Course Name	**:**	**CREATIVE ENGINEERING DESIGN**
Course Code	**:**	**IDN 511**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE

To understand the concept of Creative design for the product and system design.

Lecture wise breakup **No. of Lectures**

CREATIVE PRODUCT & SYSTEM DESIGN **(5)**

Creative design, Innovation versus invention, Globalization, Team work, Project scheduling and management.

CREATIVE MIND **(3)**

Whole Brain thinking, Creativity, What makes an individual creative?

RECLAIMING CREATIVITY **(6)**

Mental Barriers, Types of mental Barriers, False assumptions and nonexistent limitations, Associating thinking, misunderstandings, inability to communicate properly, emotions, culture and environment related barriers, improper method of solution

CREATIVE PROBLEMS SOLVING TECHNIQUES **(6)**

Brain storming, 6-3-5 method, Morphological attitude list, list of alternative actions, analogy (Case based reasoning) method, random attributes, Scamper method.

IMAGINATION, VISUALIZATION, GRAPHICAL REPRESENTATION AND COMMUNICATION **(5)**

Imagination, drawings, engineering drawings, realistic drawings, Perspectives and location of objects, determining depth in perspective: scale factors, drawing perspective, sketching, put-in-the-box scheme

DESIGN CONSIDERATION AND DECISIONS **(6)**

Cost, size, weight, material selection, method of fabrication, Physical and structural standards, Function standards and expectations, performance, efficiency, reliability, Company image and mission, quality, service ability, Styling shape, aesthetics and packaging, Safety, human factors, Environmental effects, Disposability, sustainability, Assembly-Disassembly, life expectancy, ethical issue, Patent and other intellectual property rights, Legal matters.

ENGINEERING ECONOMY **(6)**

Value, Global Economics Models, Costs, Revenue & Profits, Cost Breakdown of Products & Systems, Product Life Span, Time value of money, NPV, IRR, EUAC methods.

DESIGN AND PRODUCT LIABILITY **(5)**

Product Liability History and Background, Major Administrative Law Related to Product Liability, Basic Theories of Product Liability Law, reducing Product Liability Risk, Failure Mode and Effect Analysis (FMEA), Code of Ethics for Engineers, Standards and Codes,

COURSE OUTCOME

1. Students should be able to solve problems related to Creative design, Project scheduling and management.
2. Students should be able to use creative ideas and techniques to design a product.
3. Students should have knowledge of engineering economy, design consideration and design & product liabilities.

BOOKS:

1 Saeed Benjamin Niku, Creative Design Of Products And Systems, 2008
2 Cross, N., Engineering Design Methods, John Wiley, 1994

Course Name	**:**	**PRODUCT FORM AND AESTHETICS**
Course Code	**:**	**IDN 512**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE

To understand the importance of product form and aesthetics in the product design.

Lecture wise breakup **No. of Lectures**

ELEMENTS AND PRINCIPLES OF DESIGN **(15)**

History of design, Design in everyday life, Art, design & Society,
Elements of design : space, form, line, texture, etc,
Principles of Design: Scale, Balance, Proportion, Rhythm, etc,
course objectives of Design: Truth, Beauty, Order, Efficiency and Economy,
Theory of colours, Colour symbolism.

DESIGN THEORY AND VISUAL DESIGN **(18)**

Art movements and design: Principles of style in art, product design, architecture, and graphic design,
Art and perception : Methodology of criticism and appreciation,
Types of 2D and 3D Visual Media, Visual Grammar, Application in Visual Design, Visual Perception and Analysis, Visual Forms & Concepts, Design and
Development of Form, Communication through Visual Modes of Application.

CREATIVE VISUALIZATION **(9)**

Studies in form and style, conceptualization, exploration, and development of form and style in both product design and Visual communication.
Bases for creative visualization: Fantasy. Metaphors, Cultural connotations and Bionics in the context of form-making.
Study of evolution of forms in products : 2D and 3D space analysis Dominant - sub dominant - subordinate relationships

COURSE OUTCOME:

1. Students should be able to design a product considering the importance of form and aesthetics in the product design.
2. Students should be able to understand creative visualization and visual design.

BOOKS:

1. Noel Riley, The Elements of design, free press, 2003
2. Baker Robin, Designing the Future, Thames & Hudson,1993

REFERENCES:

1 Jones J C, Design Methods, Van Nostrand Reinhold, 2003
2 Morris Richard, The Fundamentals of Product Design ,AVA Pub, 2009

Course Name	**:**	**ADVANCED MATHEMATICS**
Course Code	**:**	**MAN 503**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE:

To understand Linear programming, Non-linear programming and constrained & unconstrained external problems.

Lecture wise breakup	**No. of Lectures**
Linear programming problem, Simplex method	**(5)**
Artificial variables and dual phase method	**(4)**
Non-linear programming problems, unconstrained extremal problems, Necessary and sufficient conditions for extrema, Fibonacci and Golden search methods	**(6)**
Gradient methods	**(6)**
Direct search methods	**(4)**
Constrained extremal problems, Equality constraints, Jacobian and Lagrangean methods	**(4)**
Inequality constraints, extension of Lagrangean method, the Kuhn -Tucker conditions	**(5)**
Direct search methods	**(3)**
Separable, Quadratic, Geometric programming and Linear combination method	**(8)**

COURSE OUTCOME

1. Students should be able to solve problems related to linear programming and non-linear programming.
2. Students should be able to solve problems related to constrained and unconstrained external problems using different methods.

Books:

1. Taha, Operations Research, Prentice Hall, 7th ed, 2002.
2. Phillips and Solberg, Ravindran, Operations Research, John Wiley & Sons, 2nd edition 2000.

REFERENCES:

1. Chapra and Canale, Numerical Methods for Engineers, Tata Mc Graw Hill, 4th edition, 2005.
2. S.S.Rao, Engineering Optimization, New Age, 3rd edition, 2000.

Course Name	**:**	**PROGRAM LAB – I (INDUSTRIAL DESIGN LAB)**
Course Code	**:**	**IDN 510**
Credits	**:**	**2**
L T P	**:**	**0 0 3**

Total no. of lectures: 42

COURSE OBJECTIVE:

The aim of these laboratory exercises is to acquaint students with basics of design process including colour theory, ergonomics, metamorphosis and analysis.

List of Experiments:

1. To generate two dimensional rhythms, deformations and patterns in design.
2. To acquire an initial understanding of human scale ergonomics from a personal viewpoint and with respect to the anthropometric features of the human body.
3. To develop an understanding of basic color theory and its application in the design of three dimensional products.
4. To develop an understanding of the cognitive, morphological process inherent in applying form analogies for generating two dimensional design concepts.

5-6. To design a product of low complexity, relatively simple geometry and which utilizes a commonly available material such as cardboard.

7. To communicate the assembly procedure for the product developed in experiment 5-6.
8. To develop an understanding of the cognitive, morphological process inherent in applying form analogies for generating three dimensional design concepts.

9-10. To carry out syntactic analysis of hand held products and similar elements.

11-12. To carry out pragmatic analysis of hand held products and similar elements.

13-14. To carry out semantic analysis of hand held products and similar elements.

COURSE OUTCOME:

1. After completing the course, students should be able to generate two dimensional rhythms, deformations and patterns in design.
2. Understand human scale ergonomics from a personal viewpoint and with respect to the anthropometric features of the human body.
3. Understand basic color theory and its application in the design of three dimensional products.
4. Understand the cognitive, morphological process inherent in applying form analogies for generating two and three dimensional design concepts.
5. Design a product of low complexity, relatively simple geometry and which utilizes a commonly available material and communicate the assembly procedure for the developed product.
6. carry out syntactic, pragmatic and semantic analysis of hand held products and similar elements

Course Name	**:**	**DESIGN OF EXPERIMENTS AND RESEARCH METHODOLOGY**
Course Code	**:**	**MAN 505**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE:

To understand various techniques of experimental design, analysis and research methodology.

Lecture wise breakup	**No. of Lectures**
Basic principles of design of experiment, Error analysis in experiments.	**(4)**
Classification of experimental designs, Design and analysis of one factor experiments Completely randomized and randomized complete block designs, Analysis of variance.	**(7)**
Estimation of parameters, Residual analysis and model checking, Sample size problem.	**(4)**
Design with two blocking variables, Latin squares, Analysis of data from a Latin square.	**(2)**
Experiment with two factors- Introduction, Main effects and interactions, Two-factor analysis of variance, Graphic analysis, Choice of sample size.	**(6)**
Design of Experiments with the help of orthogonal arrays, Taguchi's Robust parameter design, Analysis, Noise factors, Tolerance on control factors.	**(5)**
Research Methodology – Nature and COURSE OBJECTIVE of research, Research topic, Literature review, Formulation of problem, Research design, Sampling techniques, Data collection, Statistical and sensitive analysis of data, Interpretation of result and report writing.	**(9)**
RSM Technique - Introduction to Response Surface Methodology (RSM) : Fundamentals and Goals of RSM, Approximating Functions, Empirical Model Building: Checking for Lack of Fit, Checking for Collinearity Problems, 2k Factorial Designs: The General 2k Design, In Two, Four, 2p Blocks, Discussion of Confounding	**(5)**

COURSE OUTCOME:

1. Students should be able to use various techniques of experimental design.
2. Students should be able to analyze and optimize the research problems.
3. Students should be able to write a research report using research methodology.

Books:

1. Ronald E. Walpole, Myers and Ye, Probability and Statistics for Engineers and scientists, Pearson Education, 7th ed, 2002.
2. Richard A. Johnson, Irwin Miller, John Freund, Miller and Freund's probability and statistics for engineers, Prentice Hall, 2009.

REFERENCES:

1. Phillip J.R.S.S. taguchi, Techniques for quality engineers, MCGRAW HILL publication.

Course Name	**:**	**PRODUCT DESIGN AND DEVELOPMENT**
Course Code	**:**	**IDN 521**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE

To understand the concept of product design, development and planning.

Lecture wise breakup **No. of Lectures**

UNDERSTANDING DESIGN **(4)**

Design & its nature, Design activities: Design exploration, Design generation, Design evaluation, Design communication, Design Ability: Human Brain & whole brain thinking, Intuition vs. logical thinking, Difference between Scientist/Engineer & a designer, Design problems: Design brief, ill-defined problems, Final design description, Four stage design process model

PRODUCT DEVELOPMENT **(3)**

What is product development, Characteristics of successful product development, Who designs & develops products, Challenges of product development, Phases of product development process.

PRODUCT PLANNING **(3)**

Product planning, Types of product development projects, Product Planning process (steps).

CONCEPT DEVELOPMENT PHASE **(15)**

Identifying Customer Needs

Product Specifications: What are specifications, When are specifications established?, Establishing target specifications. Setting the final specifications .The activity of concept generation, A five-step method Concept Selection & Concept Testing

SYSTEM LEVEL DESIGN **(5)**

Product Architecture, Industrial design

DETAIL DESIGN **(9)**

Design for manufacturing & Robust design

Computer Aided Design: Geometric modeling approaches, Wireframe & surface modeling, NURUBS, Solid modeling, Features, Parametric & Variational Design, Computer Aided Engineering Analysis, CAD/CAM Data Exchange, Rapid prototyping

TESTING & REFINEMENT **(3)**

Prototyping basics, Principles of prototyping, Prototyping technologies, Planning for prototypes.

COURSE OUTCOME:

1. Students should be able to design a product using computer aided design.
2. Students should be able to carry out product development and planning process.
3. Students should be able to understand the concept of prototyping.

BOOKS

1. K.T. Ulrich & S.D. Eppinger, Product Design & Development, TMH,2003
2. Cross N., Engineering Design Methods-Strategies for Product Design, John Wiley & Sons, 2008

REFERENCE:

1. Singh N., Systems Approach to Computer Integrated Design & Manufacturing, John Wiley & Sons, 1996

Course Name	**:**	**APPLIED ERGONOMICS**
Course Code	**:**	**IDN 522**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE:

To understand the concept of designing a job for a worker considering various factors affecting a human ergonomically.

Lecture wise breakup **No. of Lectures**

INTRODUCTION **(3)**
Human Factors and Systems. Human Factors Research Methodologies

INFORMATION INPUT **(9)**
Information Input and Processing, Text, Graphics, Symbols and Code, Visual Display of Dynamic Information, Auditory, Tactual and Olfactory Displays, Speech Communications

HUMAN OUTPUT AND CONTROL **(8)**
Physical Work and Manual Materials Handling Motor Skills, Human Control of systems, Controls and Data Entry devices, Hand tools and devices,

WORKPLACE DESIGN **(7)**
Applied Anthropometry, Work-space design and Seating, Arrangement of Components within a Physical Space, Interpersonal Aspects of Workplace Design

ENVIRONMENTAL CONDITIONS **(6)**
Illumination, Climate, Noise, Motion

HUMAN FACTORS APPLICATIONS **(9)**
Human Error, Accidents and Safety, Human Factors and the Automobile. Human Factors in Systems design

COURSE OUTCOME:

1. Students should be able to understand human factors & systems and human output & control.
2. Students should be able to design a job for a worker considering various factors affecting a human ergonomically.
3. Students should be able to design a workplace.

BOOKS:

1. Mark Sanders, Ernest McCormick, Human Factors In Engineering and Design, 7th edition, McGraw-Hill International Editions, 1993.
2. Martin Helander, A Guide to human factors and ergonomics, Taylor and francis, 2005.

REFERENCES:

1. Stanton N et al, Handbook of human factors and ergonomic methods, CRC press, 2004.
2. Gallwey T J, Ergonomics Laboratory Exercises, CRC Press, 2009.
3. Bridger R.S., Introduction to ergonomics, MCGRAW HILL, 1995.

Course Name	**:**	**PROGRAM LAB – II (HUMAN ENGINEERING LAB)**
Course Code	**:**	**IDN 520**
Credits	**:**	**2**
L T P	**:**	**0 0 3**

Total no. of lectures: 42

COURSE OBJECTIVE:

To understand the concept of ergonomics, anthropometric investigation and MMH.

List of Experiments

1. To carry out the anthropometric investigation of student population.
2. To carry out the posture analysis using RULA and REBA.
3. To analyze a MMH task using NIOSH equation.
4. To assess a manual material handling task from physiological perspective.
5. To carry out the ergonomics analysis of office workstation.
6. To carry out the ergonomics analysis of a factory work cell.
7. To carry out investigations on information processing related to human discriminability, central information processing, motor information system and visual search.

COURSE OUTCOME:

1. Students should be able to carry out anthropometric investigation and posture analysis.
2. Students should be able to analyze a MMH task.
3. Students should be able to carry out the ergonomics analysis of office workstation and factory work cell.

Course Name	**:**	**CASE HISTORIES AND INDUSTRIAL EXPERIENCES**
Course Code	**:**	**IDN 531**
Credits	**:**	**1**
L T P	**:**	**0 0 2**

In the Course on case Histories and Industry Experiences, documented case histories shall be presented by the course instructor and, in addition, industry experts shall be invited to talk about industry experiences.

Course Name	**:**	**MATERIALS, MANUFACTURING AND DESIGN**
Course Code	**:**	**IDN 551**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE

To study various engineering materials and their selection for particular application and suitable design for specific property.

Lecture wise breakup **No. of Lectures**

INTRODUCTION **(4)**
Materials Structure, nucleation & growth, phase diagrams application of phase diagram

ENGINEERING MATERIALS **(5)**
Metals and their properties, ferrous and non-ferrous metals, uses, production, forming and joining of metals.

CERAMICS AND GLASSES **(6)**
Structures of ceramics and glasses, design properties, ceramics uses, production, forming and joining of ceramics.

POLYMERS AND COMPOSITES, MMC, FRC **(7)**

MATERIAL SELECTION **(7)**
Sources of information on materials properties, methods, of materials selection

DESIGN PROCESS **(8)**
Materials in design, design for brittle fracture, design for fatigue failure, design for corrosion resistance, design with plastic.

CASE STUDIES IN MATERIAL SELECTION **(5)**

COURSE OUTCOME:

1. Students should be able to understand the various properties of the engineering materials.
2. Students should be able to select engineering materials for particular application.
3. Students should be able to design for a specific property of a material.

Books:

1. Ashby M.F., Engineering Materials, Pergamon Press
2. Dieter, GE, engineering design, A material and processing approach, MCGRAW HILL.

REFERENCES:

1. Callister, Material science and engineering, John wiley and sons.

Course Name	**:**	**SEMINAR AND TECHNICAL WRITING**
Course Code	**:**	**IDN 532**
Credits	**:**	**1**
L T P	**:**	**0 0 2**

Students will individually present a seminar on state-of-art technology in a specific area of Production and Industrial Engineering. They will be required to submit a technical report of same.

Course Name	**:**	**FINITE ELEMENT ANALYSIS**
Course Code	**:**	**PRN 555**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVES:

To understand the concept of designing & development of products and modeling & analysis of a system using finite element analysis.

Lecture wise breakup **No. of Lectures**

Product development driven by concurrent engineering; role of CAE (Computer-Aided Engineering) in Product design; mathematical abstractions of product for functionality verification **(3)**

INTRODUCTION TO FEM **(4)**

The Finite Element Method, Elements and Nodes, Modeling the problem and Checking Results, Discretization and other Approximations, Responsibility of the user, Elementary Matrix Algebra.

BARS AND BEAMS **(4)**

Linear Static Analysis: Stiffness Matrix Formulation: Bar Element, Stiffness Matrix Formulation: Beam Element, properties of stiffness matrices – Avoiding Singularity, Mechanical Loads and Stresses, Thermal Loads and Stresses

PLANE PROBLEMS **(6)**

Constant Strain Triangle (CST),s Linear Strain Triangle (LST), Bilinear Quadrilateral (Q4), Quadratic Quadrilateral (Q8), Improved Bilinear Quadrilateral (Q6), Elements with "Drilling" dof, Elements of more General Shape, Loads, Stress Calculation.

ISOPARAMETRIC ELEMENTS AND SOLUTION TECHNIQUES **(6)**

Node Numbering and Matrix Sparsity, Equation solving, Transformations, Isoperimetric Elements Formulation, Gauss Quadrature and Isoperimetric Elements, Choice of Quadrature Rule and Instabilities, Stress Calculation and Gauss Points, Nature of Finite Element Solution, Convergence Requirements – Patch Test, Infinite Media and Infinite Elements, Substructures, Symmetry, Constraints.

MODELING, ERRORS AND ACCURACY IN LINEAR ANALYSIS **(7)**

Modeling in General, Structure Behavior and Element Behavior, Element Tests and Element Shapes, Test Cases and Pilot Studies, Material Properties, Loads, Connections, Boundary Conditions, Planning the Analysis, Numerical Error : Sources and Detection, Common Mistakes, Checking the Model, Critique of FE Results, Stress Concentrations – Sub-modeling, Convergence with Mesh Refinement, Error Measures and Adaptivity.

THERMAL ANALYSIS **(6)**

Some Basic Equations, Finite Elements in Thermal Analysis, Radiation and Other Nonlinearities, Thermal Transients, Modeling Considerations.

VIBRATION AND DYNAMICS **(6)**

Basic equations – Vibration, Mass matrices, Undamped Free Vibration, Damping, Reduction, Modeling Equations.

CASE STUDIES

COURSE OUTCOMES:

1. Students should be able to solve problems using finite element analysis.
2. Students should be able to carry out structural and thermal analysis.
3. Students should be able to carry out finite element analysis of consumer products.

BOOKS:

1. Cook R D, Finite Element Modeling for stress Analysis, John Wiley and Sons, Inc. 1995
2. Chandrupatla & Belegundu, 'Finite Elements in Engineering', Prentice Hall of India Pvt. Ltd., 1997.

REFERENCES:

1. Rao.S.S., Finite Element Methods in Engineering, Pregamon Press, 1989.
2. Reddy J.N, An Introduction to Finite Element Method, MCGRAW HILL International Editions, 1993.

Course Name	**:**	**DESIGN AND MANUFACTURE OF MECHANICAL ASSEMBLIES**
Course Code	**:**	**PRN 511**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE:

To understand product life cycle, the relevance of assemblies in this cycle and design & manufacture of assemblies.

Lecture wise breakup **No. of Lectures**

PRODUCT REQUIREMENTS AND TOP-DOWN DESIGN (3)
Chain of delivery of quality, Key characteristics, Variation risk management, Examples, Key characteristics conflict, Assembly in the context of product development, Assembling a product, Present status of assembly

MATHEMATICAL AND FEATURE MODELS OF ASSEMBLIES (8)
Types of assemblies: Distributive systems, Mechanism and structures, Types of assembly models, Matrix transformations: Nominal location transforms, Variation transforms, Assembly features and feature-based design, Mathematical models of assemblies, Examples of assembly models

CONSTRAINT IN ASSEMBLY (6)
Kinematic design, Features as carriers of constraints, Use of screw theory to represent and analyze constraints, Design and analysis of assembly features using screw theory, Constraint analysis

DIMENSIONING AND TOLERANCING PARTS AND ASSEMBLIES (7)
Dimensional accuracy in manufacturing, KCs and tolerance flowdown from assemblies to parts, Geometrical dimensioning and tolerance, Statistical and worst-case tolerancing, Modelling and managing variation buildup in assemblies

ASSEMBLY SEQUENCE ANALYSIS (6)
Assembly sequence design process, Bourjault method of generating feasible sequencies, Cutset method, Checking stability of sub-assemblies

DATUM FLOW CHAIN (6)
DFC definition, Mates and contacts, KC conflict and its relation to assembly sequence and KC priorities, Assembly precedence constraints, DFCs, tolerances and constraints, Design procedure for assemblies

DESIGN FOR ASSEMBLY AND DESIGN FOR MANUFACTURING (6)
Sequential versus concurrent engineering, understanding interactions between design and manufacturing, benefits of concurrent engineering, concurrent engineering techniques, design for assembly, design for manufacturing

COURSE OUTCOME:

1. Students should be able to mathematically model a product and carry out constraint analysis and assembly sequence analysis.
2. Students should be able to carry out tolerance analysis and synthesis.
3. Students should be able to apply principles of DFM to consumer products.

BOOKS:

1. Whitney D.E., Mechanical assemblies: Their design, manufacture and role in product development, Oxford University Press, 2004.
2. Zeid Ibrahim, CAD/CAM Theory and Practice, Tata Mcgraw Hill, 2009.

REFERENCES:

1. Singh Nanua, Systems Approach to Computer Integreted Design and Manufacturing, John Wiley & Sons, 1996.
2. Geoffery Boothroyd, Peter Dewhurst, Winston Knight, Product Design for Manufacturing and Assembly, Marcel Dekker , Newyork 2nd edition , 1994.

Course Name: : **DESIGN MANAGEMENT**
Course Code : **IDN 552**
Credits : **3**
L T P : **3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE:

To understand the concept of design management, various design strategies & methods and business strategies.

Lecture wise breakup **No. of Lectures**

DESIGN MANAGEMENT **(2)**
What is Design Management? Why is Design Management Important? The Design Management Timeline, Managing the Design Strategy

UNDERSTANDING DESIGN **(5)**
Identifying Opportunities for Design, Understanding the Audience and Market, Interpreting Client and Customer Needs, Auditing the Use of Design

DESIGN STRATEGIES **(6)**
Establishing the Design Strategy, Promoting and Selling the Design Strategy, Planning for Long-term Growth, Practice, Case Studies

MANAGING CLIENT RELATIONS **(7)**
Key Skills, Managing Client Relations, Guiding Design Decisions, Developing Good Working Relationships, Verbal Communication, Managing the Design Process

BUSINESS STRATEGIES **(8)**
Giving Form to Business Strategy, Increasing Awareness with Design, Expressing the Brand Through Design, Initiating Design Projects, Design Methods, Design Processes, Competitive Advantage Through Design, Practice, Case Studies

MANAGING DESIGNING TEAMS **(8)**
Key Skills, Managing Creative Teams, Facilitating the Design Process, Developing Collaborative Cultures, Visual Communication, Managing the Design Implementation

THE PROJECT MANAGEMENT PROCESS **(8)**
The Project Management Process, Project Management in Practice, Social and Environmental Responsibilities, Design Policies, Procedures and Guidelines, Translating Global Design into Local Design, Measuring the Success of Design, Reviewing and Revising the Design Strategy, Case Studies

COURSE OUTCOME:

1. Students should be able to select appropriate design strategy and design method.
2. Students should be able to use business strategy.
3. Students should be able to understand Project Management Process.

BOOK:

1. Best Kathryn: Design Management: Managing Design Strategy, Process and Implementation, AVA publishing 2007
2. Best Kathryn **,** The Fundamentals of Design Management, AVA publishing 2010

REFERENCES

1. Mark Oakley (Ed) : Design Management - A Handbook of Issues and Methods, Blackwell Publication 1990

Course Name	**:**	**MODELING AND SIMULATION**
Course Code	**:**	**IDN 553**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE:

To understand the modeling and simulation concept in manufacturing and material handling systems.

Lecture wise breakup **No. of Lectures**

INTRODUCTION TO MODELING **(6)**

Concept of system, continuous and discrete systems, types of models, time and advance mechanisms, components and organizations of a discrete event simulation models, step in simulation study.

STATISTICAL MODEL IN SIMULATION **(9)**

Discrete, Continuous, Poisson and empirical distributions; Output data analysis for a single system-types of simulation with regard to output analysis, statistical analysis for terminating simulations comparing alternative system configurations, statistical procedures for comparing real world observations with simulation output data, generation of arriving processes.

VERIFICATION AND VALIDATION OF SIMULATION MODELS **(5)**

Introduction, Guidelines of determining the level of model details, Verification of simulation computer programs, techniques of increasing model validity and credibility.

MONTE CARLO SIMULATION **(8)**

Introduction to Monte Carlo Simulation, random number generators, and inventory control simulations- Fixed period and Fixed quantity systems, simulation of queing problems, applications in queing models and inventory models**.**

SIMULATION OF MANUFACTURING AND MATERIAL HANDLING SYSTEMS **(8)**

Introduction, COURSE OBJECTIVE of simulation in manufacturing, modeling system randomness, sources of randomness, machine down times, calendar time and busy time approach, models of material handling systems.

CASE STUDIES **(6)**

Use of simulation package problems related to simulation of queuing systems, simulation of material handling and manufacturing systems.

COURSE OUTCOME:

1. Students should be able to simulate the material handling and manufacturing systems
2. Students should be able to verify and validate simulated models.
3. Students should be able to deal with simulation package problems related to queuing systems.
4. Students should be able to get knowledge related to the discrete, continuous, poisson & empirical distributions and monte carlo simulation.

BOOKS:

1 Law M A, Simulation Modeling and Analysis, McGraw Hill, 2007
2 Banks Jerry, Discrete event system simulation, Pearson Education 2005

REFERENCES:

1. Zeigler B. P. et al., Theory of Modeling and Simulation, Integrating Discrete Event and Continuous Complex Dynamic Systems, Academic Press

Course Name	**:**	**MECHATRONICS SYSTEM DESIGN**
Course Code	**:**	**IDN 554**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE

To understand design process, key elements, approaches and integrated design issues in mechatronics system design.

Lecture wise breakup **No. of Lectures**

INTRODUCTION **(2)**

Introduction; Integrated design issues in Mechatronics; Mechatronics key elements; Mechatronics Design Process; Approaches in Mechatronics.

MODELING & SIMULATION OF PHYSICAL SYSTEM **(8)**

Simulation in Block Diagrams; Analogies and impedance Diagrams; Electrical System; Mechanical Systems; Electromechanical coupling, Fluid System.

SENSORS AND TRANSDUCERS **(8)**

Sensors for motion and position measurement; Force, Torque and tactile sensors: flow sensors; temperature sensing devices; Ultrasonic Sensors; Rain Sensors: Active Vibration Control using magentonstrictive Transducers; Fiber optic devices in Mechatronics.

ACTUATING DEVICES **(6)**

DC Motors; PM Stepper Motors; Fluid Power Actuation; Fluid Power Design Elements; Piezoelectric Actuators.

HARDWARE COMPONENTS FOR MECHATRONICS **(6)**

Binary Logic; Karnaugh Map minimisation : Transducer Signal Conditioning and devices for data conversion: Programmable controller.

SIGNAL SYSTEMS AND CONTROLS SYSTEMS & CONTROLS **(8)**

System representation; Linearization of Non-Linear Systems; Measures of System Performance, Root Locus; Bode Plots.

REAL TIME INTERFACING **(4)**

Elements of Data Acquisition & Control System; Overview of the I/O Process

COURSE OUTCOME:

1. Students should be able to carry out modeling and simulation of physical systems.
2. Students should have knowledge related to various sensors, transducers, actuating devices and hardware components for mechatronics.
3. Students should be able to carry out real time interfacing using data acquisition & control system.

BOOKS:

1. Shetty D., Kolk R., Mechatronics System Design, PWS Publishing Co. 1997
2. Necsulescu S., Mechatronics by Pearson Education Asia, 2002

REFERENCES:

1. Bishop Robert H., The Mechatronics Handbook, Second Edition - Volume 2, 2002.

Course Name	**:**	**MECHANISM DESIGN**
Course Code	**:**	**IDN 555**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE:

To understand the concept of designing a mechanism and kinematics analysis, static & dynamics force analysis of mechanisms.

Lecture wise breakup **No. of Lectures**

INTRODUCTION **(3)**

Introduction to Kinematics and Mechanisms - motion, mobility, degree of freedom, analysis vs synthesis, etc.

KINEMATIC ANALYSIS **(9)**

Kinematic analysis of simple mechanism using Relative Velocity and Instant Center Method, Relative Acceleration, Coriolis Acceleration, Mechanisms with Curved Slots, Mechanical Advantage

STATIC AND DYNAMIC FORCE ANALYSIS **(9)**

Introduction To Statics and Dynamics Force Analysis of Mechanisms - Inertia Forces in Linkages, Kinetostatic Analysis of Mechanisms, the superposition Method (Graphical & Analytical), the Matrix Method.

COUPLER CURVES **(6)**

Application of coupler curves for Dwell Mechanisms, Two and Three position rigid body guidance.

CAM DESIGN **(6)**

Cam & Follower, Displacement Diagrams (Graphical and Analytical), Advanced Cam Profile Techniques, Graphical and Analytical Cam profile Synthesis.

GEAR AND GEAR TRAINS **(9)**

Gear Tooth Nomenclature, Forming of Gear Teeth, Cycloidal and Involute, Contact Ratio, Bevel, Helical, Worm gearing, Analysis of Gear Trains, Planetary Gear Trains (Formula, Tabular, and Instant Center , Methods), Tooth Loads and Power Flow.

COURSE OUTCOME:

1. Students should be able to carry out kinematics analysis of simple mechanism
2. Students should be able to carry out static and dynamics force analysis of mechanisms.
3. Students should have knowledge related to gear & gear trains, coupler curves and cam design.

BOOKS:

1. George N, Sandor and Arthur, Advanced Mechanism Design, Volumes I & II; Prentice Hall of India Limited, New Delhi. 1984
2. Ivan I. Artobolevsky, Mechanism in Modern Engineering Design, Vol I to IV; Mir Publishers, Moscow. 1980

REFERENCES:

1. Hamilton E, Mabie and Fred W. Ocvirk, Mechanisms and Dynamics of Machinery; John Wiley and Sons, New York. 1987

Course Name	**:**	**INTERACTION DESIGN**
Course Code	**:**	**IDN 556**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE

To understand the various processes related to interaction design, importance of interaction design and prototyping.

Lecture wise breakup **No. of Lectures**

INTRODUCTION **(2)**
Introduction, Processes of interaction design, Importance of interaction design, Interaction design and the user experience.

CONCEPTUALIZING INTERACTION AND COGNITIVE ASPECTS **(6)**
The problem space and conceptualizing design, Conceptual models, Interface metaphors, Interaction types, Paradigms for interaction, Cognition and Cognitive frameworks.

SOCIAL AND EMOTIONAL INTERACTION **(10)**
Introduction; being social, Types of conversations, Telepresence and Co-presence, Emergent social phenomena, Emotions and the user experience, Types of emotional interfaces, Anthropomorphism and zoomorphism, Models of emotion.

INTERFACES, DATA ANALYSIS, INTERPRETATION, AND PRESENTATION **(8)**
Interface, Types of Interface, Natural user interfaces, Qualitative and quantitative data analysis, Tools for data analysis, Establishing requirements, Task description, Task analysis.

DESIGN, PROTOTYPING AND CONSTRUCTION **(8)**
Introduction, Prototyping and Construction, Conceptual and Physical design, Scenarios and prototypes in design, Support for design.

EVALUATION **(8)**
Introduction of Evaluation, Types of Evaluation, Evaluation case studies, Usability testing, Experiments, Field studies, Heuristic Evaluation, Analytics, Predictive models.

COURSE OUTCOME:

1. Students should be able to understand the various processes related to interaction design, importance of interaction design.
2. Students have the knowledge of conceptualizing interaction and cognitive aspects.
3. Students have the knowledge of prototyping.

BOOKS:

1. Preece, Rogers and Sharp, Interaction Design: Beyond Human–Computer Interaction, John Wiley and Sons, Delhi, 2003.

2. Shneiderman, Designining the User Interface: Strategies for Effective Human-Computer Interaction, (3rd Ed.), Addison Wesley, 2000.

REFERENCES:

1. Andrew Sears, Julie A. Jacko The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, New York: John Wiley & Sons, 2002

Course Name	**:**	**USABILITY ENGINEERING**
Course Code	**:**	**ID 557**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE:

To understand the usability lifecycle, usability heuristics, usability testing and methods.

Lecture wise breakup **No. of Lectures**

INTRODUCTION **(2)**

Introduction, Definition of usability, various categories of users and individual user differences.

USER INTERFACES **(6)**

introduction, generations of interfaces, line-oriented interfaces, full-screen interfaces, graphical user interfaces, long term trends in usability.

THE USABILITY LIFECYCLE **(10)**

User identification, Competitive analysis, Financial impact analysis, Parallel design, Participatory design, Heuristic evaluation, Prototyping, Interface evaluation, Iterative design, Prioritizing usability activities.

USABILITY HEURISTICS **(8)**

Simple and natural dialogue, Mappings and Metaphors, User memory load, Consistency, Response time and System failure, Error messages, Prevent errors, Heuristic evaluation.

USABILITY TESTING **(8)**

Reliability and validity, testing goals and plans, Test users, Ethical aspects of tests with human subjects, Test stages, Performance measurement, Usability laboratories

USABILITY METHODS **(8)**

Observation, Questionnaires and interviews, focus groups, Logging actual use, Combining logging with follow-up interviews, Usability methods.

COURSE OUTCOME:

1. Students should have the knowledge of concept of usability, usability methods and usability testing.
2. Students should be able to understand various categories of users and the usability lifecycle.

BOOKS:

1. Nielsen J., Usability Engineering, Morgan Kaufmann, San Francisco, 1993.
2. Preece, Rogers and Sharp, Interaction Design: Beyond Human – Computer Interaction, John Wiley and Sons, Delhi, 2003.

REFERENCES:

1. Galitz W. O, The Essential Guide to User Interface Design, John Wiley and Sons – Dream Tech India Pvt. Ltd, Delhi, 2002.

Course Name	**:**	**PLASTICS ENGINEERING**
Course Code	**:**	**PRN 562**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVE

To understand the various plastics materials, mould materials and their selection criteria & product design.

Lecture wise breakup **No. of Lectures**

PLASTICS MATERIALS **(8)**

Plastics materials selection for products based on Mechanical properties and thermal behavior of plastics.

MOULD MATERIALS AND DESIGN **(18)**

Mould materials and their selection criteria, classification of Compression Moulds, Transfer mould design, Blow mould design, Injection mould design,

RAPID TOOLING **(4)**

Direct & indirection tooling

PLASTICS PRODUCT DESIGN **(12)**

Design of thermoplastics and thermosetting type of polymers under static and dynamic loads, Tribological properties of polymers, abrasion and wear, design of abrasion and wear resistant products, Designing with sample composites, Product characterization, Product faults and optimum processing, Effect of processing on product performance, product characterization and service behavior.

COURSE OUTCOME:

1. Students have the knowledge of different types of plastic materials and their properties & applications.
2. Students should be able to select mould materials and to carry out mould design.
3. Students should be able to carry out problems related to the plastics product design.

BOOKS:

1. Crawford R.J., Plastics Engineering, Pergamon Press,1988

2. Levy S. & Dubois J.H., Plastic Product Design Engineering Hand Book, , Van Nostrand Reinhold Co., New York, 1977

REFERENCES:

1. Pye R.G.W., Injection mould Design, 1989
2. Miller Edward, Marcel Dekker, Plastics Products Design Hand Book, Hanser Pub.,2006
3. Malloy Robert A., Plastic Part Design for Injection Moulding, Hanser Pub., Munich Vienna NY, 1994
4. Belofsky H., SPE, Plastics Product Design and Process Engineering, , Hanser Publication, Munich Vienna NY, 1995.

Course Name	**:**	**NON CONVENTIONAL MACHINING PROCESSES**
Course Code	**:**	**PRN 551**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVES:

To understand the various non conventional machining processes, applications and comparative analysis of various processes.

Lecture wise breakup **No. of Lectures**

INTRODUCTION

Need for new technology, classification of new technology, historical background of new technology process Definition and application of various processes, comparative analysis of various new technological processes Mechanical processes. **(2)**

ABRASIVE JET MACHINING AND ABRASIVE FLOW MACHINING **(3)**

Fundamental Principles, application possibilities, process parameters, schematic lay out of machine and operational characteristics.

ULTRASONIC MACHINING **(4)**

Introduction, range and application of possibilities of ultrasonic machining, fundamental principles, processes parameter, purpose of slurry and selection of abrasive, tool design, tool feeding mechanism, transducer megnetostriction, megnetostrictive material, analysis for metal removal rate, design of horn (velocity transformer), analysis of process parameters, exercises.

CHEMICAL MACHINING **(4)**

Introduction, fundamental principle, process parameter, classification and selection of etch ant resistant material, selection of etchant,

ELECTROCHEMICAL MACHINING (ECM) **(5)**

Background of ECM process ,classification of ECM processes, fundamental principles of ECM, determination of metal removal rate, evaluation of metal removal rate of an alloy, electrochemistry of ECM, dynamics of ECM process, hydrodynamics of ECM process, optimization analysis of ECM parameters, choice of electrolytes, problems. Such as explosive forming, electro–hydraulic forming, Electro-Magnetic forming, high speed hot forging.

ELECTROCHEMICAL GRINDING (ECG) **(5)**

Introduction, fundamental principle, electrochemistry of ECG, basic scheme of the process, classification of ECG, process of parameter ECG,.

ELECTRICAL DISCHARGE MACHINING **(5)**

Introduction, mechanism of metal removal, basic EDM circuitry and their principle of operation, analysis of relaxation and RLC type of circuits, evaluation of metal removal rate, evaluation machining accuracy, optimization analysis of metal removal rate in EDM process, selection of tool materials, choice of dielectric fluid,

LASER BEAM MACHINING **(2)**

Introduction, background of laser action, production of photon cascade in a solid optical laser, machining application of laser, other application of laser in workshop technology.

ELECTRON BEAM MACHINING **(3)**

Introduction, background of electron beam action, a dimensionless analysis to establish

correlation between EBM parameters generation of electron beam, advantage and limitation of EBM.

PLASMA ARC MACHINING **(3)**

Introduction, plasma, non thermal generation of plasma, metal removal, process parameter, operation data, quality of cut, metallurgical effects, work environment, equipment, and other application of plasma jet reference.

STUDY OF RECENT DEVELOPMENTS **(6)**

AJM, AFM, USM, CM, ECM, ECG, EDM, LBM, PAM, EBM, HVFM, E-HF, E-MF, HSH Forgings, & HS Extrusions through journals & e-journals.

COURSE OUTCOME:

1. Students should be able to select the non conventional machining process for particular application.
2. Students should have knowledge of various parameters which are affecting the non conventional machining process.
3. Students should have exposure to the recent developments in the non conventional machining process.

Books:

1. Pandey P.C. & Shan H.S., Modern Machining Process, Tata McGraw-Hill. New Delhi 2002
2. Adithan M, Modern manufacturing, New Age International Publication, 1987
3. HMT, 'Production Technology', HMT, 2001.

REFERENCES:

1. ASTME, High velocity forming of metals Printice Hall of India, 1968
2. Nagpal G.R., Metal forming Processes Khanna Publ. New Delhi, 1998

Course Name	**:**	**QUALITY MANAGEMENT SYSTEM**
Course Code	**:**	**PRN 571**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVES:

To understand various statistical methods in manufacturing, reliability engineering and quality engineering in production systems.

Lecture wise breakup **No. of Lectures**

STATISTICAL METHODS IN MANUFACTURING **(8)**
Use of Statistics to ensure Quality of Manufacturing Processes, to Predict the Reliability of Products and Processes and to Improve Manufacturing Designs and Processes.

QUALITY ENGINEERING IN PRODUCTION SYSTEMS **(10)**
Quality Value and Engineering, Quality Engineering in Product Design and Design of Production Processes, Taguchi's philosophy of Robust Design, Loss Function and Quality Level, Derivation of Loss Function, Uses of Loss Function, The Loss Function and Justification for Improvements.

TOLERANCE DESIGN AND TOLERANCES **(10)**
Quality Levels and Types of Tolerances, Determination of Tolerances, Process Capability and Product Tolerances, Statistical Build of Tolerances, Multiple Tolerance Chains.

ON-LINE FEED BACK QUALITY CONTROL **(8)**
Feed Back Control for Variable and Attribute Characteristics, Methods for Process Improvements.

RELIABILITY ENGINEERING **(6)**
Evaluation of Reliability, Reliability Assurance and Reliability Design

COURSE OUTCOME:

1. Students should be able to understand the product quality and statistical methods in manufacturing.
2. Students should be able to carry out problems related to tolerance design and tolerances.
3. Students should have knowledge of the on-line feed back quality control and reliability engineering.

Books:

1. Elsayed and Hsiang, Quality Engineering in Production Systems by Taguchi, MCGRAW HILL Publication, 1989.
2. Emick Norbert Lloyd, Quality Reliability and Process Improvement, Industrial Press Inc. New York, 1985.

REFERENCES:

1. Clements Richard Barrett, Handbook of Statistical Methods in Manufacturing, Prentice Hall, 1991.
2. Bieda John, Practical Product Assurance Management, ASQ Quality Press, 1997.

Course Name	**:**	**VALUE ENGINEERING**
Course Code	**:**	**PRN 572**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total no. of lectures: 42

COURSE OBJECTIVES:

To understand the concept of value engineering, classification & evaluation of functions and approaches related to value analysis and engineering.

Lecture wise breakup **No. of Lectures**

CONCEPTS AND APPROACHES OF VALUE ANALYSIS AND ENGINEERING **(3)**

Concept of value, Maximum value, normal degree of value, importance of value, value oriented work, use of value resources, value work expands market and jobs, approach to prepare the mind for the value analysis techniques

CLASIFICATION OF FUNCTIONS **(3)**

Use and aesthetic functions, Identification, clarification and naming functions, quantifying functions, unifying the function and its specifications, Analysis of Aesthetic functions, Classification of functions

EVALUATION OF FUNCTIONS **(6)**

Evaluation of Function, Evaluation of Functions by Comparison, Case Studies on evaluation of a single function, three functions, interactive Functions, Evaluation of all functions by comparison

PROBLEM SETTING SYSTEM **(3)**

Identify Functions, Separate Functions, Group Functions, Case study on Problem Setting, overlap of problem setting and problem solving.

PROBLEM SOLVING SYSTEM **(5)**

The Value Analysis Job Plan: Information step, Analysis step, Creativity step, Judgment step, Development planning step, Case study.

SETTING AND SOLVING MANAGEMENT-DECISION-TYPE PROBLEMS **(5)**

Types of Management problems, Setting the precise problem, Case Study -Should a company build manufacturing facilities for an important purchased assembly.

USING THE SYSTEM **(5)**

Three Basic Steps, Example of procedure, Basic Step I: identify the function, Basic Step-II: Evaluate the Function, Basic Step-III: cause value alternatives to be developed, interrelation of Basic Steps, Job Plan steps, and results- accelerating techniques

EFFECT ON OTHER WORK IN THE BUSINESS **(2)**

Accounting, Appearance design, Cost reduction activities, Cost reductions versus value analysis.

EFFECTIVE ORGANISATION FOR VALUE WORK **(5)**

Smallest and smaller business, One man Set Up, Two man Set Up, Three man Set Up, Four or more consultant, structuring the company, Decision Criteria-Performance and time, Decision Criteria-Performance, time, and Cost, Understanding the research and development problem.

ADVANCE TECHNIQUES **(5)**

Function Analysis System Technique (FAST), How to use FAST Diagram, FAST

diagram cost allocation, Case Study, Quantitative evaluation of ideas. FAST for Product services and other processes, Value optimization, Cohesive Theory, Structure Frame Work, Flow charting, Step by Step Techniques. Developing a Template for Life cycle, Cost, Customer, FAST to conduct value study.

COURSE OUTCOME:

1. Students should be able to carry out problems related to value analysis and engineering.
2. Students should be able to identify and evaluate the functions.
3. Students should have knowledge related to advance techniques.

Books:

1. Miles Lawrence D., Techniques of Value Analysis & Engineering, Eleanor Miles Walker, 1990.
2. Kaoufman Jerry, Value Analysis's Tear Down- A New Process for Product Development and innovation, Yashihiko Sato Industrial Press, 2004.

REFERENCES:

1. Mudge Arthur E, Value Engineering - A systematic approach , Part I, J. Pohl Associates, 1989.
2. Bytheway Charles W, FAST Creativity and Innovation: Rapidly Improving Processes, Product Development and Solving Complex Problems, J. Ross Publishing, 2007.

Course Name : **Physiological Signals Acquisition and Processing**
Course Code : : **IDN558**
Credits : **3**
L T P : **3 0 0**

Course Objectives:

To introduce the students to the various biomedical signals acquisition and processing techniques.

Total Lectures: 42

Lecture wise breakup	**No. of lectures**
Biomedical Signal Biomedical signals and their clinical applications.	**(2)**
Signal Acquisition and Filtering Signal definition and its types: continuous, discrete and digital signal. Time domain, frequency domain and joint time-frequency domain. Transformations: Laplace ,Z,FFT Data Acquisition: Sampling, aliasing, interpolation and quantization. Continuous-time signal into discrete-time signal conversion and discrete time signal into continuous time signal conversion. An ideal digital filter, general types of digital filter, ideal filter, filter specifications, filter tool in matlab.	**(10)**
Electrocardiogram (ECG) Anatomy and conduction system of heart. Electrocardiogram (ECG) and hardware circuitry, data acquisition, waveform recognition. Heart rate variability, band-pass filtering, QRS waves detection algorithms, outliers removal, resampling. Time-domain and frequency domain analysis. Case Study. Filtering of artifacts in ECG Signal.	**(8)**
Electroencephalogram (EEG) Electroencephalogram (EEG) and its relation to brain activity, different brain lobes, EEG signal recording, International 10-20 system & 10-10 system, sensor placement, pre-processing and feature extraction of EEG signal in time and frequency domain. Case Study: Feature Extraction from EEG Signal in matlab.	**(8)**
Electromyogram(EMG) Electromyogram (EMG) and its relation with muscle activity, fatigue etc. Hardware circuitry, data acquisition, EMG signals recording, envelope detection. Sensor placement, processing and feature extraction of EMG signal. Fatigue detection via EMG, Case Study: Integrated EMG in matlab.	**(8)**
Electrodermal Activity(EDA) Electrodermal Activity (EDA) and its relation with emotions, mental health and nervous system. Hardware circuitry, data acquisition, sensor placement, processing and feature extraction of EDA signal. Case Study: Separation of phasic and tonic from EDA signal	**(6)**

Course Outcomes:

1. Students should be able to design prototypes for a specific biomedical acquisition (EEG , EMG, ECG , etc.) applications
2. Students should be able to understand various biomedical signal and their applications
3. Students should be able to process and extraction features from various biomedical signals

Text Books

1. Medical Instrumentation Application and Design, John G. Webster, Wiley, 2009
2. Biomedical signal and image processing, K. Najarian and R. Splinter, Taylor and Francis, 2006.

Suggested Books:

1 EEG signal processing, S. Sanei and JA. Chambers, Wiley, 2007

2 Advanced Methods And Tools for ECG Data Analysis- Gari D. Clifford, Francisco Azuaje, Patrick McSharry Artech House Publishers (2006)

3 Electrodermal Activity- Wolfram Boucsein (auth.)-Springer US (2012)

4 The ABC of EMG. A Practical Introduction to Electromyogram Kinesiological Peter Konrad

5 Practical Biomedical Signal Analysis Using MATLAB®, ZygierewiczJ,CRC Press 2011:

Course Name : **ADVANCED CAD FOR MEDICAL APLPICATIONS**
Course Code : : **IDN 559**
Credits : **3**
L T P : **3 0 0**
Course Objectives:

To introduce the students to the mathematical basis of CAD/CAM process and enable the students to apply these in form of computer programs.

Total Lectures: 42

Lecture wise breakup	**No. of lectures**
INTRODUCTION Definition and scope of syllabus, Introduction to design process and role of computers in the design process and manufacturing process.	**(2)**
TRANSFORMATIONS Programming basics: If, If-Else, For and While loop. Arrays and Structures. Brief introduction to Object Oriented Programming Language. Transformations: 2D&3D transformations. Scaling, Translation, Rotation and Homogeneous transformation matrix.	**(6)**
CAD ENTITIES Types of curves, Difference between parametric and non-parametric curves. Parametric equations of a line, circle and ellipse. Introduction to synthetic curves, Manipulation and properties of Hermite curve, Bezier Curve, Open and closed B-spline curve, NURBS. Extending synthetic curves to create synthetic surfaces. Hermite surface, Bezier Surface, Open and closed B-spline surface. Surfaces of Revolution.	**(10)**
INTRODUCTION TO IMAGE PROCESSING Types of Images. Data structure of Binary, Grayscale, RGB and Indexed images. Point transformations for brightness and contrast manipulation. Histogram equalisation. Application of Gaussian , Median and Laplace filter. Edge detection using Sobel, Canny and Watershed algorithm. Introduction to DICOM image format.	**(5)**
ADDITIVE MANUFACTURING Introduction to Rapid Prototyping (RP), Basic Principles of RP, Steps in RP, Process chain in RP in integrated CAD-CAM environment, Advantages of RP. Different RP techniques. STL file generation, Defects in STL.	**(8)**
CAD/CAM DATA EXCHANGE FORMATS Types of file formats & their exchange. IGES, STEP, STL formats.	**(2)**
USING SDKs AND APIs FOR CAD/CAM DEVELOPMENT Introduction to Programming, loops, functions and file handling. Recording and editing macros. Programming for CAD software and Haptic systems	**(9)**

Course Outcome

1. Students should be able to create edit and manipulate various CAD entities
2. Students should be able to understand the creation, conversion and flow of mathematical information from design process to manufacturing process.
3. Students should be able to work with various open source SDKs and APIs to create systems for various activities.

Suggested Books:

1	Zeid, I., Mastering CAD/CAM, McGraw-Hill.	2006
2	Gonzalez, RC., Digital Image Processing Using MATLAB	2010
3	Chua, C.K., Leong, K.F., and Lim, C. S., Rapid Prototyping: Principles and Applications,World Scientific Publishing Co. Pte. Ltd., Singapore	2003

Reference books:

1	Singh, N., Systems Approach to Computer Integrated Design and Manufacturing, John Willey & Sons, Inc.	1996
2	Birkfellner, W., Applied Medical Image Processing, Second Edition: A Basic Course, CRC Press	2014