Scheme of Examination - FIRST SEMESTER

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	24CAD101T	Computer Integrated Manufacturing	3	-	-	3	30	70	100
2	24CAD101P	Computer Integrated Manufacturing Lab	-	-	4	2	50	50	100
3	24CAD102T	Computer Aided Design	3	-	-	3	30	70	100
4	24CAD102P	Computer Aided Design Lab	-	-	4	2	50	50	100
5	24CAD103T	Industrial Robotics & Machine Vision	3	-	-	3	30	70	100
6	24CAD104T	Professional Elective-I	3	-	-	3	30	70	100
7	24CAD105T	Professional Elective-II	3	-	-	3	30	70	100
8	24CAD106P	Technical Seminar & Research paper Writing/ IPR/ Quantative Methods/ Design of Experiments	-	-	2	-	-	-	-
Total			**15**	**0**	**10**	**19**	**250**	**450**	**700**

24CAD104T	Professional Elective - I		24CAD105T	Professional Elective - II
24CAD104T(i)	PE-I Design of Hydraulic and Pneumatic Systems		24CAD105T (i)	PE-II Advance Engineering Materials
24CAD104T(ii)	PE-I Machine Fault diagnosis		24CAD105T (ii)	PE-II Reliability Engineering
24CAD104T(iii)	PE-I Tribology Design		24CAD105T (iii)	PE-II Artificial Intelligence

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD101P	Computer Integrated Manufacturing Lab	-	-	4	2	50	50	100

Course Objectives	Course Outcomes
1 Develop an understanding of classical and state-of-the-art production systems, control systems, management technology, cost systems, and evaluation techniques. 2 Develop an understanding of computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality.	• Recognize automation and CIM, CIM wheel, hardware, software, components of CIM • Apply fundamentals of G.T and FMS • Apply fundamentals of CAPP and CAQC • Develop CNC programs for manufacturing applications.

Minimum 8 experiments to be performed

Expt. No.	Title of the experiment
1	Introduction to CIM. (Product Development Cycle, CIM Wheel)
2	Introduction to NC(Basic components, classification)
3	Part classification and Coding using G.T.
4	Study of F. M. S
5	Study of CAPP Systems. (Retrieval & Generative)
6	Study of different quality measurement tools.
7	Simulation on CNC Lathe & CNC Milling (one program each)
8	Manual Part Programming–Lathe.
9	Manual Part Programming– Milling
10	Manual Part Programming by using Sub routine& Canned Cycles

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Numerical Control And Computer Aided Manufacturing	Rao, N K Tiwari, T K Kundra	13th edition (2007)	Tata McGraw-Hill Education
2.	Computer Control of Manufacturing Systems	Koren	2005	Mcgraw Hill

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	G.T Planning and Operation, in The automated factory Hand Book: Technology and Managemen	Askin, R.G. and Vakharia, A.J Cleland, D.I. and Bidananda,	1991	B (Eds), TAB Books, NY
2.	Planning, design and analysis of cellular manufacturing systems	Kamrani, A.K, Parsaei	1995	H.R and Liles, D.H. (Eds) Elsevier

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD101T	Computer Integrated Manufacturing	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
1. To develop an understanding of classical and state-of-the-art production systems, control systems, management technology, cost systems, and evaluation techniques. **2.** To develop an understanding of computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality**.**	• Study the application of computers in manufacturing sector. • Get acquainted with Group Technology & classification and coding • get acquainted with various FMS systems concepts. • get acquainted with various Manufacturing Planning and control like process planning, CAQC, JIT • recognize NC, CNC and DNC manufacturing and generate APT & manual part program for CNC machining.

Unit I	**[8Hrs]**
Introduction: Fixed, Programmable and Flexible Automation, Classification of automated manufacturing systems based on product variety & production volume. Evolution of CIM, Segments of CIM, Computer aided Design, Computer Aided Manufacturing, Computer controlled business functions. Overview of CIM software's.	
Unit II	**[8Hrs]**
Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT, Part families , classification and coding, Machine cell design, PFA	
Unit III	**[8Hrs]**
Introduction to flexible manufacturing systems, Subsystems of FMS, Types of FMS layouts. Introduction to Automated inspection devices: Coordinate Measuring Machine (CMM), Inspection probes etc .Automated storage &retrieval systems.	
Unit IV	**[8Hrs]**
Manufacturing Planning and control: Automated process planning: Retrieval & Generative Expert process planning, Introduction to process planning software's. Manufacturing Production Planning: Aggregate Production planning, Master production schedule, Materials requirement planning, Capacity requirement planning, JIT Production system. Computerized statistical process control, Shop floor control, Shop floor data collection techniques, CAQC,	
Unit V	**[8Hrs]**
Concepts of NC, CNC, DNC. Classification of CNC machines, Machine configurations, Types of control, CNC controllers characteristics, Interpolators. Cutting tool materials, carbide inserts classification, qualified; semi-qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices, of CNC Machines. Programming CNC machines, Part print analysis and Process planning, Advanced Programming features, Canned cycles, Subroutines, Macros, special cycles etc. Manual part programming for CNC turning, milling and machining center.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Automation, Production Systems and Computer Integrated Manufacturing	Mikell P. Groover		Prentice Hall publication
2.	Computer Integrated Design and Manufacturing	David Bedworth, Etal		McGraw Hill Book Co
3.	Computer Aided Design and Manufacturing	Mikell P. Groover and Zimmers E.W		Prentice Hall Publication

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	CAD, CAM, CIM	P. Radhakrishnan		New Age International Pvt. Ltd
2.	CNC Technology and Programming	Krar, S., and Gill, A		McGraw Hill pub. Co

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD102P	Computer Aided Design Lab	-	-	4	2	50	50	100

Course Objectives	Course Outcomes
To understand the role of computer graphics in CAD/CAM and contemporary terminology, progress issues and trends in computer graphics. Also, to understand the computer graphics techniques such as geometric transformations, geometric algorithms, 3Dmodeling, vector representation of geometric entities, 3D object models (surface, volume and implicit), visible surface algorithms	• Design a computer system by selecting different input and out devices required for graphic application. • Write, compile and troubleshoot a computer program from the basic geometrical entity generation algorithm • Write, compile and troubleshoot a computer program to transform an object. • Optimize an engineering problem using appropriate optimization technique

- **Minimum eight experiments to be performed from the list**

Expt. No.	Title of the experiment
1	To study various input/ output devices for development of any graphics system.
2	To study DDA line generation algorithm and its program.
3	To study Bresenham's line generation algorithm and its program.
4	To study Bresenham's mid-point circle generation algorithm and its program.
5	To study Bresenham's mid-point ellipse generation algorithm and its program.
6	To study 2D Basic transformations and its program.
7	To study 2D special transformations and its program.
8	To generate a 3D model by using any modeling software.
9	To study Normal specification optimization problem and its program.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Computer Graphics in Mathematical Approaches	D P Kothari, G K Awari, D D Shrimankar, Amit Bhende	2017	New Age International New Delhi
2.	CAD /CAM Theory and Practice	Ibrahim Zeid	International Edition, 1998	McGraw Hill,
3.	CAD/CAM Principles, Practice and Manufacturing Management	Chris McMohan and Jimmi Browne	2000	Pearson Education Asia,Ltd

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Mathematical Elements for Computer Graphics	Rogers/Adams	1985	McGraw Hill
2.	Computer Graphics: A Programming Approach	Harington Stevan	1983	McGraw Hill

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD102T	Computer Aided Design	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
To understand the role of computer graphics in CAD/CAM and contemporary terminology, progress issues and trends in computer graphics. Also, to understand the computer graphics techniques such as geometric transformations, geometric algorithms, 3Dmodeling, vector representation of geometric entities, 3D object models (surface, volume and implicit), visible surface algorithms	• Develop GUI for various engineering applications. • Model the object using various geometrical entities. • Develop various surfaces using analytical approach and parametric modeling. • Develop the models, assembly design and perform simulation using CAD software's tools. Also, determine various physical properties of solid models. • Optimize the design using Johnson optimization technique for normal, redundant specification problem.

Unit I **[8Hrs]**

Introduction: Computer Graphics, computer aided design process, development of graphics systems, display devices, image generation, image storage, introduction to image processing, vector representation of geometric entities like line, circle, ellipse, arc etc.

Unit II **[8Hrs]**

2-D and 3-D transformations: Translation, scaling, rotation, reflection, homogeneous representation, concatenated transformations, translational mapping rotational mapping, general mapping, inverse transformations and mapping, introduction to windowing and clipping algorithms, viewing transformations.

Unit III **[8Hrs]**

Curves and surface representation: curve representation: Parametric representation of analytic curves, parametric representation of synthetic curves, curve manipulations, Surface representation, parametric Representation of surfaces.

Unit IV **[8Hrs]**

Fundamentals of 3-D modeling: Introduction to modeling techniques, Coordinate system, Datum features, Geometric constraints, boundary representation (B-rep), Constructive Solid Geometry (CSG), sweep representation, blend representations; solid manipulations (displaying, editing, transformations, windowing and clipping). Solid modeling based applications (calculations of mass properties, CG, inertia, surface analysis etc.), 2-D drafting features, representation of dimension/tolerances/symbols & annotation, tolerance analysis, associativity, parent child relationship.

Unit V **[8Hrs]**

Optimization: Introduction, Johnson method of optimization normal specification problem, redundant specification problem, introduction to genetic algorithm.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Computer Graphics in Mathematical Approaches	D P Kothari, G K Awari, D D Shrimankar, Amit Bhende	2017	New Age International New Delhi
2.	CAD /CAM Theory and Practice	Ibrahim Zeid	International Edition, 1998	McGraw Hill,
3.	CAD/CAM Principles, Practice and Manufacturing Management	Chris McMohan and Jimmi Browne	2000	Pearson Education Asia,Ltd

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Mathematical Elements for Computer Graphics	Rogers/Adams	1985	McGraw Hill
2.	Computer Graphics: A Programming Approach	Harington Stevan	1983	McGraw Hill

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD103T	Industrial Robotics and Machine Vision	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
1. To understand constructional details and operations of robot 2. To learn design of kinematic and dynamics of robot. 3. To enable learning about constructional and operational details of robotics as well as programming. 4. To understand sensor and machine vision system for the said application.	• Explain the basic principles of Robotic technology, configurations, control and programming of Robots. • Design an industrial robot which can meet kinematic and dynamic constraints. • Describe the concept of Robot kinematics and dynamics, latest algorithms & analytical approaches • Discuss and apply the concepts of dynamics for a typical Pick and Place robot • Choose the appropriate Sensor and Machine vision system for a given application.

Unit I **[9Hrs]**

Introduction: Automation and Robotics, Historical Development, Definitions, Basic Structure of Robots, Robot Anatomy, Complete Classification of Robots, Fundamentals about Robot Technology, Factors related to use Robot Performance, Basic Robot Configurations and their Relative Merits and Demerits, the Wrist & Gripper Sub-assemblies.Concepts about Basic Control System, Control Loops of Robotic Systems, Different Types of Controllers Proportional, Integral, Differential, PID controllers. (SLE: Types of Drive Systems and their Relative Merits) Kinematics of Robot Manipulator: Introduction, General Mathematical Preliminaries on Vectors & Matrices, Direct Kinematics problem, Geometry Based Direct kinematics problem, Co-ordinate and vector transformation using matrices, Rotation matrix, Inverse Transformations, Problems, Composite Rotation matrix, Homogeneous Transformations, Robotic Manipulator Joint Co-Ordinate System, Euler Angle & Euler Transformations, Roll Pitch-Yaw (RPY) Transformation. DH Representation & Displacement Matrices for Standard Configurations, Jacobian Transformation in Robotic Manipulation.(SLE: Geometrical Approach to Inverse Kinematics.)

Unit II **[9Hrs]**

Kinematics of Robot Manipulator: Introduction, General Mathematical Preliminaries on Vectors & Matrices, Direct Kinematics problem, Geometry Based Direct kinematics problem, Co-ordinate and vector transformation using matrices, Rotation matrix, Inverse Transformations, Problems, Composite Rotation matrix, Homogeneous Transformations, Robotic Manipulator Joint Co-Ordinate System, Euler Angle & Euler Transformations, Roll Pitch-Yaw (RPY) Transformation. DH Representation & Displacement Matrices for Standard Configurations, Jacobian Transformation in Robotic Manipulation. (SLE: Geometrical Approach to Inverse Kinematics.)

Unit III **[9Hrs]**

Introduction, Trajectory Interpolators, Basic Structure of Trajectory Interpolators, Cubic Joint Trajectories. General Design Consideration on Trajectories:- 4-3-4 & 3-5-3 Trajectories. (SLE: Admissible Motion Trajectories) Dynamics of Robotic Manipulators: Introduction, Preliminary Definitions, Generalized Robotic Coordinates, Jacobian for a Two link Manipulator, Euler Equations, The Lagrangian Equations of motion. Application of Lagrange–Euler (LE) Dynamic Modeling of Robotic Manipulators: - Velocity of Joints, Kinetic Energy T of Arm, Potential Energy V of Robotic Arm, The Lagrange L, Two Link Robotic Dynamics with Distributed Mass. (SLE: Dynamic Equations of Motion for A General Six Axis Manipulator)

Unit IV **[9Hrs]**

Dynamics of Robotic Manipulators: Introduction, Preliminary Definitions, Generalized Robotic Coordinates, Jacobian for a Two link Manipulator, Euler Equations, The Lagrangian Equations of motion. Application of Lagrange–Euler (LE) Dynamic Modeling of Robotic Manipulators: - Velocity of Joints, Kinetic Energy T of Arm, Potential Energy V of Robotic Arm, The Lagrange, Two Link Robotic Dynamics with Distributed Mass.(SLE: Dynamic Equations of Motion for A General Six Axis Manipulator)

Unit V **[9Hrs]**

Use of Sensors and Sensor Based System in Robotics, Machine Vision System, Description, Sensing, Digitizing, Image Processing and Analysis and Application of Machine Vision System, Robotic Assembly Sensors and Intelligent Sensors, visual servo-control. Application of Robotics: Applications of robotics in active perception, medical robotics, autonomous vehicles, and other areas.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Digital Image Processing	Rafael C. Gonzalez and Richard E. Woods	3rd International edition	Pearson Education
2.	Robot vision	Bershold Klaus, Paul Holm		The MIT press

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Digital Signal Processing	N. G. Palan		Tech-Max...Publication
2.	Digital Signal Processing (Principles, Algorithms and applications)	John G. Prokis, Dimitris G. Manolakis		PHI. Publication

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD104T(i)	PE-I Design of Hydraulic And Pneumatic Systems	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
• To impart students on the science, use and application of Hydraulics and Pneumatics as Fluid Power in Industry. • To introduce the basic components and functions of hydraulic and pneumatic system elements such as pumps, control valves, control assemblies, actuators, switching and control devices and use standard symbols. • To enable students to acquire the knowledge and skills to apply hydraulic and pneumatic principles to the design and control of automated systems. • To understand the operation of hydraulic and pneumatic power systems for their maintenance and troubleshooting	• Describe the function and operation of hydraulic and pneumatic system. • Identify components of hydraulic systems, using symbols and schematics, with a view to design and assemble a fluid power system. • Understand and design electro-hydraulic and electro-pneumatic circuits using schematic diagrams. • Describe the principles and construction of various components of pneumatic systems. • Demonstrate appropriate use of test equipment, find fault, evaluate circuit performance and apply appropriate troubleshooting techniques to rectify problems of hydraulic and pneumatic power systems.

Unit I	**[6Hrs]**
Introduction: Introduction to Hydraulics and Pneumatics, their structure, Advantages and Limitations. Properties of Fluids, Fluids for Hydraulic systems, Governing laws. Distribution of fluid power, ISO symbols, Energy losses in Hydraulic systems. Applications, Basic types and constructions of Hydraulic pumps and motors. Pump and motor analysis and their sizing. Performance curves and parameters.	
Unit II	**[6Hrs]**
Hydraulic actuators, types and constructional details, sizing criteria, lever systems, control elements – direction, pressure and flow control valves, valve configurations, general valve analysis, valve lap, flow forces and lateral forces on spool valves, series and parallel pressure compensation flow control valves, flapper valve analysis and design.	
Unit III	**[6Hrs]**
Proportional control valves and servo valves, non-linearities in control systems (backlash, hysteresis, dead band and friction non-linearities), design and analysis of typical hydraulic circuits,regenerative circuits, high low circuits, synchronization circuits,meter-in, meter-out and bleed-off circuits, fail safe and counterbalancing circuits, Locked cylinder using pilot check valves, Hydraulic Motor Breaking System, accessories used in fluid Power system, filtration systems and maintenance of system.	
Unit IV	**[6Hrs]**
Pneumatic Systems: Pneumatic, Fundamentals, Merits & Demerits over Hydraulic systems, Pneumatic Conditioners-Filters-Regulators-Lubricators-Mufflers- Air dryers, Types of Air Compressors, Pneumatic Actuators, direction, flow and pressure control valves in pneumatic systems Design of Pneumatic Circuits. valves for logic functions, time delay valve, exhaust and supply air throttling, travel-dependent control and time dependent control, combined control. Fluid Circuit Failures: Common causes of failure dirt- Heat-Misapplication -Improper fluids – Faulty Installation – Improperly designed Circuits. Maintenance: Maintenance of Hydraulic & Pneumatic Circuits. Valves for logic functions, time delay valve, exhaust and supply air throttling	
Unit V	
Hydraulic and Pneumatic Design: Design of Hydraulic & Pneumatic circuit for specific application- Cascading – Ladder diagram (Electrical controls), Microprocessor controlled design of Circuits, Circuits for Copying, Lathe, Broaching Machines & Milling Machines. Applications in assembly, feeding, metal working, materials handling and plastics working. Servo systems, hydro mechanical servo systems, electro hydraulic servo systems and proportional Valves, fluidics – Principles of Fluid Logic Control, introduction to fluidic devices, Fluidic Sensors, simple circuits, introduction to electro hydraulic pneumatic ,logic circuits, ladder diagrams, PLC applications in fluid power control, fluid power circuits; failure and troubleshooting.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Pneumatic Systems: Principles and Maintenance	S. R. Majumdar	2015	McGraw Hill Education, Print.
2.	Fluid Power with Applications	Antony Espossito	1980	Prentice Hall, Print

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Pneumatics & Hydraulics	Harry L. Stewart		D.B. Taraporevala sons
2.	Fluid Power Trouble Shooting	Hehn Anton, H		Marcel Dekker Inc., New York

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD104T(ii)	PE-I Machinery Fault Diagnosis	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
At the end of this course, the student will able to understand the basics of Condition Monitoring Techniques (CBM) which would give insight into machine fault finding in mechanical components. The student will be able to select appropriate instrumentation for CBM. The signals sensed by the instrumentation can be analyzed using appropriate signal processing techniques. Further the student will be able to explore the research prospect in the area of CBM.	• To identify and distinguish between the types of machinery failure • To select appropriate maintenance strategy for machine condition monitoring. • To select appropriate signal processing technique to detect machine fault. • To develop data acquisition system for machine fault diagnosis. • To analyse signal for determination of presence of fault, location of fault, level of fault severity and remaining useful life of component.

Unit I	**[8Hrs]**
Machinery failure, Causes of failure,Types of failure, Frequency of failure	
Unit II	**[8Hrs]**
Basic Maintenance Strategies, Run to Failure (Breakdown Maintenance), Preventive Maintenance, Condition Based (Predictive, Proactive, Reliability Centered, On-Condition) Maintenance, Factors which influence Maintenance Strategy, Machine Condition Monitoring, Periodic Monitoring, Continuous Monitoring	
Unit III	**[8Hrs]**
Classification of signals, Signal generation from various failures, Data Acquisition, Signal Conditioning, Signal Processing, Signal Processing Techniques, Selection of Signal Processing Techniques	
Unit IV	**[8Hrs]**
Types of Sensors, Selection of Sensors, Selecting and Configuring DAQ Measurement Hardware, Software for Data Acquisition.	
Unit V	**[8Hrs]**
Fault diagnostics, Bearing Fault, Gear Fault, Balancing Defects, Shaft Misalignment	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Vibration-Based Condition Monitoring –Industrial, Aerospace and Automotive applications	Robert Bond Randall	2011	John Wiley & Sons Ltd
2.	Maintenance Engineering and Management	R. C. Mishra, K. Pathak	2002	Prentice Hall of India Pvt. Ltd.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Machinery Condition Monitoring Principles and Practices	Dr. Amiya R. Mohanty		CRC Press
2.	Introduction to Machinery Analysis and Monitoring	John S. Mitchell		Penn Well Books

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD104T(iii)	PE-I Tribology Design	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
i) Theories of friction, wear and lubrication and their practical applications ii) Developing tribological solutions to problem iii) Design of hydrodynamic and rolling contact bearings.	• Apply theories of friction and wear to various practical situations by Analyzing the physics of the process. • Select materials and lubricants to suggest a tribological solution to a Particular situation. • Design a hydrodynamic bearing using various bearing charts. • Design rolling element bearings, determine its life. • Understand the various surface measurement techniques and effect of surface texture on tribological behavior of a surface.

Unit I	**[8Hrs]**
SURFACES, FRICTION AND WEAR: Topography of Surfaces, Surface features, Surface interaction, Theory of Friction, Sliding and Rolling Friction, Friction properties of metallic and non-metallic materials, Friction in extreme conditions, Wear, types of wear, Mechanism of wear, wear resistance materials, Surface treatment, Surface modifications, Surface coatings.	
Unit II	**[8Hrs]**
LUBRICATION THEORY: Lubricants and their physical properties lubricants standards, Lubrication Regimes in Hydrodynamic lubrication, Reynolds Equation, Thermal, inertia and turbulent effects, Elasto hydrodynamic (EHD) magneto hydrodynamic lubrication, Hydro-static lubrication, Gas lubrication, Solid lubrication.	
Unit III	**[8Hrs]**
DESIGN OF FLUID FILM BEARINGS: Design and performance analysis of thrust and journal bearings , Full, Partial, Fixed and pivoted journal bearings design, Lubricant flow and delivery, Power loss, Heat and temperature of steady and dynamically loaded journal bearings, Special bearings, Hydro-static Bearing design.	
Unit IV	**[8Hrs]**
ROLLING ELEMENT BEARINGS: Geometry and kinematics, Materials and manufacturing processes, Contact stresses, Hertzian stress equation, Load divisions, Stresses and deflection, Axial loads and rotational effects, Bearing life capacity and variable loads, ISO standards, Oil films and their effects, Rolling Bearings Failures.	
Unit V	**[8Hrs]**
TRIBO MEASUREMENT AND INSTRUMENTATION: Surface Topography measurements, Electron microscope and friction and wear measurements, Laser method, Instrumentation, International standards, Bearings performance measurements, Bearing vibration measurement.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Basic Lubrication Theory	Cameron	1981	Ellis Horwood Ltd
2.	Fundamentals of Fluid Film Lubrication	B. J. Hamrock,	1994	McGraw Hill International

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Introduction to Tribology of Bearings	B. C. Majumdar	1985	A.H. Wheeler & co. pvt. ltd

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD105T(i)	PE-II Advanced Materials Engineering	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
This course is aimed to understand & develop fundamentals in selecting appropriate materials for industrial and engineering applications. This course also aims to compute the mechanical properties of engineering materials using various testing methods. To study the structure and properties of engineering materials. Studying concept to avoid failures with respect to fatigue, creep and fracture.	• Understand the fundamentals of various engineering materials, properties and their crystal structure. • Compute the mechanical properties of engineering materials using tension and torsion testing. • Compute the mechanical properties of engineering materials using fatigue testing. • Estimate the creep behavior • Realize the significance of fracture mechanics.

Unit I	**[8Hrs]**
STRUCTURE AND PROPERTIES: Structure of metals, Defects in crystals, Deformation, Relationship between structure and properties, Mechanical properties of metals, Strain hardening, Strengthening mechanisms.	
Unit II	**[8Hrs]**
TENSION AND TORSION: Stress - Strain curve, Measures of yielding, Measures of ductility, Toughness, Flow curve, Effect of temperature on flow properties, Anisotropy, mechanical properties in torsion, Method of measuring shear stress, Types of torsion failures, Torsion test Vs Tension test. Stress –Strain curve of composite materials.	
Unit III	**[8Hrs]**
FATIGUE: Fatigue phenomena, Theories of fatigue failure, Evaluation of fatigue resistance, Methods of presenting fatigue data, Fatigue crack propagation, Parameters influencing fatigue, Cyclic stress strain behavior, Design against fatigue, Low cycle fatigue.	
Unit IV	**[8Hrs]**
CREEP: Description of creep, Creep curve, Stress-rupture test, Creep mechanisms Dislocation glide, Diffusion flow, Dislocation and Diffusion, Creep in two phase alloys, Deformation Mechanism Maps, Materials aspects creep design, Estimates of creep behavior, Presentation of Engineering creep data Super plasticity.	
Unit V	**[8Hrs]**
FRACTURE MECHANICS: Types of fracture, Theoretical strength of a solid, Griffith's Theory, Irwin-Orowan Theory crack propagation Modes, Dislocation Theories of Brittle fracture, Ductile fracture, Analysis of crack propagation, Stress intensity factor, Crack opening displacement, integrals-Fracture toughness measurement methods.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Engineering Materials and Metallurgy	U. C. Jindal	2011	Pearson
2.	Mechanical Metallurgy	George E. Dieter	1988	McGraw Hill
3.				

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Process of Creep and fatigue of Metals	Kennedy, A. J	1958	Industrial Press,

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD105T(ii)	PE-II Reliability Engineering	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
● Demonstrate the approaches and techniques to assess and improve process and/or product quality and reliability. ● Introduce the principles and techniques and their practical uses in product and/or process design and monitoring. ● Illustrate the basic concepts and techniques of modern reliability engineering tools.	• Understand and explain the concepts of reliability, maintainability etc. • Analyse the data related to reliability and develop prediction models • Perform reliability management tasks like testing, growth monitoring, Allocation and replacement models • To perform reliability risk assessment and analysis

UNIT 1:. Reliability Concept: Reliability function-failure rate - Mean Time Between Failures (MTBF) - Mean Time to Failure (MTTF) –failure modes and effects and criticality analysis (FMECA) , mortality curve –use full availability–maintainability-system effectiveness. **[8 Hours]**

Unit II: Reliability Data Analysis: Time-to-failure distributions - Exponential, normal, Gamma, Weibull, ranking of data-probability plotting techniques-Hazard plotting. **8 Hours]**

Unit III:. Reliability Prediction Models: Series and parallel systems – RBD approach-Stand by systems-m/n configuration-Application of Baye's theorem –cut and tie set method**. [8 Hours]**

Unit IV:. Reliability Management: Reliability testing-Reliability growth monitoring-Non-parametric methods Reliability and life cycle costs-Reliability allocation. **[8 Hours]**

Unit V: Risk Assessment: Definition and measurement of risk - risk analysis techniques-risk reduction resources–industrial safety and risk assessment. **[8 Hours]**

Text Books

S.N	Title	Authors	Edition	Publisher

Reference Books

1	Reliability Engineering and Quality Management	O. N. Pandey, Bhupesh Aneja		S. K. Kataria & Sons
2	Practical Reliability Engineering	Patrick D T O'Connor	4th Edition	Wiley India

S.N	Title	Authors	Edition	Publisher
1	Reliability And Maintenance Engineering	R C Mishra		New Age International New Delhi
2	Reliability Engineering And Risk Analysis: A Practical Guide	Mohammad Modarres, Mark P. Kaminskiy, Vasiliy Krivtsov		Taylor & Francis Ltd

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD105T(iii)	PE-II Artificial Intelligence	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
In this course, the students will study, analyze and simulate various Artificial Intelligence (AI) Techniques and Expert Systems. They will develop the concepts of AI in real life applications, use of AI in machine through the Natural Language Programming (NLP),the architecture of expert systems and understand the knowledge rule based systems in AI. They will also learn object oriented programming system in expert system.	• Apply the basics of AI and expert system to analyze practical problems. • Select appropriate AI & expert systems and tools for solving real life • Problems and their analysis. • Develop the knowledge base for solving real life engineering problem. • Use neural network in cellular manufacturing and other areas of mechanical engineering. • Understand advanced computing techniques that would help in further research and development.

UNIT 1: Human and machine intelligence, artificial intelligence (AI), programming in AI environment, natural language processing (NLP), architecture of an expert system. **[8 Hours]**

Unit II: Knowledge base, inference engine forward and backward chaining, use of probability and fuzzy logic, selection of inference mechanism, semantic nets, structure and objects, ruled systems for semantic nets,-certainty factors, automated learning. **[8 Hours]**

Unit III:. Introduction to rule based system, conflict resolution, advantages and drawbacks of rule based systems clausal form logic; rule base verification, refinement and validation creating knowledge base, knowledge engineer and domain expert, phases of knowledge engineering, tools for knowledge engineering. **[8 Hours]**

Unit IV:. Neural network (NN) applications, artificial neural network models (ANN), NN applications in cellular manufacturing and other areas of mechanical engineering **[8 Hours]**

Unit V: : Fundamentals of OOP (Object Oriented Programming), creating structures and objects, object operations, invoking procedures, programming applications, object oriented expert systems. Advanced topics. **[8 Hours]**

Text Books

S.N	Title	Authors	Edition	Publisher
1	Designing Knowledge Based System'	Addis, T. R	1985	Prentice Hall
2	Principles of Artificial Intelligence and Expert Systems Development	Rolston, D.W	1988	McGraw Hill

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Rule based expert systems	Sasikumar, Ramani		
2	Handbook of Expert Systems in Manufacturing	Maus, R. and Keyes, J	1991	McGraw Hill