GATE SYLLABUS

Group – 1

1. ENGINEERING MATHEMATICS

1.1. Linear Algebra:

1.1.1. Matrix algebra
1.1.2. Systems of linear equations
1.1.3. Eigen values and Eigen vectors

1.2. Calculus:

1.2.1. Functions of single variable
1.2.2. Limit, continuity and differentiability
1.2.3. Mean value theorems
1.2.4. Indeterminate forms
1.2.5. Evaluation of definite and improper integrals
1.2.6. Double and triple integrals
1.2.7. Partial derivatives
1.2.8. Total derivative
1.2.9. Taylor series (in one and two variables)
1.2.10. Maxima and minima
1.2.11. Fourier series
1.2.12. Gradient
1.2.13. Divergence and Curl
1.2.14. Vector identities
1.2.15. Directional derivatives
1.2.16. Line, Surface and Volume integrals
1.2.17. Stokes, Gauss and green's theorems

1.3. Differential equations:

1.3.1. First order equations (linear and nonlinear)
1.3.2. Higher order linear differential equations with constant coefficients
1.3.3. Euler – Cauchy equations
1.3.4. Initial and boundary value problems
1.3.5. Laplace transforms
1.3.6. Solutions of one dimensional heat, wave and Laplace equation

1.4. Complex variables:

1.4.1. Analytic functions
1.4.2. Cauchy-Riemann equations
1.4.3. cauchy's integral theorem and integral formula
1.4.4. Taylor and Laurent series

1.5. Probability and Statistics:

1.5.1. Definitions of probability
1.5.2. sampling theorems
1.5.3. Conditional probability
1.5.4. Mean, median, mode and standard deviation
1.5.5. Random variables
1.5.6. Poisson distributions
1.5.7. Normal distributions
1.5.8. Binomial distributions

1.6. Numerical Methods:

1.6.1. Numerical solutions of Linear and non - linear algebraic equations
1.6.2. Integration by trapezoidal and simpson's rule
1.6.3. single and multi - step methods for differential equations

2. GENERAL APTITUDE

2.1. Verbal Ability:

2.1.1. English grammar
2.1.2. sentence completion
2.1.3. verbal analogies
2.1.4. word groups
2.1.5. instructions
2.1.6. critical reasoning and verbal deduction

2.2. Numerical Ability:

2.2.1. Numerical computation
2.2.2. numerical estimation
2.2.3. numerical reasoning and data interpretation

Group – 2

3. MANUFACTURING AND INDUSTRIAL ENGINEERING

3.1. Engineering Materials:

3.1.1. Structure and properties of engineering materials
3.1.2. Phase diagrams
3.1.3. heat treatment
3.1.4. stress - strain diagrams for engineering materials

3.2. Metal Casting:

3.2.1. Design of patterns

3.2.2. Different types of casting
3.2.3. moulds and cores
3.2.4. solidification and cooling
3.2.5. riser and gating design
3.2.6. design considerations

3.3. Forming:
3.3.1. Plastic deformation and yield criteria
3.3.2. fundamentals of hot and cold working processes
3.3.3. load estimation for bulk (forging, rolling, extrusion, drawing)
3.3.4. sheet (shearing, deep drawing, bending) metal forming processes

3.4. Powder metallurgy
3.4.1. Principles of powder metallurgy

3.5. Joining
3.5.1. Physics of welding
3.5.2. brazing and soldering
3.5.3. adhesive bonding
3.5.4. design considerations in welding

3.6. Machining and Machine Tool Operations:
3.6.1. Mechanics of machining
3.6.2. single and multi - point cutting tools
3.6.3. tool geometry and materials
3.6.4. tool life and wear
3.6.5. economics of machining
3.6.6. principles of non - traditional machining processes
3.6.7. principles of work holding
3.6.8. principles of design of jigs and fixtures

3.7. Metrology and Inspection:
3.7.1. Limits, fits and tolerances
3.7.2. linear and angular measurements
3.7.3. comparators
3.7.4. gauge design
3.7.5. interferometry
3.7.6. form and finish measurement
3.7.7. alignment and testing methods
3.7.8. tolerance analysis in manufacturing and assembly

3.8. Computer Integrated Manufacturing:
Basic concepts of CAD/CAM and their integration tools

3.9. Production Paining and Control:

3.9.1. Forecasting models
3.9.2. aggregate production planning
3.9.3. scheduling
3.9.4. materials requirement planning

3.10. Inventory Control:

3.10.1. Deterministic and probabilistic models
3.10.2. safety stock inventory control systems

3.11. Operations Research:

3.11.1. Linear programming
3.11.2. simplex and duplex method
3.11.3. transportation
3.11.4. assignment
3.11.5. network flow models
3.11.6. simple queuing models
3.11.7. PERT and CPM

Group – 3

4. THERMAL SCIENCES

4.1. Thermodynamics:

4.1.1. Zeroth, First and Second laws of thermodynamics
4.1.2. thermodynamic system and processes
4.1.3. Carnot cycle
4.1.4. Irreversibility and availability
4.1.5. behavior of ideal and real gases
4.1.6. properties of pure substances
4.1.7. calculation of work and heat in various processes
4.1.8. availability and irreversibility
4.1.9. analysis of thermodynamic cycles related to energy conversion

4.2. Heat - Transfer:

4.2.1. Modes of heat transfer
4.2.2. one dimensional heat conduction
4.2.3. resistance concept and electrical analogy
4.2.4. unsteady heat conduction
4.2.5. heat transfer through fins
4.2.6. lumped parameter system
4.2.7. heisler's chart
4.2.8. dimensionless parameters in free and forced convective heat transfer

4.2.9. Heat transfer correlations for flow over flat plates and through pipes
4.2.10. thermal boundary layer
4.2.11. effect of turbulence
4.2.12. radiative heat transfer
4.2.13. black and grey surfaces
4.2.14. shape factors
4.2.15. wien's displacement law
4.2.16. Stefan-boltzmann law
4.2.17. View factor
4.2.18. Radiation network analysis
4.2.19. heat exchanger performance
4.2.20. LMTD and NTU methods

4.3. Applications:

4.3.1. Power Engineering
4.3.1.1. Air and gas compressors
4.3.1.2. Vapour and gas power cycles
4.3.1.3. Concepts of regeneration and reheat

4.3.2. I.C. engines
4.3.2.1. Air standard otto , diesel and dual cycles

4.3.3. Refrigeration and air - conditioning
4.3.3.1. Vapor refrigeration cycle
4.3.3.2. heat pumps
4.3.3.3. gas refrigeration
4.3.3.4. Reverse Brayton cycle
4.3.3.5. moist air
4.3.3.6. psychrometric chart
4.3.3.7. basic psychrometric processes

Group – 4

5. FLUID MECHANICS

5.1. Fluid Mechanics:

5.1.1. Fluid properties
5.1.2. fluid statics
5.1.3. manometry
5.1.4. buoyancy
5.1.5. forces on submerged bodies
5.1.6. stability of floating bodies
5.1.7. control - volume analysis of mass, momentum and energy

5.1.8. fluid acceleration
5.1.9. differential equations of continuity and momentum
5.1.10. Bernoulli's equation
5.1.11. Dimensional analysis
5.1.12. viscous flow of incompressible fluids
5.1.13. boundary layer
5.1.14. elementary turbulent flow
5.1.15. flow through pipes
5.1.16. head losses in pipes, bends and fittings

5.2. Applications:

5.2.1. Turbomachinery: Pelton wheel, Francis and Kaplan turbines
5.2.2. impulse and reaction principles
5.2.3. velocity diagrams

Group – 5

6. APPLIED MECHANICS AND DESIGN

6.1. Engineering Mechanics:

6.1.1. Free body diagrams and equilibrium
6.1.2. strusses and frames
6.1.3. virtual work
6.1.4. kinematics and dynamics of particles and of rigid bodies in plane motion
6.1.5. impulse and momentum (linear and angular)
6.1.6. energy formulations
6.1.7. Impact

6.2. Strength of Materials:

6.2.1. Stress and strain,
6.2.2. stress - strain relationship and elastic constants
6.2.3. Mohr's circle for plane stress and plane strain
6.2.4. thin cylinders
6.2.5. shear force and bending moment diagrams
6.2.6. bending and shear stresses
6.2.7. deflection of beams
6.2.8. torsion of circular shafts
6.2.9. Euler's theory of columns
6.2.10. strain energy methods
6.2.11. Thermal stresses

6.3. Theory of Machines:

6.3.1. Displacement, velocity and acceleration analysis of plane mechanisms
6.3.2. dynamic analysis of slider - crank mechanism
6.3.3. Gear and gear trains
6.3.4. cams
6.3.5. governors
6.3.6. Flywheel
6.3.7. balancing of reciprocating and rotating masses
6.3.8. Gyroscope

6.4. Vibrations:

6.4.1. Free and forced vibration of single degree of freedom systems
6.4.2. effect of damping
6.4.3. vibration isolation
6.4.4. resonance
6.4.5. critical speeds of shafts

6.5. Design:

6.5.1. Design for static and dynamic loading
6.5.2. failure theories
6.5.3. fatigue strength and the S - N diagram
6.5.4. principles of the design of machine elements such as bolted
6.5.5. riveted and welded joints
6.5.6. shafts
6.5.7. spur gears
6.5.8. rolling and sliding contact bearings
6.5.9. brakes and clutches