## ANNA UNIVERSITY, CHENNAI
### AFFILIATED INSTITUTIONS
#### REGULATIONS 2013
#### M.E. CAD / CAM
#### I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS
### SEMESTER I

<table>
<thead>
<tr>
<th>SL. NO</th>
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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE: 72**

### LIST OF ELECTIVES FOR M.E. CAD / CAM

#### SEMESTER I (Elective I)

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AIM:

OBJECTIVE:
To impart knowledge on numerical methods that will come in handy to solve numerically the problems that arise in engineering and technology. This will also serve as a precursor for future research.

UNIT I ALGEBRAIC EQUATIONS (9+3)

UNIT II ORDINARY DIFFERENTIAL EQUATIONS (9+3)
Runge Kutta Methods for system of IVPs, numerical stability, Adams-Bashforth multistep method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

UNIT III FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATION (9+3)

UNIT IV FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS (9+3)
Laplace and Poisson's equations in a rectangular region: Five point finite difference schemes, Leibmann's iterative methods, Dirichlet and Neumann conditions – Laplace equation in polar coordinates: finite difference schemes – approximation of derivatives near a curved boundary while using a square mesh.

UNIT V FINITE ELEMENT METHOD (9+3)

T= 15, TOTAL: 60 PERIODS

OUTCOME:
• It helps the students to get familiarized with the numerical methods which are necessary to solve numerically the problems that arise in engineering.

REFERENCES
OBJECTIVES:
- To impart knowledge on computer graphics which are used routinely in diverse areas as science, engineering, medicine, etc.

OUTCOME:
- With laboratory classes in conjunction, It helps the students to get familiarized with the computer graphics application in design. This understanding reinforces the knowledge being learned and shortens the overall learning curves which are necessary to solve CAE problems that arise in engineering.

UNIT I  INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS  8
Output primitives (points, lines, curves etc.), 2-D & 3-D transformation (Translation, scaling, rotators) windowing - view ports - clipping transformation.

UNIT II  CURVES AND SURFACES MODELLING  10
Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations.

UNIT III  NURBS AND SOLID MODELING  9
NURBS- Basics- curves , lines, arcs, circle and bi linear surface.

UNIT IV  VISUAL REALISM  9
Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric and variational geometry based software’s and their principles creation of prismatic and lofted parts using these packages.

UNIT V  ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE  9
Assembly modeling - interferences of positions and orientation - tolerances analysis - mass property calculations - mechanism simulation.

T=30, TOTAL : 75 PERIODS
Laboratory session: Writing interactive programs generate graphics and to solve design problems - using any languages like Auto LISP/ C / FORTRAN etc. Each assessment should contain a component of Laboratory session.

REFERENCES
OBJECTIVES:
- To know the integrated design procedure of different machine elements for mechanical applications.

OUTCOME:
- This will familiarize the students with the concepts of integration of design of machines and structures.

UNIT I FUNDAMENTALS AND DESIGN OF SHAFTS

Oblique stresses – Transformation Matrix – Principal stresses – Maximum shear stress - Theories of Failure – Ductile vs. brittle component design - Analysis and Design of shafts for different applications – integrated design of shaft, bearing and casing – Design for rigidity

UNIT II DESIGN OF GEARS AND GEAR BOXES

UNIT III BRAKES & CLUTCHES
Dynamics and thermal aspects of brakes and clutches – Integrated design of brakes and clutches for machine tools, automobiles and mechanical handling equipments.

UNIT IV INTEGRATED DESIGN
Integrated Design of systems consisting of shaft, bearings, springs, motor, gears, belt, rope, chain, pulleys, Cam & Follower, flywheel etc. Example - Design of Elevators, Escalators, rope chain, pulleys, Cam & Follower, flywheel etc. Example - Design of Elevators, Escalators, Gear Box, Valve gear Mechanisms, Machine Tools

T = 15, TOTAL: 60 PERIODS

The Pattern of Question Paper will consist one Question from Unit – 4 for 50% of total marks.

a Term Project must be given for Assessment – 3 (Compulsory)

REFERENCES:

Approved Data Books
CM7201 COMPETITIVE MANUFACTURING SYSTEMS  L T P C  3 0 0 3

AIM:
To impart knowledge on the pace of changes in the manufacturing technology.

OBJECTIVE:
To emphasize the knowledge on the quality improvement, automation, and advanced manufacturing techniques to create the highest-caliber products quickly, efficiently, inexpensively, and in synchronization with the marketing, sales, and customer service of the company.

UNIT I  MANUFACTURING IN A COMPETITIVE ENVIRONMENT  9

UNIT II  GROUP TECHNOLOGY & FLEXIBLE MANUFACTURING SYSTEMS  9

UNIT III  COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS  9

UNIT IV  LEAN MANUFACTURING:  9

UNIT V  JUST IN TIME  9

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES
AIM:
The aim is to provide the students with knowledge of the finite element method that will be of use in different manufacturing areas and to provide a foundation for further study.

OBJECTIVE:
- The objective is to equip students with fundamentals of finite element principles so as to enable them to understand the behaviour of various finite elements and to be able to select appropriate elements to solve physical and engineering problems with emphasis on structural and thermal engineering applications.

UNIT I INTRODUCTION: 6

UNIT II ONE DIMENSIONAL ANALYSIS: 10
Steps in FEA – Discretization, function – derivation of element characteristics matrix, shape function, assembly and imposition of boundary conditions – solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

UNIT III SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS 10

UNIT IV ANALYSIS OF PRODUCTION PROCESSES 10

UNIT V COMPUTER IMPLEMENTATION 9
Pre Processing, Mesh generation, elements connectivity, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages such as ANSYS and DEFORM – Development of code for one dimensional analysis and validation.

T= 15, TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES
OBJECTIVE:
- To impart knowledge on how to prepare drawings for various mechanical components using any commercially available 3D modeling software's.
- To impart knowledge on the use of Finite Element Analysis software to solve various field problems in mechanical engineering to optimize and verify the design of machine elements.

OUTCOME:
- With laboratory classes, it helps the students to get familiarized with the computer applications in design and preparing drawings for various mechanical components.
- Model and analyze various physical problems.
- Select appropriate elements and give boundary conditions.
- Solve structural, thermal, modal and dynamics problems.

  - CAD Introduction.
  - Sketcher
  - Solid modeling – Extrude, Revolve, Sweep, etc and Variational sweep, Loft etc
  - Surface modeling – Extrude, Sweep, Trim etc and Mesh of curves, Free form etc
  - Feature manipulation – Copy, Edit, Pattern, Suppress, History operations etc.
  - Assembly - Constraints, Exploded Views, Interference check

Exercises in Modeling and drafting of Mechanical Components - Assembly using Parametric and feature based Packages like PRO-E / SOLID WORKS / CATIA / NX etc

Analysis of Mechanical Components – Use of FEA Packages like ANSYS/ NASTRAN etc.,
Exercises shall include analysis of
  i) Machine elements under Static loads
  ii) Thermal Analysis of mechanical systems
  iii) Modal Analysis
  iv) Machine elements under Dynamic loads
  v) Non-linear systems

TOTAL: 30 PERIODS

OBJECTIVES:
- To know the concept of design for manufacturing, assembly and environment.
- To know the computer application in design for manufacturing and assembly.

OUTCOME:
- To make the students get acquainted with the design for manufacturing, assembly and environment.

UNIT I
INTRODUCTION
General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances Geometric tolerances - Assembly limits - Datum features - Tolerance stacks.

UNIT II
FACTORS INFLUENCING FORM DESIGN
Working principle, Material, Manufacture, Design - Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.
UNIT III  COMPONENT DESIGN - MACHINING CONSIDERATION  

UNIT IV  COMPONENT DESIGN - CASTING CONSIDERATION  
Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

UNIT V  DESIGN FOR THE ENVIRONMENT  

TOTAL: 45 PERIODS

REFERENCES

CM7001  ADDITIVE MANUFACTURING  
L T P C  3 0 0 3

OBJECTIVE:
- To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology and the associated Aerospace, Architecture, Art, Medical and industrial applications.

OUTCOME:
On completion of this course, they will learn about a variety of Additive Manufacturing (AM) technologies, their potential to support design and manufacturing, case studies relevant to mass customized manufacturing, and some of the important research challenges associated with AM and its data processing tools

UNIT I  INTRODUCTION:  
UNIT II REVERSE ENGINEERING AND CAD MODELING: 10

UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS: 10
Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications.

UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS: 10

UNIT V OTHER ADDITIVE MANUFACTURING SYSTEMS: 7
Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.

TOTAL: 45 PERIODS

REFERENCES

CM7202 APPLIED MATERIALS ENGINEERING L T P C
3 0 0 3
OBJECTIVE:
- This course provides knowledge in the areas of Industrial metallurgy, advanced materials and selection of materials for industrial applications.

UNIT I ELASTIC AND PLASTIC BEHAVIOUR 8
UNIT II  FRACTURE BEHAVIOUR

UNIT III  SELECTION OF MATERIALS
Motivation, cost basis and service requirements – selection for Mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with Relevance to aero, auto, marine, machinery and nuclear applications.

UNIT IV  MATERIAL PROCESSING
Processing of engineering materials – Primary and Secondary processes – astability, Weldability, forgeability and malleability Criteria – Process induced defects – Monitoring and control.

UNIT V  MODERN MATERIALS AND TREATMENT
Dual phase steels, high strength low alloy steel, transformation included plasticity steel, maraging steel, smart materials, properties and applications of engineering plastics and composites materials - advanced structural ceramics – WC, TiC, TaC, Al₂O₃, SiC, Si₃N₄, CBN, diamond – Plasma, PVD, CVD- thick and thin film deposition – Functionally Gradient Materials , Nano materials

OUTCOME:
At the end of this course the student will be able to select the materials for Engineering applications by understanding basic mechanical properties of materials, the relation of the microstructure and mechanical properties, processing techniques for controlling shape and properties in the final product and able to work in R&D activity in the field of materials science.

REFERENCES:

WEB REFERENCES:
1. www.astm.org/labs/pages/131350.htm
2. www.appliedmaterials.com/carrers/aqu-ei.html

CC7202 INTEGRATED PRODUCT DESIGN AND PROCESS DEVELOPMENT L T P C
UNIT I INTRODUCTION 3 1 0 4
Need for IPPD-Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement
UNIT II CONCEPT GENERATION, SELECTION AND TESTING


UNIT III PRODUCT ARCHITECTURE

Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems - architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

UNIT IV INDUSTRIAL DESIGN


UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT

Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis - Understanding and representing tasks-baseline project planning - accelerating the project-project execution.

TOTAL: 60 PERIODS

A Term Project/Presentation must be given for Assessment – 3 (Compulsory)

TEXT BOOK:

REFERENCES
4. www.me.mit/2.7444.

CC7211 CAM LAB


EQUIPMENTS FOR CAM LAB

1. CAM Software for tool path generation for planer machining, contour machining, drilling, turning etc. & post processing modulus for different CNC controllers : 10 Nos
2. Medium production type CNC turning center with popular industrial type controller: 1
3. Medium production type CNC machining center with popular industrial type controller: 1
4. Bench Model CMM: 1
5. Vision & image processing software: 2
6. Data Processing Software: 2

TOTAL: 30 PERIODS

CC7212 DESIGN PROJECT L T P C
0 0 3 2

OBJECTIVES:
- The main objective is to give an opportunity to the student to achieve integrated mechanical design of a product through parts design assembly preparation of manufacturing drawings.

GUIDELINE FOR REVIEW AND EVALUATION
Each students works under a project supervisor. The product system /component(s) to be designed may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the student which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners

TOTAL : 45 PERIODS

OUTCOMES:
- Use of design principles and develop conceptual and engineering design of any components.
- Ability to integrate the parts design with assembly and ability to prepare manufacturing drawings.

CC7001 COMPUTER CONTROL IN PROCESS PLANNING L T P C
3 0 0 3

UNIT I INTRODUCTION

UNIT II PART DESIGN REPRESENTATION
Design Drafting - Dimensioning - Conventional tolerance - Geometric tolerance - CAD - input / output devices - topology - Geometric transformation - Perspective transformation - Data structure - Geometric modelling for process planning - GT coding - The optiz system - The MICLASS system.

UNIT III PROCESS ENGINEERING AND PROCESS PLANNING
Experienced, based planning - Decision table and decision trees - Process capability analysis - Process Planning - Variant process planning - Generative approach - Forward and Backward planning, Input format, AI.

UNIT IV COMPUTER AIDED PROCESS PLANNING SYSTEMS
Logical Design of a Process Planning - Implementation considerations -manufacturing system components, production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.
UNIT V  AN INTERGRADED PROCESS PLANNING SYSTEMS  9

TOTAL: 45 PERIODS

REFERENCES

WEB REFERENCES:

ED7001  OPTIMIZATION TECHNIQUES IN DESIGN  L T P C
UNIT I  UNCONSTRAINED OPTIMIZATION TECHNIQUES  10
Introduction to optimum design - General principles of optimization – Problem formulation & their classifications - Single variable and multivariable optimization, Techniques of unconstrained minimization – Golden section, Random, pattern and gradient search methods – Interpolation methods.

UNIT II  CONSTRAINED OPTIMIZATION TECHNIQUES  10
Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - Geometric programming

UNIT III  ADVANCED OPTIMIZATION TECHNIQUES  10
Multi stage optimization – dynamic programming; stochastic programming; Multi objective optimization, Genetic algorithms and Simulated Annealing techniques; Neural network & Fuzzy logic principles in optimization.

UNIT IV  STATIC APPLICATIONS  8

UNIT V  DYNAMIC APPLICATIONS  7
Dynamic Applications – Optimum design of single, two degree of freedom systems, vibration absorbers. Application in Mechanisms – Optimum design of simple linkage mechanisms.

TOTAL: 45 PERIODS

REFERENCES
OBJECTIVES:
- To know the fundamentals of mechanics of materials under various loading conditions.

UNIT I  ELASTICITY

UNIT II  SHEAR CENTER AND UNSYMMETRICAL BENDING
Location of shear center for various thin sections - shear flows. Stresses and Deflections in beams subjected to unsymmetrical loading-kern of a section.

UNIT III  STRESSES IN FLAT PLATES AND CURVED MEMBERS
Circumference and radial stresses – deflections - curved beam with restrained ends - closed ring subjected to concentrated load and uniform load - chain links and crane hooks. Solution of rectangular plates – pure bending of plates – deflection – uniformly distributed load – various end conditions

UNIT IV  TORSION OF NON-CIRCULAR SECTIONS
Torsion of rectangular cross section - St.Venant's theory - elastic membrane analogy - Prandtl's stress function - torsional stress in hollow thin walled tubes.

UNIT V  STRESSES IN ROTATING MEMBERS AND CONTACT STRESSES
Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness allowable speeds. Methods of computing contact stress-deflection of bodies in point and line contact applications.

OUTCOME:
- It helps the students to be familiarized with the stresses under different loading conditions.

REFERENCES

OBJECTIVES:
- To impart students on the need, use, application and design of different material handling techniques, equipments and machines used in common use and in industrial sector
OUTCOME:
- The course would familiarize the student on the technique to select suitable material handling equipment and design them based on the need.

UNIT I   MATERIALS HANDLING EQUIPMENT  5
Types, selection and applications

UNIT II   DESIGN OF HOISTS  10

UNIT III   DRIVES OF HOISTING GEAR  10
Hand and power drives - Traveling gear - Rail traveling mechanism - cantilever and monorail cranes - slewing, jib and luffing gear - cogwheel drive - selecting the motor ratings.

UNIT IV   CONVEYORS  10
Types - description - design and applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors.

UNIT V   ELEVATORS  10
Bucket elevators: design - loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

TOTAL: 45 PERIODS

REFERENCES
TEXT BOOKS:

WEB REFERENCE:

CC7003 INDUSTRIAL SAFETY MANAGEMENT  L T P C
UNIT I SAFETY MANAGEMENT  9

UNIT II OPERATIONAL SAFETY  9

UNIT III SAFETY MEASURES  9
Layout design and material handling - Use of electricity - 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 IV ACCIDENT PREVENTION  9
Human side of safety - personal protective equipment - Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP - Training and development of employees - First Aid- Fire fighting devices - Accident reporting, investigation.

UNIT V SAFETY, HEALTH, WELFARE & LAWS  9

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
1. Occupational Safety Manual BHEL.
2. Industrial safety and the law by P.M.C. Nair Publisher's, Trivandrum.

CD7003  ADVANCED TOOL DESIGN  L T P C  3 0 0 3

UNIT I  INTRODUCTION TO TOOL DESIGN  8

UNIT II  DESIGN OF CUTTING TOOLS  9
Mechanics of Metal cutting – Oblique and orthogonal cutting - Chip formation and shear angle - Single-point cutting tools – Milling cutters – Hole making cutting tools- Broaching Tools - Design of Form relieved and profile relieved cutters - Design of gear and thread milling cutters

UNIT III  DESIGN OF JIGS AND FIXTURES  10

UNIT IV  DESIGN OF PRESS TOOL DIES  10

UNIT V  TOOL DESIGN FOR CNC MACHINE TOOLS  8

TOTAL: 45 PERIODS

REFERENCES:
2. E.G.Hoffman, ”Jig and Fixture Design”, Thomson Asia Pvt Ltd, Singapore, 2004

UNIT II KINEMATIC ANALYSIS

UNIT III PATH CURVATURE THEORY, COUPLER CURVE
Fixed and moving centroids, inflection points and inflection circle. Euler Savary equation, graphical constructions – cubic of stationary curvature. Four bar coupler curve-cusp-crunode-coupler driven six-bar mechanisms-straight line mechanisms

UNIT IV SYNTHESIS OF FOUR BAR MECHANISMS

UNIT V SYNTHESIS OF COUPLER CURVE BASED MECHANISMS & CAM MECHANISMS

Total 45 + 30 = 75 PERIODS

NOTE: TUTORIAL / PRACTICE: 30 PERIODS

A Term Project must be given for Assessment – 3 (Compulsory)

REFERENCES:

IC7072 COMPUTATIONAL FLUID DYNAMICS L T P C
3 0 0 3

AIM
This course aims to introduce numerical modeling and its role in the field of heat and fluid flow, it will enable the students to understand the various discretisation methods and solving methodologies and to create confidence to solve complex problems in the field of heat transfer and fluid dynamics.

OBJECTIVES:
• To develop finite difference and finite volume discretized forms of the CFD equations.
• To formulate explicit & implicit algorithms for solving the Euler Eqns & Navier Stokes Eqns.

UNIT I  GOVERNING DIFFERENTIAL EQUATION AND FINITE DIFFERENCE METHOD

Classification, Initial and Boundary conditions – Initial and Boundary Value problems – Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

UNIT II  CONDUCTION HEAT TRANSFER

Steady one-dimensional conduction, Two and three dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

UNIT III  INCOMPRESSIBLE FLUID FLOW


UNIT IV  CONVECTION HEAT TRANSFER AND FEM


UNIT V  TURBULENCE MODELS

Algebraic Models – One equation model, K – ε Models, Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes.

TOTAL: 45 PERIODS

REFERENCES
UNIT III  RELIABILITY ASSESSMENT  10
Different configurations – Redundancy – m/n system – Complex systems: RBD – Baye’s method –
Cut and tie sets – Fault Tree Analysis – Standby system.

UNIT IV  RELIABILITY MONITORING  8
Life testing methods: Failure terminated – Time terminated – Sequential Testing –Reliability
growth monitoring – Reliability allocation – Software reliability.

UNIT V  RELIABILITY IMPROVEMENT  7
Analysis of downtime – Repair time distribution – System MTTR – Maintainability prediction –
Measures of maintainability – System Availability – Replacement theory.

TOTAL: 45 PERIODS

REFERENCES

REFERENCES

ED7004 DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS L T P C
3 0 0 3
UNIT I OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS
Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics.

UNIT II CONTROL AND REGULATION ELEMENTS
Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems.

UNIT III HYDRAULIC CIRCUITS

UNIT IV PNEUMATIC SYSTEMS AND CIRCUITS
Pneumatic fundamentals - control elements, position and pressure sensing - logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods - step counter method - compound circuit design - combination circuit design.

UNIT V INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS
Pneumatic equipments- selection of components - design calculations – application -fault finding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

TOTAL: 45 PERIODS

REFERENCES
UNIT I  DIGITAL COMPUTERS & MICRO PROCESSORS
Block diagram - register transfer language - arithmetic, logic and shift micro operations - instruction code - training and control instruction cycle - I/O and interrupt design of basic computer. Machine language - assembly language - assembler.
Registers ALU and Bus Systems - timing and control signals - machine cycle and timing diagram - functional block diagrams of 80 x 86 and modes of operation. Features of Pentium Processors

UNIT II  OPERATING SYSTEM & ENVIRONMENTS
Types - functions - UNIX & WINDOWS NT - Architecture - Graphical User Interfaces
Compilers - Analysis of the Source program - the phases of a compiler - cousins of the compiler, the grouping of phases - compiler construction tools.

UNIT III  COMMUNICATION MODEL
Data communication and networking - protocols and architecture - data transmission concepts and terminology - guided transmission media - wireless transmission - data encoding - asynchronous and synchronous communication - base band interface standards RS232C, RS449 interface.

UNIT IV  COMPUTER NETWORKS
Network structure - network architecture - the OSI reference model services - network standardization - example - Managing remote systems in network - network file systems - network working in manufacturing.

UNIT V  INTERNET
Internet services - Protocols - intranet information services - mail based service - system and network requirements - Internet tools - usenet - e-mail - IRC - www - FTP - Telnet.

REFERENCES

CC7006  PERFORMANCE MODELLING AND ANALYSIS OF MANUFACTURING SYSTEM  L T P C
UNIT I  MANUFACTURING SYSTEMS & CONTROL

UNIT II  MANUFACTURING PROCESSES
Examples of stochastic processes - Poisson process Discrete time Markov chain models - Definition and notation - Sojourn times in states - Examples of DTMCs in manufacturing -

UNIT III QUEUING MODELS
Notation for queues - Examples of queues in manufacturing systems - Performance measures - Little's result - Steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns - Analysis of a flexible machine center.

UNIT IV QUEUING NETWORKS

UNIT V PETRI NETS

TOTAL: 45 PERIODS

REFERENCES
UNIT IV  THEORY OF HYDRODYNAMIC AND HYDROSTATIC LUBRICATION

12 Reynolds Equation,-Assumptions and limitations-One and two dimensional Reynolds Equation-Reynolds and Sommerfeld boundary conditions- Pressure wave, flow, load capacity and friction calculations in Hydrodynamic bearings-Long and short bearings-Pad bearings and Journal bearings-Squeeze film effects-Thermal considerations-Hydrostatic lubrication of Pad bearing-Pressure , flow , load and friction calculations-Stiffness considerations- Various types of flow restrictors in hydrostatic bearings

UNIT V  HIGH PRESSURE CONTACTS AND ELASTO HYDRODYNAMIC LUBRICATION

10 Rolling contacts of Elastic solids- contact stresses – Hertzian stress equation- Spherical and cylindrical contacts-Contact Fatigue life- Oil film effects- Elasto Hydrodynamic lubrication Theory-Soft and hard EHL-Reynolds equation for elasto hydrodynamic lubrication- Film shape within and outside contact zones-Film thickness and friction calculation- Rolling bearings- Stresses and deflections-Traction drives.

TOTAL: 45 PERIODS

REFERENCES

UNIT I  MEASURING MACHINES


UNIT II  STATISTICAL QUALITY CONTROL

Data presentation - Statistical measures and tools - Process capability - Confidence and tolerance limits - Control charts for variables and for fraction defectives - Theory of probability - Sampling - ABC standard - Reliability and life testing.

UNIT III  LIQUID PENETRANT AND MAGNETIC PARTICLE TESTS


UNIT IV  RADIO GRAPHY

Sources of ray-x-ray production - properties of d and x rays - film characteristics - exposure charts - contrasts - operational characteristics of x ray equipment - applications.

UNIT V  ULTRASONIC AND ACOUSTIC EMISSION TECHNIQUES

Production of ultrasonic waves - different types of waves - general characteristics of waves -

REFERENCES:

WEB REFERENCES:
1. www.metrologytooling.com
2. www.sisndt.com
3. www.iuk’tu-harburg.de

CC7008 QUALITY MANAGEMENT TECHNIQUES

UNIT I INTRODUCTION
Need for TQM, evolution of quality, Definition of quality, TQM philosophy – CONTRIBUTIONS OF Deming Juran, Crosby and Ishikawa, TQM models.

UNIT II PLANNING
Vision, Mission, Quality policy and objective Planning and Organization for quality, Quality policy Deployment, Quality function deployment, introduction to BPR and analysis of Quality Costs.

UNIT III TQM PRINCIPLES

UNIT IV TQM TOOLS AND TECHNIQUES
PDSA, The Seven Tools of Quality, New Seven management tools, Concept of six sigma, FMEA, Bench Marking, JIT, POKA YOKE, 5S, KAIZEN, Quality circles.

UNIT V QUALITY SYSTEMS

TEXT BOOK:

REFERENCES
AIM:
To impart knowledge on group technology, optimization algorithms, implementation of GT/CMS, Performance measurements and economical aspects of CMS.

OBJECTIVES:
At the end of this course the student should be able to understand
- Concepts and applications of Cellular manufacturing systems
- Traditional and non-traditional approaches of Problem solving
- Performance measurement
- Human and economical aspects of CMS.

UNIT I  INTRODUCTION
Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.

UNIT II  CMS PLANNING AND DESIGN

UNIT III  IMPLEMENTATION OF GT/CMS
Inter and Intra cell layout, cost and non-cost based models, establishing a team approach, Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS.

UNIT IV  PERFORMANCE MEASUREMENT AND CONTROL
Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP framework.

UNIT V  ECONOMICS OF GT/CMS:
Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS - cases.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES