

Syllabus for Sandip University Joint Entrance Exam(SU-JEE)

Exam Name – SU-JEE MTech Mechanical

Title	Syllabus	No of Questions
Mathematics	<p><u>General calculus</u>: Limits & continuity, derivatives and integration of basic functions,</p> <p><u>Geometry</u>: Coordinate geometry, trigonometry, hyperbolic functions, scalars and vectors, vector calculus, algebraic operations for circle, cylinder and cone, conic sections</p> <p><u>Number theory & game theory</u>: Permutation & combination, probability theory,</p> <p>Sequences and series, determinants, Cramer's rule, matrices & their basic operations, application for solution of linear algebraic equations</p> <p><u>Statistics</u>: Measures of dispersion, mean, median, variance, standard deviation</p> <p><u>Matrices</u>: Eigen values and eigen vectors, basic theorems for matrix operations-Caley Hamilton's theorem</p> <p><u>General Calculus</u>: Ordinary differential equations (ODE), solution methodologies, modelling of physical phenomenon- spring mass system, Bernoulli equation, potential flow problems, double integrals and triple integrals,</p> <p>Partial differential equations (PDE), types of PDEs, general solutions and particular integrals</p> <p><u>Vector Integration</u>: Gradients, divergence, curl of vectors, Green's theorem, Stokes theorem</p>	20

	<p><u>Series solutions to algebraic equations:</u> Taylor series, Maclaurin series, Fourier series</p> <p>Statistics for engineering problems: Linear curve fitting, goodness of fit</p>	
<p>Thermal Engineering</p>	<p><u>Basic thermodynamics:</u> Laws of thermodynamics, basic thermodynamic processes, gas laws, concept of entropy, reversible and irreversible processes, Carnot theorem, general thermodynamic relations</p> <p><u>Applied thermodynamics:</u> Fuels, calorific value of fuel and their determinations, thermodynamics of combustible mixtures, proximate and ultimate analyses, mass fraction and mole fraction, stoichiometric mixtures, flue gas analysis</p> <p>Centrifugal air compressors, performance evaluation parameters, surging and choking of rotary compressors</p> <p>Gas turbines and their types- Brayton cycle, constant pressure open cycle, velocity diagrams, head losses in gas turbines, reheat, intercooling and regeneration effects on thermal efficiency, auxiliary system – starting and ignition systems, fuel control systems</p> <p>Jet propulsion cycles- ramjet, pulse jet, turbo-prop, turbo fan, scram jet engines, thrust equations and augmentation, performance parameters</p> <p>Rocket propulsion – Liquid propellants, staging</p> <p>Air refrigeration cycles - Bell Coleman cycle, regenerative cycle, boot-strap method, reduced ambient method</p>	<p>15</p>

	<p>Psychrometry – Definitions, psychrometric processes-cooling, heating, humidification & dehumidification, comfort air conditioning</p>	
<p>Fluid Mechanics</p>	<p><u>Properties of fluid</u>: classification of fluids, basic fluid properties, continuum approach,</p> <p><u>Fluid dynamics</u>: Continuity equation, momentum equation, types flow field, potential and stream functions, Navier-Stokes equations, Eulerian approach to solve fluid flow problems, Bernoulli's theorem</p> <p><u>Flow measuring devices</u>: Pressure gauges, Pitot tube, venturi and orifice meters</p> <p><u>Internal flows</u>: Developing and fully developed flows of incompressible fluids in pipes, velocity & shear stress distribution, flow between flat plates and flow development, laminar and turbulent flows, boundary layer theory, methods of controlling boundary layers, losses in pipe flows-major losses and minor losses, Hagen-Poiseuille equation</p> <p><u>External flows</u>: Flow over flat plate, boundary layer thickness, methods of controlling boundary layers, forces on immersed bodies, drag and lift, flow past bluff bodies like cylinders, sphere, flow past aerofoils-pressure distribution</p> <p><u>Dimensional analysis</u>: Dimensional homogeneity, Buckingham's pi theorem, physical significance of non-dimensional numbers in fluid dynamics</p>	<p>15</p>

	<p><u>Compressible fluid flow:</u> Isentropic flow through varying passage, ideal gas flow through nozzle, nozzle efficiency, sonic velocity, Mach number, Mach angle and Mach line</p>	
<p>Heat Transfer</p>	<p><u>Fundamentals of heat transfer:</u> Fourier's law of conduction, Newton's law of cooling, Stefan-Boltzmann's law of radiation</p> <p><u>Conduction:</u> Mechanism of conduction in solids, liquids and gases, general equations of conduction in solids in Cartesian, cylindrical and spherical coordinates, transient conduction by lumped capacitance method, non-dimensional numbers in conduction</p> <p><u>Convection:</u> Velocity boundary layer, thermal boundary layer, free convection, significant non-dimensional parameters, governing equations, convection over flat plates, spheres, cylinders, convection between parallel plate channels</p> <p>Forced convection, significant non-dimensional parameters, governing equations, convection over flat plates, spheres, cylinders, convection between parallel plate channels</p> <p><u>Heat Exchangers:</u> Types of heat exchangers, concept of overall heat transfer coefficient, heat exchanger analysis-LMTD approach & NTU method</p> <p><u>Radiation:</u> Terminologies, concept of back body radiation, Kirchhoff's law, Plank's distribution, Wein's displacement law, concept of grey surface, heat exchange between surfaces by radiation- view factor calculations</p>	<p>10</p>
<p>Solid Mechanics</p>	<p><u>Simple stresses & strains:</u> Concept of rigid body, Hooke's law, Poisson's ratio, Moduli of elasticity, interrelation between elastic constants</p> <p><u>Stresses in beams:</u> SFD & BMD for different beam loading conditions, bending stress calculations-</p>	<p>10</p>

	<p>theory of simple bending, shear stress calculations-shear stress distribution diagram, shear stress connectors, concept of shear flow and shear centre</p> <p><u>Torsion of circular shafts:</u> Theory of torsion, concept of polar moment of inertia, twisting moment diagrams</p> <p><u>Principal stresses:</u> Oblique planes, concept of principal stresses, analytical approach of calculation,</p> <p><u>Strain energy & impact loading:</u> Concept of strain energy, deformation of axially loaded members under gradual, sudden and impact loads</p>	
<p>Mechanisms and machines</p>	<p><u>Kinematics of motion:</u> Simple harmonic motion, kinematic pairs, degrees of freedom- Kutzbach's criterion, simple mechanisms – four bar chain, slider crank, double slider chain, concept of IC, relative velocity method</p> <p><u>Mechanism with lower pairs:</u> Pantograph, straight line mechanisms</p> <p><u>Power transmission mechanisms:</u> Types of belt drives, selection criteria, materials for belts, slip and creeping of belts, condition for maximum power transmission, rope drives-types, materials, ratio of driving tensions for rope drives, chain drives-terminologies, relation between pitch and PCD, clutches-types, single plate and multi-plate clutch system, materials for friction liners</p> <p><u>Gear trains:</u> simple gear train, law of gearing, epicyclic gear train, spur gears, helical gears, bevel gears, rack and pinion arrangement, worm & worm wheel</p> <p><u>Mechanism for automation:</u> Cam-follower system-types, displacement, velocity diagrams</p>	<p>20</p>

	<p><u>Other machine elements:</u> Rolling contact bearings-types, selection criteria, lubrication of bearings, bearing seals, static and dynamic load carrying capacity</p> <p><u>Vibrations:</u> Free undamped vibrations-governing equation, transverse & torsional vibrations</p> <p>Free damped vibrations – Linear damping, governing equation, damping coefficients, damping factors, solution of free damped system</p> <p>Forced damped system – governing equation, analytical solution, forced vibrations with unbalanced systems, transmissibility curves, and frequencyresponse curves</p> <p>Torsional vibrations – two rotor system, free torsional vibrations, torsional dampers</p> <p>Single rotor-shaft system, multi rotor-shaft system for critical speed</p> <p><u>Gyroscope:</u> Gyroscopic action, gyroscopic effect in aeroplanes, determination of gyroscopic couple</p> <p><u>Balancing:</u> Static & dynamic balancing, balancing of rotating masses</p>	
<p>Material science</p>	<p><u>Metallurgy of ferrous metals:</u> iron-iron carbide diagram, phases of transformation, plain carbon steels-types, characteristics and applications,</p> <p><u>Heat treatment processes of steels:</u></p> <p>annealing, normalising, hardening, tempering, carburising, carbonitriding, cyaniding,</p> <p>nitriding, flame hardening</p> <p>Alloy steels: Alloying elements, effects of alloying, structural grade of alloy steels, stainless steels – grading</p>	<p>10</p>

	<p><u>Cast iron:</u> classification, malleabilisation heat treatment</p> <p><u>Metallurgy of non-ferrous metals:</u></p> <p>Copper & copper alloys-brass,bronze,copper-nickel alloys,</p> <p>Aluminium & aluminium alloys,Indian standard codes for designation,bearing alloys</p> <p>Ceramics- traditional ceramics,deformation & fracture of ceramics,low temperature brittle fracture,high temperature creep rupture</p> <p><u>Mechanical testing of materials:</u></p> <p>Tensile tests,compression tests,hardness test-Brinell,Vicker,Rockwell</p> <p>Impact tests-Charpy,Izod test,fatigue tests and creep tests</p> <p><u>Non-destructive testing = ultrasonic test, radiographic test</u></p>	
Total		100