Part I : Engineering Mathematics (Common to all Candidates)

i) Determinants and Matrices: Solving system of equations – Rank of the Matrix – Eigen values and Eigen vectors – Reduction of quadratic form to canonical form.

ii) Calculus and Differential Equations: Partial derivatives – Jacobians – Taylor's expansion – Maxima and Minima. Linear ordinary differential equations with constant coefficients – Simultaneous first order linear equations with constant coefficients. Formation of partial differential equation (PDE) – Solution of first order PDE – Solution of linear higher order PDE with constant coefficients.

iii) Vector Calculus: Double and triple integrations and their applications – Gradient, Divergence, Curl and Laplacian – Green's, Gauss divergence and Stroke's theorem.

iv) Functions of Complex Variables and Complex Integration: Analytic functions – Conformal Mapping – Bilinear transformation – Cauchy's integral theorem and integral formula – Taylor and Laurent Series – Singularities – Residues – Residue theorem and its applications.

v) Transforms: Laplace Transform – Inverse transforms – Application to solution of linear ordinary differential equations with constant coefficients. Fourier integral theorem – Fourier transform pair – Sine and Cosine transforms. Transform – Inverse Z–transform – Solution of difference equations using Z– transform.

vi) Numerical Methods: Solution of linear system by direct and iterative methods – Interpolation and approximation – Numerical Differentiation and Integration – Solving Ordinary Differential Equations.

vii) Applied Probability: Probability and Random variables – Standard Discrete and Continuous distribution – Moments – Moment generating function and their properties. Two Dimensional Random Variables – Covariance – Correlation and Regression.

Part – II : Basic Engineering & Sciences (Common to all Candidates)

i) **Applied Mechanics :** Law of Mechanics – Lame's theorem – Forces, Moments and Couples – Displacement, velocity and Acceleration – Friction – Moment of Inertia.

ii) **Mechanical Engineering :** Laws of thermodynamics – Open and closed systems – Equation of state – Heat and Work.

iii) **Physics :** Sound – Lattices – Ultrasonic flaw detector – X ray radiography – Interference Fringes – Planck's quantum theory – Laser and Fibre Optics.

iv) **Material Science :** Fracture – Magnetic and Dielectric materials – Conductor and Semi conductor materials – Ceramic and Super conductor materials.

v) **Civil Engineering :** Fluid Statics and Dynamics – Boundary Layer – Pumps and Turbines – Environmental Pollution.

vi**) Electrical Engineering :** Ohm's law – Kirchoff's law – A.C. circuits – D.C. machines – Transformers – Synchronous machines – Instrumentation.

vii**) Computers :** Computer organisation – Architecture – Arrays – Pointers – User defined function – C program.

viii) **Chemistry :** Adsorption – Chromatography – Chemical kinetics – Electrochemistry – Spectroscopy – Fuels and Combustion.

3. Mechanical, Automobile & Aeronautical Engineering

i) Mechanics : Statics of Particles, Equilibrium of Rigid Bodies, Properties of Surfaces and Solids, Dynamics of Particles, Friction and Elements of Rigid Body
Dynamics – Basics of Mechanisms, Kinematics of Linkage Mechanisms, Kinematics of Cam Mechanisms, Gears and Gear Trains, Friction, Force Analysis, Balancing and Vibration.

ii) Strength of Materials and Design : Stress, Strain and Deformation of Solids, Transverse Loading on Beams and Stresses in Beams, Deflection of Beams, Energy Principles, Thin cylinders and spherical resells Torsion – Fundamentals of Design for Strength and Stiffness of Machine Members, Design of Shafts and Couplings, Design of Fasteners and Welded Joints, Design of Springs and Engine Parts, Design of Engine parts, Bearings and Flywheels, Design of Transmission Systems for Flexible Elements, Spur Gears and Parallel Axis Helical Gears, Bevel, Worm Gears and Crossed Helical Gears, Design of Gear Boxes, Design of Cam, Clutches and Brakes.

iii) Material Science and Metallurgy : Constitution of Alloys and Phase Diagrams, Heat Treatment, Ferrous and Non ferrous Metals, Non Metallic Materials, Mechanical Properties and Testing, Crystal Defects and Strengthening of Materials Conducting and Semiconducting Materials, Magnetic and Dielectric Materials, Nuclear Physics, Superconducting and New Engineering Materials.

iv) Thermodynamics : Basic Concepts and First Law, Second Law, Entropy and Availability, Properties of Steam, Psychrometry, Ideal and Real Gases and Thermodynamic Relations, Fuels and Combustion, – Gas Power Cycles, Stream Turbines, Internal Combustion Engines, Internal Combustion Engines Testing and Performance, Gas Turbines, – Steam Nozzle, Air Compressor, Refrigeration and Air Conditioning, Boilers, Cogeneration and Waste Heat
Recovery.

v) Heat Transfer : Conduction, Phase Change Heat Transfer and Heat Exchangers, Radiation, Mass Transfer Refrigeration Cycle, Refrigerants, System Components and Balancing, Psychrometry, Air Conditioning Systems, Unconventional Refrigeration Cycles.

vi) Production Technology : Foundry Technology, Hot & Cold Working, Forging, Advances in Forming Process, Principles and Applications of Joining Processes, Theory of Metal Cutting, Centre Lathe and special Purpose Lathes, Reciprocating Machines, Milling Machines and Gear Cutting, Abrasive Process, Broaching, CNC Machine Tools and Part Programming.

vii) Automotive Engines : Engine Construction and Operation, SI Engine Fuel System, Cooling and Lubrication System, Combustion and Combustion Chambers, Two Stroke Engines, Diesel Engine Basic Theory, Fuel Injection System, Air Motion, Combustion and Combustion Chambers, Supercharging and Turbo charging, Diesel Engine Testing and Performance.

viii) Automotive Transmission and Pollution : Clutch and Gear Box, Hydrodynamic Drive, Planetary Gear Boxes, Automatic Transmission Applications, Hydrostatic and Electric Drive – S.I. Engine Combustion and Emissions, CI Engine Combustion and Emissions, Control

Techniques for Reduction of SI and CI Engine Emission, Test Procedure & Instrumentation for Emission Measurement and Emission Standards.

ix) Aerodynamics : Basic Fluid Mechanics, Two Dimensional In viscid Incompressible Flow, Airfoil Theory, Subsonic Wing Theory, Laminar and Turbulent Flow, Fundamental Aspects of Compressible Flow, Shock and Expansion Waves, Two Dimensional compressible Flow, High Speed Flow Over Airfoils, Wings and Airplane Configuration.

x) Aerospace Propulsion: Fundamentals of Gas Turbine Engines, Subsonic and Supersonic Inlets for Jet Engines, Centrifugal and Axial Flow Compressors, Combustion Chambers for Jet Engines, Turbines for Jet Engines, Nozzles for Jet Engines, Ramjet Propulsion, Hypersonic Air breathing Propulsion, Chemical Rocket Propulsion, Advanced Propulsion Techniques.

TAUTWELL LEARNING SOLUTIONS INDIA PVT. LTD.

Office 116/82, Velachery Road, Little mount, Chennai - 600 015.

Mobile : + 91 87540 80336

E-mail : info@tautwell.com
www.tautwell.com