERENCES

1. Supply Chain Management, Strategy, Planning, and operation – Sunil Chopra and Peter Meindl- PHI, Second edition, 2007

2. Logistics, David J.Bloomberg, Stephen Lemay and Joe B.Hanna, PHI 2002
3. Logistics and Supply Chain Management –Strategies for Reducing Cost and Improving Service. Martin Christopher, Pearson Education Asia, Second Edition
4. Modeling the supply chain, Jeremy F.Shapiro, Thomson Duxbury, 2002
5. Handbook of Supply chain management, James B.Ayers, St.Lucle Press, 2000

IE 9167 INDUSTRIAL SAFETY AND HYGIENE

L	T	P	C
3	0	0	3

UNIT-I OPERATIONAL SAFETY 9

Hot metal operation, boiler, pressure vessels – heat treatment shop – gas furnace operation – electroplating – hot bending pipes – safety in welding and cutting, Cold – metal operation – safety in machine shop – cold bending and chamfering of pipes- metal cutting – shot blasting, grinding, painting – power press and other machines. Management of toxic gases and chemicals – industrial fires and prevention – road safety – highway and urban safety – safety of sewage disposal and cleaning – control of environmental pollution – managing emergencies in industries – planning security and risk assessments, on – site and off site. Control of major industrial hazards.

UNIT-II SAFETY APPRAISA L AND ANALYSIS 9

Human side of safety – personal protective equipment – causes and cost of accidents. Accidents prevention program – specific hazard control strategies – HAZOP training and development of employees – first aid – fire fight devices – accident reporting, investigation. Measurement of safety performance, accident reporting and investigation – plant safety inspection, job safety analysis – safety permit procedures. Product safety – plant safety rules and procedures – safety sampling – safety inventory systems. Determining the cost effectiveness of safety measurement.

UNIT-III OCCUPATIONAL HEALTH 9

Concept and spectrum of health functional units and activities of operational health service – occupational and related disease – levels of prevention of diseases – notifiable occupational diseases Toxicology Lead – Nickel, chromium and manganese toxicity – gas poisoning (such as CO, Ammonia Chlorise, So2, H2s.) their effects and prevention – effects of ultra violet radiation and infrared radiation on human system.

UNIT-IV SAFETY AND HEALTH REGULATIONS 9

Safety and health standards – industrial hygiene – occupational diseases prevention welfare facilities. The object of factories act 1948 with special reference to safety provisions, model rules 123a, history of legislations related to safety – pressure vessel act – Indian boiler act – the environmental protection act – electricity act – explosive act.

UNIT-V SAFETY MANAGEMENT **9**

Evaluation of modern safety concepts – safety management functions – safety organization, safety department- safety committee, safety audit – performance measurements and motivation – employee participation in safety - safety and productivity.

TOTAL: 45

TEXT BOOKS:

1. John.V .Grimaldi and Rollin. H Simonds, “Safety Managenent”, All India traveler book seller, New Delhi – 1989.
2. Krishnan N.V, “Safety in Industry” , Jaico Publisher House, 1996.

REFERENCES

1. Occupational Safety Manual BHEL.
2. Industrial Safety and the law by P.M.C Nair Publishers, Trivandrum.
3. Managing emergencies in industries, loss prevention of India Ltd., proceedings, 1999.
4. Safety security and Risk management by U.K singh & J.M Dewam,. A.P.H. publishing company, New Delhi, 1996.
5. singh, U.K and Dewan, J.M., “Sagety, Security And Risk Management”, APH publishinf company, New Delhi, 1996.
6. John V Grimaldi, Safety Manageemnt. AITB publishers, 2003.
7. Safety MaNUAL. EDEL engineering Consultancy, 2000.

PD 9152 CREATIVITY IN DESIGN

L	T	P	C
3	0	0	3

UNIT-I INTRODUCTION **4**

Need for design creativity – creative thinking for quality – essential theory about directed creativity

UNIT-II MECHANISM OF THINKING AND VISUALIZATION **12**

Definitions and theory of mechanisms of mind heuristics and models : attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles- line, plane, shape, form, pattern, texture gradation, color symmmetry.Spatial relationships and compositions in 2 and 3 dimensional space - procedure for genuine graphical computer animation – Animation aerodynamics – virtual environments in scientific Visualization – Unifying principle of data management for scientific visualization – Unifying principle of data management for scientific visualization - Visualization benchmarking

UNIT-III CREATIVITY **10**

Methods and tools for Directed Creativity – Basic Principles – Tools of Directed Creativity – Tools that prepare the mind for creative thought – stimulation of new ideas – Development and Actions: The Bridge between man creativity and the rewards of innovativeness – Applying Directed Creativity to the challenge of quality management

UNIT-IV DESIGN **9**

Process Design, Recycling and availability-Creativity and customer needs analysis – Innovative product and service designs, future directions in this application of creativity thinking in quality management

UNIT-V IMPLEMENTATION **10**

Achieving Creativity – the essential factors – mind mapping – force filled analysis
The game – Introduction – uses of the game – Pre-game preparation – playing the game – The seven creative prompts lists – walking the walks: Taking action – Ben Balance – Work Sheet – Celebrations Document – Sniper Trap

TOTAL: 45

REFERENCES

1. Rousing Creativity: Think New NowFloyd Hurr, ISBN 1560525479, Crisp Publications Inc. 1999

IE 9159 DECISION SUPPORT SYSTEMS

L	T	P	C
3	0	0	3

AIM:

OBJECTIVE:

UNIT-I	**DECISION MAKING** Managerial decision making, system modeling and support-preview of the modeling process-phases of decision making process.	**5**
UNIT-II	**MODELING AND ANALYSIS** DSS components- Data warehousing, access, analysis, mining and visualization-modeling and analysis-DSS development.	**12**
UNIT-III	**KNOWLEDGE MANAGEMENT** Group support systems- enterprise DSS- supply chain and DSS-knowledge management methods, technologies and tools.	**12**
UNIT-IV	**INTELLIGENT SYSTEMS** Artificial intelligence and expert systems-concepts, structure, types-knowledge acquisition and validation, knowledge representation	**12**
UNIT-V	**IMPLEMENTATION** Implementation, integration and impact of management support systems	**4**
	TOTAL	**45**

REFERENCES

1. Efraim Turban and Jay E Aronson, Decision Support and Intelligent Systems, Pearson education Asia, Seventh edition, 2005.

2. Elain Rich and Kevin Knight, Artificial intelligence, TMH,2006.

BA9127 BUSINESS RESEARCH METHODS

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3 0 0 3

UNIT – I INTRODUCTION 9

Business Research – Definition and Significance – the research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross –Sectional and time – series Research – Research questions / Problems – Research objectives – Research hypotheses – characteristics – Research in an evolutionary perspective – the role of theory in research.

UNIT – II RESEARCH DESIGN AND MEASUREMENT 9

Research design – Definition – types of research design – exploratory and causal research design – Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument.

UNIT – III DATA COLLECTION 9

Types of data – Primary Vs Secondary data – Methods of primary data collection – Survey Vs Observation – Experiments – Construction of questionaire and instrument – Validation of questionaire – Sampling plan – Sample size – determinants optimal sample size – sampling techniques – Probability Vs Non–probability sampling methods.

UNIT – IV DATA PREPARATION AND ANALYSIS 9

Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Bivariate and Multivariate statistical techniques – Factor analysis – Discriminant analysis – cluster analysis – multiple regression and correlation – multidimensional scaling – Application of statistical software for data analysis.

UNIT – V REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH 9

Research report – Different types – Contents of report – need of executive summary – chapterization – contents of chapter – report writing – the role of audience – readability – comprehension – tone – final proof – report format – title of the report – ethics in research – ethical behaviour of research – subjectivity and objectivity in research.

Total: 45

TEXT BOOKS

1. Donald R. Cooper and Pamela S. Schindler, Business Research methods ,9th Edition, Tata Mc Graw Hill, 2006.
2. Alan Bryman and Emma Bell, Business Research methods, Oxford University Press, New Delhi, 2008.
3. Uma Sekaran, Research methods for Business, Wiley India, New Delhi, 2006.
4. K. N. Krishnaswamy, Appa Iyer Sivakumar and M. Mathirajan, Management Research Methodology, Pearson Education, New Delhi, 2006.

QE 9156 LEAN SIX SIGMA

L T P C

3 0 0 3

UNIT-I EVOLUTION OF LEAN SIX SIGMA 5

Introduction to Lean Principles and Six Sigma Concepts-Similarities and differences – Synergy-Evolution of Lean Six Sigma

UNIT-II LEAN SIX SIGMA APPROACH 8

Lean Six Sigma Methodology- Phases of Lean Six Sigma Method, Managing Lean Six sigma Project ,Six sigma Methodologies (DMAIC, DMADV , DFSS)

UNIT-III SIX SIGMA TOOLS AND TECHNIQUES 12

Advanced Statistical Tools - Statistical Process Control-Process Capability Analysis Sigma computation -Hypothesis Testing-ANOVA-Design of Experiments- chi-square test, Regression analysis –Case studies

UNIT-IV LEAN TOOLS 10

Value Stream Mapping – Poka Yoke-5S-Cycle Time Analysis-Push-Pull Systems- Waste Elimination- Total Productive Maintenance- Failure Mode Effect Analysis- Standard Work Practices-Control Plans, SMED , Kanban , Visual control , Kaizen –Case studies

UNIT-V LEAN SIX SIGMA IMPLEMENTATION 10

Identifying Lean Six Sigma Projects, Define Scope, Planning for Implementation, Selection of tools and techniques for each phase, measuring the Benefits

TOTAL: 45

REFERENCES

1. Michael L. George, David Rowlands, Bill Kastle ,What is Lean Six Sigma, McGraw-Hill, 2003
2. Thomas Pyzdek,The Six Sigma Handbook ,McGraw-Hill, 2000
3. James P. Womack , Daniel T. Jones ,Lean Thinking, Free press business, 2003.
4 Forrest W. Breyfogle III ,Implementing Six Sigma: Smarter Solutions Using Statistical Methods ,1999.
5. Liker, Jeffrey; Meier, David ,Toyota Talent , Tata Mcgraw Hills

IE 9155 TOTAL QUALITY MANAGEMENT AND SYSTEM

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UNIT I CONCEPTS AND PHILOSOPHY 9

Basic concepts, need for TQM, principles of TQM, Quality philosophies of Deming, Crosby, Juran, Ishikawa and Feigenbaum, TQM models.

UNIT II TQM PROCESS 9

QC tools, problem solving methodologies, new management tools, quality circles, bench marking, strategic quality planning.

UNIT III TQM SYSTEMS 9

Quality policy deployment, quality function deployment, introduction to BPR and FMEA.

UNIT IV QUALITY SYSTEM 9

Need for ISO 9000 system, advantages, clauses of ISO 9000, Implementation of ISO 9000, QS9000 systems, introduction to EMS, quality costs, quality auditing, case studies.

UNIT V IMPLEMENTATION OF TQM 9

KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods, steps in TQM implementation, national and international quality awards, case studies.

TOTAL : 45

REFERENCES

1. Dale H.Besterfiled, "Total Quality Management", Pearson Education Asia, (Indian reprint 2002)
2. Rose, J.E. Total Quality Management, Kogan Page Ltd. 1993.
3. John Bank, The essence of total quality management, PHI 1993.
4. Greg Bounds, Lyle Yorks et al, Beyond Total Quality Management, McGraw Hill, 1994.
5. Takashi Osada, The 5S's The Asian Productivity Organization, 1991.
6. Masaki Imami, KAIZEN, McGraw Hill, 1986.