B.E. (PTDC) Mechanical Engineering
SEMESTER – II

Branch	Subject Title	Subject Code	Periods Per week			
			L	T	P	C
B.E. PART TIME MECHANICAL	Mathematics-II	BEPT-201	3	1	0	4

Unit I

Functions of complex variables : Analytic functions, Harmonic Conjugate, Cauchy-Riemann Equations, Line Integral, Cauchy's Theorem, Cauchy's Integral Formula, Singular Points, Poles & Residues, Residue Theorem , Application of Residues theorem for evaluation of real integrals

Unit II

Errors & Approximations, Solution of Algebraic & Trancedental Equations (Regula Falsi , Newton-Raphson, Iterative, Secant Method), Solution of simultaneous linear equatins by Gauss Elimination, Gauss Jordan, Crout's methods , Jacobi's and Gauss-Siedel Iterative methods

Unit III

Difference Operators, Interpolation (Newton Forward & Backward Formulae, Central Interpolation Formulae, Lagrange's and divided difference formulae), Numerical Differentiation and Numerical Integration.

Unit IV

Solution of Ordinary Differential Equations(Taylor's Series, Picard's Method, Modified Euler's Method, Runge-Kutta Method, Milne's Predictor & Corrector method), Correlation and Regression, Curve Fitting (Method of Least Square).

Unit V

Concept of Probability : Probability Mass function, Probability density function. Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution ,Gamma Distribution ,Beta Distribution ,Testing of Hypothesis |:Students t-test, Fisher's z-test, Chi-Square Method

Reference:

(i) Numerical Methods using Matlab by J.H.Mathews and K.D.Fink, P.H.I.
(ii) Numerical Methods for Scientific and Engg. Computation by MKJain, Iyengar and RK Jain, New Age International Publication
(iii) Mathematical Methods by KV Suryanarayan Rao, SCITECH Publuication
(iv) Numerical Methods using Matlab by Yang,Wiley India
(v) Pobability and Statistics by Ravichandran ,Wiley India
(vi) Mathematical Statistics by George R., Springer

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Branch	Subject Title	Subject Code	Periods Per week			
			L	T	P	C
B.E. PART TIME MECHANICAL	Thermodynamics	PTME-202	3	1	2	6

Unit I

Basic concepts: Thermodynamics, Property, Equilibrium, State, Process, Cycle, Zeroth law of thermodynamics, statement and significance, concept of an Ideal gas, Gas laws, Avogadro's hypothesis, Heat and work transfer. First law of thermodynamics- Statement of first law of thermodynamics, first law applied to closed system, first law applied to a closed system undergoing a cycle, processes analysis of closed system, flow process, flow energy, steady flow process, Relations for flow processes, limitations of first law of thermodynamics.

Unit II

Second law of thermodynamics, heat engine, heat reservoir, Refrigerator, heat pump, COP, EPR, Available energy, Carnot's theorem, Carnot's cycle, efficiency of Carnot's cycle, statement of second law Reversible and irreversible processes, consequence of second law, Entropy, Entropy change for ideal gas, T-S diagrams, Availability and Irreversibility. Gibbs and Helmholtz functions

Unit III

Real gas, Deviation with ideal gas, Vander-wall's equation, evaluation of its constants, limitations of the equation. The law of corresponding states Compressibility factor, Generalized compressibility chart, P-V-T surface of a Real gas, Thermodynamics relations, Maxwell relations and there applications.

Unit IV

Pure Substance, Phase, Phase-transformations, formation of steam, properties of steam, PVT surface, HS,TS,PV,PH,TV diagram, processes of vapor measurement of dryness fraction, Use of steam table and Mollier chart.

Unit V

Air standard cycles, Carnot, Otto, Diesel, Dual cycles and there comparison, two stroke and four stroke engines, Brayton cycle, non reactive gas mixture, PVT relationship, mixture of ideal gases, properties of mixture of ideal gases, internal energy, Enthalpy and specific heat of gas mixtures, Enthalpy of gas-mixtures.

References:

1. P.K.Nag; Engineering Thermodynamics; TMH
2. Van GJ; Thermodynamics; John Wylen
3. Cengel Y; Thermodynamics; TMH
4. Arora CP; Thermodynamics; TMH
5. Thermal Engineering by R Yadav
6. Engineering Thermodynamics by Omkar Singh New Age International.
7. Engineering Thermodynamics by Ratha Krishanan PHI India Pvt. Ltd.
8. Engineering Thermodynamics by M. Achuthan, PHI India.

List of Experiments (Pl. expand it):

1. To find mechanical equivqlent of heat using Joules apparatus
2. To study working of impulse and reaction steam turbine by models.\
3. To study working of Gas turbines by models and to identify various processes of Brayton Cycle.
4. To calculate COP of vapour compression refrigeration system and to plot on T-s, p-H diagrams.
5. To plot specific fuel consumption versus rpm diagrams for diesel and petrol engines Theory classes must be supplemented with laboratory classes.

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			L	T	P	C
B.E. PART TIME MECHANICAL	Kinematics of M/Cs	PTME-203	3	1	2	6

Unit 1:
Mechanisms and Machines: Mechanism, machine, plane and space mechanisms, kinematic pairs, kinematic chains and their classification, degrees of freedom, Grubler's criterion, kinematic inversions of four bar mechanism and slider crank mechanism, equivalent linkages, pantograph, straight line motion mechanisms, Davis and Ackermann's steering mechanisms, Hooke's joint.

Unit 2:
Kinematic analysis of plane mechanisms using graphical and Cartesian vector notations: Planar kinematics of a rigid body, rigid body motion, translation, rotation about a fixed axis, absolute general plane motion. General case of plane motion, relative velocity method, velocity and acceleration analysis, instantaneous center and its application, Kennedy's theorem, relative motion, Coriolis component of acceleration; velocity and acceleration analysis using complex algebra (Raven's) method.

Unit 3 :Gears: Classification of gears, nomenclature, involutes and cycloidal tooth profile properties, synthesis of tooth profile for spur gears, tooth system, conjugate action, velocity of sliding, arc of contact, path of contact, contact ratio, interference and undercutting, helical, spiral, bevel and worm gears.

Unit 4:
Cams: Classification of followers and cams, radial cam nomenclature, analysis of follower motion (uniform, modified uniform, simple harmonic, parabolic, cycloidal), pressure angle, radius of curvature, synthesis of cam profile by graphical approach, cams with specified contours.
Gear Trains: Simple, compound, epicyclic gear trains; determination of gear speeds using vector, analytical and tabular method; torque calculations in simple, compound and epicyclic gear trains.

Unit 5:
Gyroscopic Action in Machines: angular velocity and acceleration, gyroscopic torque/ couple; gyroscopic effect on naval ships; stability of two and four wheel vehicles, rigid disc at an angle fixed to a rotating shaft.

References:

1. Rattan SS; Theory of machines; TMH
2. Ambekar AG; Mechanism and Machine Theory; PHI.
3. Sharma CS; Purohit K; Theory of Mechanism and Machines; PHI.
4. Thomas Bevan; Theory of Machines; Pearson/ CBS PUB Delhi.
5. Rao JS and Dukkipati; Mechanism and Machine Theory; NewAge Delhi.
6. Dr.Jagdish Lal; Theory of Machines; Metropolitan Book Co; Delhi –
7. Ghosh,A,.Mallik,AK; Theory of Mechanisms & Machines, 2e,;East West Press, Delhi.

List of experiments (expandable)
1.To study all inversions of four-bar mechanisms using models
2.Draw velocity and acceleration polygons of all moving link joints in slider crank mechanism
3.Determination of velocity and acceleration in above using method of graphical differentiation
4.To study working of differential gear mechanism.
5.To study working of sun and planet epicycle gear train mechanism using models
6.To plot fall and rise of the follower versus angular displacement of cam and vice versa. 7.Study of universal gyroscope
8.Analytical determination of velocity and acceleration in simple mechanism using Roven's M.

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B.E. PART TIME MECHANICAL	Mechanics of Material	PTME-204	3	1	2	6

UNIT I

Mechanical properties of materials: Ductility, malleability, hardness, toughness, fatigue, creep; behavior of materials under tension, compression, bending, shear; ductile and brittle materials, failure of MS and CI in tension and torsion

Stress and strain: stresses in members of a structure, axial loading, normal stress, shear stress, bearing stress, analysis of simple structures, stepped rods, members in series and parallel: stress strain diagram, Hooke's law, modulus of elasticity, elastic and plastic behavior of materials, deformation under axial loading, statically indeterminate problems, stress due to temperature, Poisson's ratio, Bulk modulus, shear strain, relation among elastic constants, residual stress, fiber reinforced composite materials, strain energy under axial loads and stresses due to impact of falling weights.

UNIT II

Transformation of stress and strain, principal stresses, normal and shear stress, Mohr's circle and its application to two and three dimensional analysis, ductile and brittle failures, transmission shaft under combined bending and torsion; stresses in thin walled pressure vessel

UNIT III

Bending: pure bending, symmetric member, deformation and stress, bending of composite sections, eccentric axial loading, shear force and BM diagram, relationship among load, shear and BM, shear stresses in beams, strain energy in bending, deflection of beams, equation of elastic curve, Macaulay's method and Area moment method for deflection of beams.

UNIT IV

Torsion in shafts: stresses in a shaft, deformation in circular shaft, angle of twist, stepped-hollow, thin walled-hollow transmission shafts Leaf springs; helical springs, open and closed coil, stress in spring wire, deflection of helical spring, springs in series and parallel.

UNIT V

Theories of failures: maximum normal stress & shear stress theory; maximum normal and shear strain energy theory; maximum distortion energy theory; application of theories to different materials and loading conditions Columns: stability of structures, Euler's formula for columns with different end conditions, Rankin's formula.

References:

1. Beer FP, Johnson ER, Dewolf JT : Mechanics of Materials; TMH
2. Rattan; Strength of materials; TMH
3. Nash William; Schaum's Outline Series; Strength of Materials; TMH.
4. Negi ; strength of materials; TMH
5. Singh Arbind K; Mechanics of Solids; PHI
6. Sadhu Singh; Strength of Materials; Khanna Pub.
7. Kamal K and Ghai RC; Advanced Mechanics of Materials; Khanna Pub.

List of experiments:

1. Standard tensile test on MS and CI test specimen
2. Direct/ cross Shear test on MS and CI specimen
3. Transverse bending test on wooden beams to obtain modulus of rupture
4. Fatigue test
5. Brinell Hardness tests
6. Vicker hardness test
7. Izod/ Charpy impact test.