

(d) Trigonometry.

(i) Plane.

Measurement of angles, circular measure and its applications. Solution of plane triangles.

Graphs of trigonometrical functions.

Formulae for trigonometrical ratios of sum and difference of two angles.

Trigonometrical functions of $A/2$ given those of A . Haversines.

Transformation of formulae for logarithmic calculation.

For small angles, $\sin x = x \sin 1''$. Construction of tables.

(ii) Spherical.

General ideas on the sphere and spherical triangles.

The fundamental formulae for the solution of a spherical triangle.

i.e., $\cos a = \cos b \cos c + \sin b \sin c \cos A$ and

$$\frac{\sin a}{\sin A} = \frac{\sin b}{\sin B} = \frac{\sin c}{\sin C}.$$

Conversion for logarithmic computation by the use of the haversines—*i.e.*, $\text{hav } a = \text{hav } (b \sim c) + \frac{\sin b \sin c \text{ hav } A}{\sin A}$, and $\text{hav } A = \text{cosec } b \text{ cosec } c \sqrt{\text{hav } (a - b \sim c) \text{ hav } (a + b \sim c)}$. Solution of right-angled spherical triangles and quadrantal triangles.

64. Paper 2.

GENERAL SCIENCE. (3 hours.)

(a) Mechanics.

(i) Velocity; acceleration; uniform motion in a straight line. Composition and resolution of velocities and accelerations. Relative velocity. Currents and apparent wind. The laws of motion. Mass. Force. Weight. Inertia. Momentum. Relation between force, time, and momentum; relation between force, mass, and acceleration. Conservation of momentum. Motion under gravitational forces. Work. Energy—Kinetic and potential. Conservation of energy. Rate of doing work. Horse-power. Use of fly-wheels. Uniform circular motion. Angular velocity. Simple harmonic motion. Pendulums. Connecting rods and cranks.

(ii) Force and its graphical representation. Composition and resolution of forces. Parallel forces. Equilibrium of a rigid body in two dimensions.

Centre of gravity.

Theorem of moments. Couples. Bending moments and shearing forces. Work done by a force. Graphical representation. Transmission of work. Friction and its laws. Simple machines—Levers, inclined plane, wheel and axle, capstan. Pulleys—simple and differential.

(b) Hydrostatics.

Pressure of fluids. Principle of Archimedes. Density and Specific Gravity. Hydrometers. Displacement of a ship. Laws of equilibrium of floating bodies. Buoyancy. Centre of buoyancy. Centres of pressure. Hydraulic machines—presses and pumps.

Gases—Boyle's Law. Atmospheric pressure. Barometer. Sounding tubes. Pressure gauges and manometers.

(c) Heat.

Temperature and its measurement. Expansion of solids, liquids, and gases. Applications. Maximum density of water. Specific heat. Change of state—fusion and solidification. Latent heat. Vaporization and condensation. Hygrometry. Conduction, convection, and radiation of heat.

(d) Light.

Shadows and eclipses. Reflection—plane, mirrors. Refraction. Prisms and lenses. Telescopes. Sextant and errors. Other optical instruments used at sea.

(e) Sound.

Production and propagation of sound. Transmission and velocity. Reflection and refraction of sound. Effects of temperature and wind on transmission of sound waves.