Branch: MECHANICAL	Year: II	Semester: Even
Subject Code: RAS-401	Subject Name: Mathematics-III	

Course Outcomes:	1. Understand and evaluate the linear equations by using numerical methods.
	2. Analyze the problems which are faced in engineering.
	3. Comprehend the meaning of analytic function, singularities and Laurent series.
	4. Construct, analyze and evaluate the solutions of differential equation by using numerical methods.
	5. Evaluate the root of the algebraic and transcendental equation by using numerical methods.
	6. Analyze the behavior of statistical data by using testing of hypothesis and probability distributions.

Syllabus: As per AKTU	
Unit 1	Function of Complex variable: Analytic function, C-R equations, Harmonic Functions, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities, Zeroes and Poles, Residue theorem, Evaluation of real integrals of the type $\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$ and $\int_{-\infty}^{+\infty} f(x)dx$.
Unit 2	Statistical Techniques: Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, non–linear and multiple regression analysis, Binomial, Poisson and Normal distributions, Tests of significations: Chi-square test, t-test.
Unit 3	Numerical Techniques–I: Zeroes of transcendental and polynomial equations using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods. Interpolation: Finite differences, Newton's forward and backward interpolation, Lagrange's and Newton's divided difference formula for unequal intervals
Unit 4	Numerical Techniques–II: Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss- Seidel method. Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's one third and three-eight rules, Solution of ordinary differential equations (first order, second order and simultaneous) by Euler's, Picard's and fourth-order Runge-Kutta methods.
Unit 5	[This unit contains two parts. Students have to read only one part of this unit as question paper will contain questions from both the parts with choice.] Numerical Techniques-III: Boundary Value Problem, Finite Difference Method, Eigen Value Problems, Condition Number, Polynomial Method,

	Power Method, Numerical solution of partial differential equations, Elliptic, parabolic and Hyperbolic equations. **OR** Integral Transforms: Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Z- transform and its application to solve difference equations.

Branch: MECHANICAL	Year: II	Semester: Even
Subject Code: REE-409	Subject Name: Electrical Machines and Controls	

Course Outcomes:	1. Understand the fundamentals of the electromechanical devices and control system.
	2. Comprehend the concept for construction and working of various electrical machines.
	3. Understand the performance and characteristics of electrical machines.
	4. Develop mathematical model of a mechanical system using its analogous electrical system.
	5. Apply various techniques to determine time response and stability of a given system.
	6. Understand characteristics and applications of different process controllers.

Syllabus: As per AKTU	
Unit 1	**Single phase Transformer:** Efficiency Voltage regulation, O.C.& S.C. Tests. **Three Phase Transformer:** Three phase transformer connections, 3-phase to 2-phase or 6-phase connections and their applications. **Auto Transformer:** Volt- Amp relations, efficiency, advantages & disadvantages, applications. **D.C. Motors:** Concept of starting, speed control, losses and efficiency.
Unit 2	**Three phase Induction Motor:** Construction, equivalent circuit, torque equation and torque- slip characteristics, speed control. **Alternator:** Construction, e.m.f. equation, Voltage regulation and its determination by synchronous impedance method. **Synchronous Motor:** Starting, effect of excitation on line current (V-curves), synchronous condenser. **Servo Motor:** Two phase A.C. servo motor & its application.
Unit 3	**Modeling of Mechanical System:** linear mechanical elements, force-voltage and force current analogy, electrical analog of simple mechanical systems; concept of transfer function & its determination for simple systems. **Control System:** Open loop & closed loop controls, servo mechanisms; concept of various types of system. **Signals:** Unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics**.**
Unit 4	**Time Response Analysis:** Time response of a standard second order system and response specifications, steady state errors and error constants. **Stability:** Concept and types of stability, Routh Hurwitz Criterion and its application for determination of stability, limitations; Polar plot, Nyquist stability Criterion and assessment of stability.

Unit 5	**Root Locus Techniques:** Concept of root locus, construction of root loci. **Frequency Response Analysis:** Correlation between time and frequency responses of a second order system; Bode plot, gain margin and phase margin and their determination from Bode and Polar plots. **Process control:** Introduction to P, PI and PID controllers their characteristics, representation and applications.

Branch: MECHANICAL	Year: II		Semester: Even
Subject Code: RME-401	Subject Name: Measurement and Metrology		
Course Outcomes:	1. Understand the concept of measurement and related terms.		
	2. Understand measurements of Time, Pressure and temperature		
	3. Understand measurement of Strain, Force, Torque, Acceleration, and Vibration.		
	4. Understand measurement of Fluid Velocity and Flow rate.		
	5. Understand the fundamental of metrology and inspections.		
	6. Understand the measurement of various geometric forms and surface roughness.		
	Syllabus: As per AKTU		
Unit 1	**Mechanical Measurements:** Introduction to measurement and measuring instruments. General concept–Generalized measurement system and its elements-Unit sand standards-measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response- repeatability-systematic, Source of error, statistical analysis of error and random errors-correction, calibration. Dimensional and geometric tolerance **Sensors and Transducers**: Types of sensors, types of transducers and their characteristics.		
Unit 2	**Time Related Measurements:** Stroboscope, frequency measurement by direct comparison. Measurement of displacement **Measurement of Pressure:** Gravitational, directing acting, elastic and indirect type pressure transducers. Measurement of very low pressures (high vacuum). **Strain Measurement**: Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration.		
Unit 3	**Flow Measurement:** Hot Wire Anemometry, Laser Doppler Velocimetry, Rotameter **Temperature Measurement**: Thermometers, bimetallic thermocouples, thermistors and pyrometers. **Measurements of Force, Torque:** Different types of load cells, elastic transducers, pneumatic & hydraulic systems. Seismic instruments **Measurements of Acceleration, and Vibration**: Accelerometers vibration pickups and decibel meters, vibrometers.		
Unit 4	**Coordinate measuring machine (CMM):** Need, constructional features and		

	types, **Metrology and Inspection:** Standards of linear measurement, line and end standards. Interchange ability and standardization. Linear and angular measurements devices and systems **Comparators:** Sigma, Johansson's Microkrator. Limit gauges classification, Taylor's Principle of Gauge Design.
Unit 5	**Limits, Fits &Tolerance and Surface roughness:** Introduction to Limits, Fits, Tolerances and IS standards, Limit-gauges, and surface-roughness. Measurement of geometric forms like straightness, flatness, roundness. Tool makers microscope, profile projector, autocollimator. **Interferometry**: principle and use of interferometry, optical flat. Measurement of screw threads and gears. Surface texture: quantitative evaluation of surface roughness and its measurement.

Branch: MECHANICAL	Year: II	Semester: Even
Subject Code: RME-402	Subject Name: Manufacturing Science & Technology-I	
Course Outcomes:	1. Differentiate conventional and non-conventional manufacturing processes.	
	2. Analyze metal forming operations like forging, tube drawing, extrusion, rolling etc.	
	3. Describe and analyze various aspects of sheet metal working operations.	
	4. Explain the various aspects of casting processes especially die casting, centrifugal casting, investment casting, continuous casting, CO_2 casting, stir casting.	
	5. Explain the manufacturing of plastic components.	
	6. Explain the principle of locating, holding and guiding devices.	
Syllabus: As per AKTU		
Unit 1	**Introduction**: Importance of manufacturing. Economic & technological considerations in manufacturing. Classification of manufacturing processes. Materials & manufacturing processes for common items. **Metal Forming Processes**: Elastic & plastic deformation, yield criteria (Mises' and Tresca's). Hot working versus cold working. Analysis (equilibrium equation method) of Forging process for load estimation with sliding friction, sticking friction and mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging.	
Unit 2	**Metal Forming Processes (continued)**: Analysis of Wire/strip drawing and maximum-reduction, Tube drawing, Extrusion and its application. Condition for Rolling force and power in rolling. Rolling mills & rolled-sections. Design, lubrication and defects in metal forming processes.	
Unit 3	**Sheet Metal working**: Presses and their classification, Die & punch assembly and press work methods and processes. Cutting/Punching mechanism, Blanking vs. Piercing. Compound vs. Progressive die. Flat-face vs Inclined-face punch and Load (capacity) needed. Analysis of forming process like	

	cup/deep drawing. Bending & spring-back.
Unit 4	**Casting (Foundry)**: Basic principle & survey of casting processes. Types of patterns and allowances. Types and properties of moulding sand, sand testing. Elements of mould and design considerations, Gating, Riser, Runners, Core. Solidification of casting, Sand casting, defects & remedies and inspection. Cupola furnace. Die Casting, Centrifugal casting, Investment casting, Continuous casting, CO_2 casting and Stir casting etc.
Unit 5	**Unconventional Metal forming processes**: Unconventional metal forming or High Energy Rate Forming (HERF) processes such as explosive forming, electromagnetic, electro-hydraulic forming. **Powder Metallurgy**: Introduction to Powder metallurgy manufacturing process. Application and, advantages. **Jigs & Fixtures**: Locating & Clamping devices & principles. Jigs and Fixtures and its applications. **Manufacturing of Plastic components**: Review of plastics, and its past, present & future uses. Injection moulding. Extrusion of plastic section. Welding of plastics. Future of plastic & its applications. Resins & Adhesives.

Branch: MECHANICAL	Year: II		Semester: Even
Subject Code: RME-403	Subject Name: Applied Thermodynamics		
Course Outcomes:	1.	Understand various thermodynamic relations and carry out combustion analysis of fuels.	
	2.	Classify boilers & condensers and have understanding of their working principles.	
	3.	Analyze different vapour power cycles and understand the working principles & performance characteristics of steam engines.	
	4.	Understand the working of steam/gas nozzles.	
	5.	Analyze the steam turbine using velocity diagram.	
	6.	Understand the principle & working of gas turbine and turbo jet engines.	
Syllabus: As per AKTU			
Unit 1	**Gas power cycle:** Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparison of Otto, Diesel and dual cycles. **I.C. Engine**: Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test.		
Unit 2	**Vapour Power cycles:** Rankine cycle, effect of pressure and temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, Combined cycles, Cogeneration. **Fuels and Combustion:** Combustion analysis, heating values, air requirement, Air/Fuel ratio, standard heat of reaction and effect of temperature on standard heat of reaction, heat of formation, Adiabatic flame temperature.		
Unit 3	**Boilers:** Classifications and working of boilers, boiler mountings and accessories, Draught and its calculations, air pre heater, feed water heater, super heater. Boiler		

	efficiency, Equivalent evaporation. Boiler trial and heat balance. **Condenser:** Classification of condenser, air leakage, condenser performance parameters.
Unit 4	**Steam and Gas Nozzles:** Flow through Convergent and convergent-divergent nozzles, variation of velocity, area and specific volume, Choked flow, throat area, Nozzle efficiency, Off design operation of nozzle, Shock waves stationary normal shock waves, Effect of friction on nozzle, Super saturated flow. **Steam Turbines :** Classification of steam turbine, Impulse and Reaction turbines, Staging, Stage and Overall efficiency, Reheat factor, Bleeding, Velocity diagram of simple and compound multistage impulse and reaction turbines and related calculations, work done, efficiencies of reaction, Impulse reaction turbines, state point locus, Losses in steam turbines, Governing of turbines, Comparison with steam engine.
Unit 5	**Gas Turbine:** Gas turbine classification, Brayton cycle, Principles of gas turbine, Gas turbine cycles with intercooling, reheat and regeneration and their combinations, Stage efficiency, Polytropic efficiency. Deviation of actual cycles from ideal cycles. **Jet Propulsion:** Introduction to the principles of jet propulsion, Turbojet and turboprop engines and their processes, Principle of rocket propulsion, Introduction to Rocket Engine.