SOPEEC
STANDARDIZATION OF POWER ENGINEER EXAMINIATIONS COMMITTEE

Sample Questions
SECOND CLASS PARTS A1, A2, AND A3

(NOTE: these questions are intended as representations of the style of questions that may appear on examinations, they are not intended as study material and, as such, may not be in line with any current examination syllabus)

1.   A body having an initial velocity of 'u' m/s is given a uniform acceleration of 'a' m/s/s and after 6.4 and 9.6 s from that instant it is found to have moved through distances of 29.2 m and 47.7 m respectively.

Find the value of 'u' and 'a'.

2.   The minimum safe load which a piece of string can carry is 15 kg. The string is used to swing a mass of 1.5 kg in a horizontal circle at a radius of 0.5 m.

Calculate the maximum speed in rpm of the mass without the string breaking.

3.   The rim of a cast iron flywheel is 0.5 m wide and its inner and outer diameters are 1.8 m and 2.6 m respectively.

Calculate the:
(a)   the moment of inertia Ic of the rim about its geometric axis;

(b)   the radius of gyration k.

4.   A torque of 11.3 kNm is applied to a solid shaft 125mm diameter and 1.8 m long and the angle of twist is one degree.

Calculate the:
(a)   modulus of rigidity;

(b)   stress in the shaft;

(c)   work done to twist the shaft.

5. Determine the mass of wire having a relative density of 8.77 which must be wrapped around a cork weighing 15 g in order that the cork shall just sink in fresh water.

6. A venturi has an inlet of 120 mm and a throat diameter of 60 mm. If 1,750 litres of water pass through the inlet every minute,

   Calculate the difference of head, in metres, between the inlet and the throat.

7. (a) What wall thickness of water tube strength welded to a drum in an area absorbing heat will be required to contain a maximum working pressure of 2,800 kPa if the tube is manufactured from SA-178-A material with an outside diameter of 89 mm and the design temperature is not to exceed 350 °C ?

   (b) What wall thickness will be required if the tube is rolled?

   (c) When expanded into the drum of a boiler, what is the maximum allowable pressure on a seamless steel tube of SA-210, A-1 material, 63.5 mm OD, 4.77mm wall thickness?

8. A boiler takes fuel oil of specific gravity 0.81 and calorific value 27,912 kJ/kg from a tank 6.0 metres diameter. At the time of maximum firing the level of fuel oil in the tank is lowered 51 mm in one hour and the absolute boiler pressure is 1,620 kPa.

   What does the ASME Code require the minimum nozzle throat area for the throat area for the safety valve on this boiler to be, when the average coefficient of discharge is 0.85.

9. (a) Explain what is meant by the term "Demineralization" as applied to water conditioning.

   (b) Make a simple line sketch of the equipment required for any system of demineralization and silica removal, and clearly explain the process you have sketched.

10. With the aid of a sketch describe the:

    (a) principle of operation of a pH meter;

    (b) procedure for a test using a pH meter.