



YOUR CAREER QUEST ENDS HERE

GATE
MECHANICAL
ENGINEERING
SYLLABUS
2017

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Section 1: Engineering Mathematics

Linear Algebra:

1. Matrix algebra
2. Systems of linear equations
3. Eigenvalues and eigenvectors

Calculus:

1. Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms
2. Evaluation of definite and improper integrals
3. Double and triple integrals
4. Partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima, Fourier series
5. Gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems

Differential equations:

1. First order equations (linear and nonlinear)
2. Higher order linear differential equations with constant coefficients
3. Euler-Cauchy equation initial and boundary value problems
4. Laplace transforms
5. Solutions of heat, wave and Laplace's equations

Complex variables:

1. Analytic functions
2. Cauchy-Riemann equations
3. Cauchy's integral theorem and integral formula
4. Taylor and Laurent series

Probability and Statistics:

1. Definitions of probability, sampling theorems, conditional probability
2. Mean, median, mode and standard deviation
3. Random variables, binomial, Poisson and normal distributions

Numerical Methods:

1. Numerical solutions of linear and non-linear algebraic equations
2. Integration by trapezoidal and Simpson's rules
3. Single and multi-step methods for differential equations

Section 2: Applied Mechanics and Design

Engineering Mechanics:

1. Free-body diagrams and equilibrium
2. Trusses and frames virtual work
3. Kinematics and dynamics of particles and of rigid bodies in plane motion
4. Impulse and momentum (linear and angular) and energy formulations, collisions

Mechanics of Materials:

1. Stress and strain, elastic constants, Poisson's ratio
2. Mohr's circle for plane stress and plane strain
3. Thin cylinders
4. Shear force and bending moment diagrams
5. Bending and shear stresses deflection of beams
6. Torsion of circular shafts
7. Euler's theory of columns
8. Energy methods
9. Thermal stresses
10. Strain gauges and rosettes
11. Testing of materials with universal testing machine
12. Testing of hardness and impact strength

Theory of Machines:

1. Displacement, velocity and acceleration analysis of plane mechanisms
2. Dynamic analysis of linkages
3. Cams
4. Gears and gear trains
5. Flywheels and governors
6. Balancing of reciprocating and rotating masses

7. Gyroscope

Vibrations:

1. Free and forced vibration of single degree of freedom systems, effect of damping
2. Vibration isolation
3. Resonance
4. Critical speeds of shafts

Machine Design:

1. Design for static and dynamic loading
2. Failure theories
3. Fatigue strength and the S-N diagram
4. Principles of the design of machine elements such as bolted, riveted and welded joints
5. Shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs

Section 3: Fluid Mechanics and Thermal Sciences

Fluid Mechanics:

1. Fluid properties
2. Fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies
3. Control-volume analysis of mass, momentum and energy
4. Fluid acceleration
5. Differential equations of continuity and momentum
6. Bernoulli's equation
7. Dimensional analysis
8. Viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings

Heat-Transfer:

1. Modes of heat transfer
2. One dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins
3. Unsteady heat conduction, lumped parameter system, Heister's charts

4. Thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence
5. Heat exchanger performance, LMTD and NTU methods
6. Radioactive heat transfer, Stefan Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis

Thermodynamics:

1. Thermodynamic systems and processes
2. Properties of pure substances, behaviour of ideal and real gases
3. Zeroth and first laws of thermodynamics, calculation of work and heat in various processes
4. Second law of thermodynamics
5. Thermodynamic property charts and tables, availability and irreversibility thermodynamic relations

Applications:

1. *Power Engineering*: Air and gas compressors
2. Vapour and gas power cycles, concepts of regeneration and reheat
3. *IC Engines*: Air-standard Otto, Diesel and dual cycles
4. *Refrigeration and air-conditioning*: Vapour and gas refrigeration and heat pump cycles
5. Properties of moist air, psychometric chart, basic psychometric processes
6. *Turbo machinery*: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines

Section 4: Materials, Manufacturing and Industrial Engineering

Engineering Materials:

- Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials

Casting, Forming and Joining Processes:

1. Different types of castings, design of patterns, moulds and cores
2. Solidification and cooling
3. Riser and gating design
4. Plastic deformation and yield criteria
5. Fundamentals of hot and cold working processes
6. Load estimation for bulk (forging, rolling, extrusion, and drawing) and sheet (shearing, deep drawing, and bending) metal forming processes
7. Principles of powder metallurgy
8. Principles of welding, brazing, soldering and adhesive bonding

Machining and Machine Tool Operations:

1. Mechanics of machining
2. Basic machine tools
3. Single and multi-point cutting tools, tool geometry and materials, tool life and wear
4. Economics of machining principles of non-traditional machining processes
5. Principles of work holding, design of jigs and fixtures

Metrology and Inspection:

1. Limits, fits and tolerances
2. Linear and angular measurements
3. Comparators
4. Gauge design
5. Interferometry
6. Form and finish measurement
7. Alignment and testing methods
8. Tolerance analysis in manufacturing and assembly

Computer Integrated Manufacturing:

- Basic concepts of CAD/CAM and their integration tools

Production Planning and Control:

- Forecasting models, aggregate production planning, scheduling, materials requirement planning

Inventory Control:

1. Deterministic models
2. Safety stock inventory control systems

Operations Research:

- Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM

“All the best for a bright future!

May there be success at every turn of life

And all your dreams come true.”

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