



Sample Questions

REVISED SECOND CLASS PARTS B1, B2, AND B3

(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) If a large power generating station is operating with steam at 16,000 kPa and 500 and exhausting to a condenser at, 37.6 mm mercury absolute;

Determine the Carnot efficiency of its cycle.

- (b) Calculate the ideal standard air cycle efficiency for a gas engine with a cylinder bore of 50 mm, a stroke of 75 mm and a clearance volume of 21.3.

ASSUME the specific heat of air at constant pressure to be 1.005 kJ/kg, the specific heat of air at constant volume to be 0.7118 kJ/kg.

2. (a) Sketch a sectional view of an induced-draft cooling-tower showing water and air distribution, and name the materials of construction.

- (b) Explain the principle upon which cooling-towers operate.

3. A group of nozzles in a turbine is required to expand 10.2 kg steam per second from 500 kPa at 250 to 100 kPa. If the isentropic efficiency is 0.925;

Determine the:

- (a) velocity of the steam
(b) total exit area of the nozzles

4. (a) State five (5) different advantages that gas turbines have over other prime movers.

- (b) Give a description of the starting procedure you would adopt for a typical gas-turbine driven, alternating-current generator set.



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5. (a) With the aid of simple line sketches briefly describe the following types of compressed air systems:
- central air system
 - unit air system.
- (b) State four (4) advantages of each of the systems in (a).
- (c) Name six (6) typical compressor safety devices and state the function of each device.
6. An air compressor requires 11.5 kW to deliver air at the rate of 2.3 kg/min. The compressor is cooled by water whose specific enthalpy rise during the process is not to exceed 35 kJ/kg. Assuming that the kinetic energy of the air is negligible and that the heat energy loss to the atmosphere is negligible;
- Calculate the flow of cooling water in kg/h required.
- At inlet, the Pressure is 100 kPa, the specific volume is 0.92/kg and the specific internal energy is 237 kJ/kg. At outlet, the Pressure is 750 kPa, the specific volume is 0.185/kg and the specific internal energy is 437 kJ/kg.
7. Explain how the following factors influence the volumetric efficiency of a reciprocating refrigeration compressor:
- compressor clearance;
 - variation of suction and discharge pressures;
 - iredrawing;
 - ylinder heating;
 - valve and piston leakage.



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8. (a) In air conditioning, what would you look for and what would you do if:
- (i) Cooling was insufficient in spaces when refrigeration equipment seemed to be working correctly?
 - (ii) There were bad odours in the conditioned air?
 - (iii) The humidity is too low?
- (b) Explain how brine coils and direct expansion coils in ammonia refrigeration systems are defrosted.
- (c) Discuss the considerations which govern the selection of the following ammonia refrigeration compression systems for cold storage use:
- (i) Direct Expansion;
 - (ii) Brine cooling (indirect expansion).
9. (a) Explain how electrostatic charges are generated.
- (b) Describe what steps you would take to lower the potential hazards due to electrostatic charges in an industrial plant.
10. (a) State five (5) reasons whereby a d.c. generator may fail to build up its voltage.
- (b) Describe how you would remedy the faults you have described in (a)



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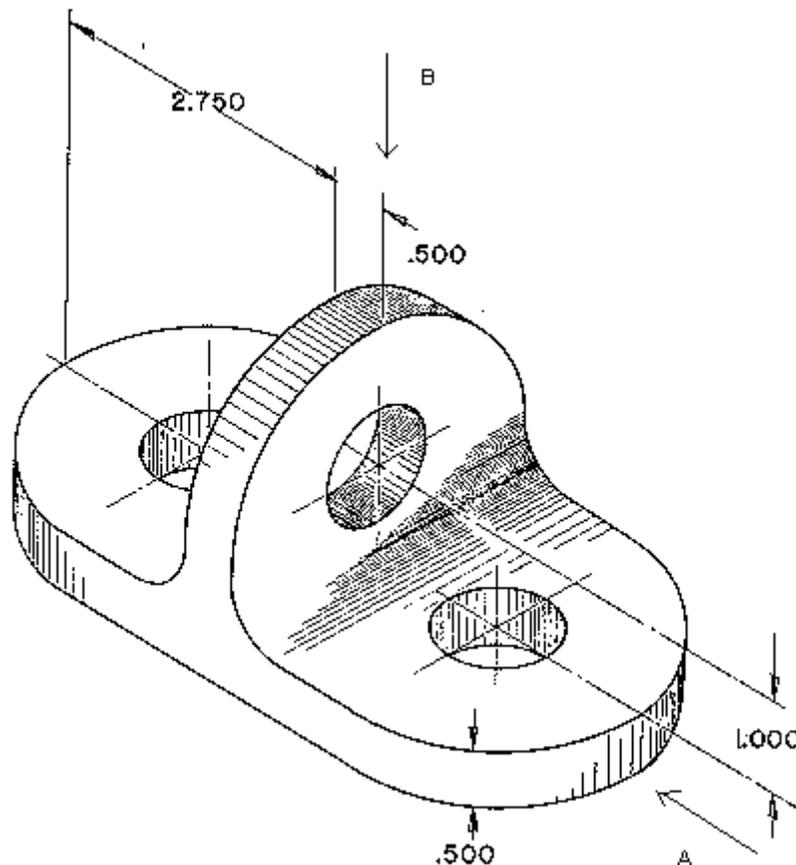
11. THIS QUESTION MUST BE ATTEMPTED AND COMPLETED ON 11 X 17 PAPER PROVIDED BY INVIGILATOR.

A steel bracket is shown below.

Draw:

- (a) a side elevation from "A" (10 marks)
- (b) a plan view from "B" (10 marks)

Note: All dimensions are in cm and must be shown and all holes are 0.75cm in diameter. Draw at 5 times actual scale.





12. Three loads each having an impedance of 17.2 ohms and a reactance of 10 ohms are star connected across a 220 volt three phase supply.
- Calculate the following:
- (a) resistance per phase;
 - (b) current per phase;
 - (c) three phase kVa;
 - (d) power factor.
13. (a) Describe how you would change the speed of a squirrel-cage induction motor whose frequency of supply has been fixed.
- (b) Describe how the slip in an induction motor is accomplished.
- (c) The rotor speed of a 6 pole 60 cycle induction motor is 1,150 rpm. Calculate the percentage slippage of the motor.
14. Describe the properties, and give the approximate composition of the following metals, listing two engineering uses for which each metal is particularly suited:
- (a) wrought iron;
 - (b) low carbon steel;
 - (c) cast steel;
 - (d) cast iron;
 - (e) brass.



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15. (a) Explain the significance of the following when you examine a Pressure Welder's Qualification card before permitting him to proceed with welding repairs to a pressure vessel:
- (i) date of last test;
 - (ii) welding process;
 - (iii) material group;
 - (iv) maximum thickness;
 - (v) filler metal;
 - (vi) welding positions.
- (b) Explain the object of pre-heat and post-heat procedures in welding.
16. Define the following as they apply to lubrication:
- (a) tallow oil;
 - (b) rapeseed oil;
 - (c) castor oil
 - (d) sperm oil;
 - (e) menhaden oil;
 - (f) seal oil;
 - (g) whale oil;
 - (h) degreas;
 - (i) mica;
 - (j) molybdenum disulfide.