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DIPLOMA IN MECHANICAL ENGINEERING
(DME) ADVANCED LEVEL CERTIFICATE
COURSE IN MECHANICAL ENGINEERING
(DMEVI/ACMEVI)

Term-End Examination

December, 2013

BME-032 : REFRIGERATION AND
AIR-CONDITIONING

Time : 2 hours

Maximum Marks : 70

Note : All questions are compulsory. All questions carry equal marks. Use of scientific calculator is permitted.

1. Choose the correct answer from the given four alternatives. 7x2=14
- (a) The refrigerant used for absorption refrigerators working on heat from solar collectors is a mixture of water and :
- (i) carbon dioxide
 - (ii) sulphur dioxide
 - (iii) lithium bromide
 - (iv) freon - 12
- (b) For large tonnage (more than 200 tons) air - conditioning applications, which one of the following types of compressor is recommended ?
- (i) Reciprocating
 - (ii) Rotating
 - (iii) Centrifugal
 - (iv) Screw

(c) In an ideal refrigeration (reversed carnot) cycle, the condenser and evaporator temperatures are 27°C and -13°C respectively. The COP of the cycle would be :

- (i) 6.5
- (ii) 7.5
- (iii) 10.5
- (iv) 15.0

(d) Which one of the following statements regarding ammonia absorption system is correct ?

The solubility of ammonia in water is :

- (i) a function of the temperature and pressure of the solution
- (ii) a function of the pressure of the solution irrespective of the temperature
- (iii) a function of the temperature of the solution alone
- (iv) independent of the temperature and pressure of the solution.

(e) Air refrigeration cycle is used in :

- (i) Commercial refrigerators
- (ii) domestic refrigerators
- (iii) gas liquefaction
- (iv) air conditioning

(f) In milk chilling plants, the usual secondary refrigerant is :

- (i) ammonia solution
- (ii) Sodium silicate
- (iii) glycol
- (iv) brine

- (g) In air conditioning design for summer months, the condition inside a factory where heavy work is performed as compared to a factory in which light work is performed should have :
- (i) lower dry bulb temperature and lower relative humidity
 - (ii) lower dry bulb temperature and higher relative humidity
 - (iii) lower dry bulb temperature and same relative humidity
 - (iv) same dry bulb temperature and same relative humidity

2. Answer **any two** of the following : **7x2=14**

- (a) What are the limitations of the Carnot cycle with gas as a refrigerant ?
- (b) A reversed Carnot cycle working between low temperature, T_2 and high temperature T_1 has refrigerating COP of 4,
 - (i) Determine the ratio T_1/T_2 ; and
 - (ii) If this cycle is used as heat pump, determine the COP, and heat delivered to high temperature reservoir.
- (c) An ice plant produces 10 tonnes of ice per day at 0°C , using water at room temperature of 20°C . Estimate the power rating of the compressor motor if the COP of the plant is 2.5, and overall electromechanical efficiency is 0.9.

Take latent heat of freezing of water = 335KJ/Kg .

Specific heat of water = 4.18KJ/Kg .

3. Answer **any two** of the following : **2x7=14**
- (a) With the help of block diagram , briefly explain the vapour compression refrigeration system.
 - (b) Ice is formed at 0°C from water at 20°C . The temperature of the brine is -8°C . Find out the kg of ice formed per KWh. Assume that the refrigeration cycle used is perfect reversed carnot cycle. Take latent heat of ice is 335 KJ/Kg
 - (c) Find the least power of a perfect reversed heat engine that makes 400 kg of ice per hour at -8°C from feed water at 18°C . Assume specific heat of ice as 2.09 KJ/Kg-k and latent heat 334 KJ/Kg
4. Answer **any two** of the following : **2x7=14**
- (a) Enumerate the main parts of the equipment in the air conditioning cycle.
 - (b) Distinguish between primary and secondary refrigerants. Why is there a need for an alternative to CFCs ?
 - (c) What is the range of effective temperatures and RH for which people feel most comfortable ? Describe the methods of air purification and odour control.
5. Answer **any two** of the following : **2x7=14**
- (a) What do you mean by ' dehumidifiers' ? Describe one such dehumidifier.
 - (b) What is the need for defrosting ? How is defrosting achieved in a domestic refrigerator ?
 - (c) Describe a ventilation system in detail. What materials are used for ducts ?
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