IAMI Science A & B Syllabus

IAMI Science A

1. Mechanics

The candidate will know:

- The relationship of linear and angular velocity, distance and acceleration.
- The effect of forces and torques on motion and lifting machines.
- Forces in equilibrium.
- The Conservation of Energy theory and momentum.
- The relationship between mass, volume and density.
- Static and dynamic friction.
- The effects of tensile, compressive and shear forces.
- The relationship between stress and strain.
- The mechanical properties of materials.
- Factor of safety.

The candidate will be able to:

- Solve problems relating to linear and angular distance, velocity and acceleration.
- Solve problems relating to work, power, energy and efficiency.
- Solve problems relating to lifting machines using mechanical advantage and velocity ratio.
- Solve problems relating to force, inertia and momentum.
- Solve problems relating to forces in equilibrium by graphical or analytical means.
- Solve problems relating to simply supported beams involving vertical forces and uniformly distributed loads.
- State and apply the conservation of energy theory.
- Solve problems relating to density of solids.
- Describe the relationship between density and specific gravity.
- Solve problems relating to static and dynamic friction.
- Describe the effect of friction on and between materials.
- Describe the effects of forces acting on a material.
- Explain tensile, compressive and shear forces.
- Explain the tensile test for an elastic material.
- Explain ductility, brittleness, toughness, hardness, elasticity, plasticity, malleability.
- Explain working stress and factor of safety.
- Solve problems relating to stress and strain, safe working load and factor of safety.

2. Naval Architecture

The candidate will know:

- The relationship between centre of gravity and centre of buoyancy and the significance of the relative position of these points.
- The changes to the vessel's condition when weights are added, removed and moved.

The candidate will be able to:

- Explain the relationship between centre of gravity and centre of buoyancy and the significance of the relative position of these points.
- Solve problems involving simple ship shapes to establish changes relating to the changes in vessel condition when weights are added, removed or moved within the ship.
- Apply the formula $GM = \dfrac{md}{\Delta \tan \theta}$

IAMI Science B

1. Thermodynamics

The candidate will know:

- The heat required to change the temperature of solids, liquids and gases.
- The transfer of heat through solids, liquids and gases.
- The dimensional effects on liquids and solids of changes in temperature.
- The change of state of water as it is heated and the relationship between temperature and heat.
- The use of steam tables to determine the state of water and steam.
- The application of the gas laws.
- The application of the steady flow energy equation.
- The relevance of the calorific values of fuels.
- The combustion process and the effects of excess and insufficient air supply.
- The use of indicator diagrams to determine the power of an engine.
- The heat balance of an internal combustion engine.
- The basic refrigeration cycle and the components within a refrigeration plant.

The candidate will be able to:

- Solve problems on the transfer of heat and Specific Heat Capacity.
- Differentiate between heat and temperature.
- Describe heat transfer between different media and methods of improving and/or reducing heat transfer.
- Describe the affect to dimensions of change of temperature on different media.
- Solve problems on thermal expansion and contraction.
- Describe the change of state of water as heat is added or removed.
- Solve problems on the state of water and steam using steam tables.
- Solve problems involving the gas laws.
- Solve problems involving the steady flow energy equation.
- Describe the combustion of hydrocarbon fuels.
- Solve problems on combustion of fuels containing hydrogen, carbon and sulphur.
- Explain higher and lower calorific values.
- Describe the effects on combustion of excess air and inadequate air
- Solve problems involving indicator diagrams to determine the power of an engine.
- Solve problems to determine the energy balance of an engine involving: Indicated Power; Brake Power; Friction Power; Brake Thermal Efficiency; Friction losses; Cooling Water losses; Exhaust losses.
- Describe the basic refrigeration cycle, indicating the condition of the refrigerant at key points.
- Describe the components of the refrigeration system, explaining the change of state that occurs within the components.

2. Hydrostatics

The candidate will know:

- The thrust on horizontal and vertical immersed surfaces.
- Determine that pressure increases with depth and the pressure acting at a specified depth.
- The relationship between the centre of pressure and the centroid of an immersed surface.
- The reaction at surface supports of immersed and partially immersed surfaces.
- The principles of Archimedes.
- The application of the Principles of Archimedes to floating rectangular shaped vessels.

The candidate will be able to:

- Solve problems to determine thrust on horizontal and vertical immersed surfaces.
- Solve problems involving the use of formula ρgh to establish pressure at a specified depth.
- Describe centre of pressure and the centroid of an immersed surface, explaining how they differ.
- Solve problems involving the use of centre of pressure and centroid of immersed and partially immersed surfaces and the reaction at flat surface supports.
- Explain the principles of Archimedes.
- Solve problems applying the Principles of Archimedes to floating rectangular shaped vessels.

3. Electricity

The candidate will know:

- DC circuits with resistances in parallel and series.
- Power and energy in DC circuits.
- AC circuits comprising resistance capacitance and inductance, voltage and current magnification factor.
- True power, apparent power and power factor.

The candidate will be able to:

- Solve problems involving DC circuits with resistances in parallel and series.
- Solve problems involving power and energy in DC circuits.
- Solve problems involving AC circuit comprising resistance capacitance and inductance, voltage and current magnification factor.
Solve problems involving true power, apparent power and power factor.