

General Engineering Science I

The candidate will know:

Mathematics

Fractions and Ratios
The Rules of Algebra
Graphs
Trigonometry
Geometry and Mensuration

Mechanics

Kinematics
Dynamics
Statics
Friction
Machines
Strength of Materials

The candidate will be able to:

Mathematics

Fractions and Ratios

Convert vulgar to decimal fractions to a specified number of places.

Add, subtract, multiply and divide vulgar and decimal fractions.

Convert vulgar and decimal fractions to percentages.

Solve problems on ratio, proportion and percentage.

The Rules of Algebra

Solve problems related to addition, subtraction and product of positive and negative numbers.

Solve problems related to addition, subtraction and product of indices, including fractional indices.

Solve problems involving quadratic function divided by linear factor

Graphs

Form linear equations consistent with data provided.

Plot ordered pairs on graph paper, either given or calculated and join the points with an appropriate curve.

Interpret the equation for a straight-line graph, identifying the intercept and gradient.

Trigonometry

Convert degrees to radians and vice-versa.

Solve problems relating to right angle triangles given two facts about the triangle.

Solve problems on similar triangles.

Geometry and Mensuration

Solve problems on the area of an annulus of a circle.

Determine the area of a figure using the mid-ordinate rule.

Solve problems relating to the surface area and volume of cylinder, pyramid, cone and sphere.

Determine the mass of an object from its volume and density.

Mechanics

Kinematics

Plot straight line distance time graphs from given data.

Calculate and interpret the gradient of distance time graph as speed.

Plot straight line velocity time graphs from given data.

Calculate and interpret the gradient of velocity time graph as acceleration.

Convert linear to angular velocity and vice versa.

Solve problems relating to distance, time, linear velocity, uniform linear acceleration, angle turned using appropriate diagrams or calculations.

Dynamics

Solve problems involving momentum, force, mass and acceleration.

Convert units of pressure between N/m^2 , Pascals and bar, gauge and absolute and vice versa.

Solve problems involving force, area and pressure.

Draw graphs of force/distance and torque/angle from given data and interpret the area under the graph to Work Done.

Solve problems involving work, energy and power.

Statics

Define equilibrium and the principle of moments

Determine the centroid of a symmetrical lamina.

Solve problems related to levers, shafts. Cantilevers and simply supported beams involving concentrated or uniformly distributed loads.

Differentiate between scalar and vector quantities.

Resolve forces in horizontal and vertical components restricted to the first quadrant.

Solve problems involving two forces meeting at a point.

Solve problems involving the triangle of forces with the aid of Bow's notation.

Friction

Distinguish between static and dynamic friction.

Determine the co-efficient of friction and explain the effect of lubrication.

Solve problems relating to friction in a horizontal plane.

Machines

Describe, with the aid of a sketch, the construction of:

- Differential wheel and axle;
- Weston differential pulley block;
- Screwjack;
- Crabwinch;
- Worm and worm wheel;
- Rope-pulley block system.

Determines the velocity ratio of the above machines.

Solve problems relating to efficiency, mechanical advantage and velocity ratio.

Derives the linear law associated with a machine $E=aW + c$.

Strength of Materials

Solve problems relating to direct stress.

Solve problems relating to direct strain.

Sketch and explain a complete load/extension diagram for low carbon steel.

Compare stress/strain graphs for ductile and brittle materials in terms of ductility, brittleness, hardness, limit of proportionality, elastic limit, yield stress.

Define Factor of Safety and relate it to Ultimate Tensile Stress, Ultimate Compression Stress and Working Stress.

Solve problems relating to Factor of Safety, stress and strain.

Solve problems relating to shear.