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BIME-015

B. Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

December, 2015

BIME-015 : REFRIGERATION AND AIR CONDITIONING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of Steam table, Refrigeration charts, Mollier diagram, Psychrometric chart, and Scientific calculator is permitted. Assume missing data suitably.*

1. (a) Define the COP of a refrigerator. Show that the COP of a heat pump is greater than the COP of a refrigerator by unity.

(b) A cold storage is to be maintained at – 5°C while the surroundings are at 35°C. The heat leakage from the surroundings into the cold storage is estimated to be 29 kW. The actual COP of the refrigeration plant used is one-third that of an ideal plant working between the same temperature. Find the power required (in kW) to drive the plant. 7+7

2. (a) What do you understand by dry and wet compression ? Which is preferred and why ?

(b) What are the effects of CFCs on the environment ? How do they affect the ozone layer ? 7+7

3. (a) A vapour compression refrigeration system uses R-12 and operates between pressure limits of 0·745 MPa and 0·15 MPa. The vapour entering the compressor has a temperature of $-10°C$ and the liquid leaving the condenser is at 28°C. A refrigerating load of 2 kW is required. Determine the COP and the swept volume of the compressor, if it has a volumetric efficiency of 76% and runs at 600 rpm.

(b) Determine the ideal COP of a vapour absorption refrigerating system in which the heating, cooling and refrigeration take place at 197°C, 17°C and $-3°C$ respectively. 7+7

4. (a) What is an absorption refrigeration cycle ? How does it differ from a vapour compression cycle ?

(b) Atmospheric air at 1·0132 bar has a dbt of 32°C and a wbt of 26°C.

Compute

(i) the partial pressure of water vapour,

(ii) the specific humidity,

(iii) the dew temperature, and

(iv) the relative humidity. 7+7

5. (a) What is specific humidity ? Define dew point temperature.

(b) What are the various factors that should be taken into consideration while selecting a system of air-conditioning ? 7+7

6. (a) Describe briefly the working principle of a window type air-conditioner.

(b) Describe the working principle of Advanced Vapour Compression System. How does it differ from Simple Vapour Compression System ? 7+7

7. (a) An air refrigeration system operating on Bell Coleman Cycle, takes in air from a cold room at 268 K and compresses it from 1·0 bar to 5·5 bar. The index of compression is 1·25. The compressed air is cooled to 300 K. The ambient temperature is 20°C. Air expands in an expander where the index of expansion is 1·35.

Calculate the

(i) COP of the system,

(ii) quantity of air circulated per minute for production of 1500 kg of ice per day at 0°C from water at 20°C, and

(iii) capacity of the plant in terms of kJ/sec.

Take

C_p = 4·18 kJ/kg K for water,

C_p = 1·005 kJ/kg K for air,

Latent heat of ice = 335 kJ/kg.

(b) 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. 7+7

8. Write short notes any ***four*** of the following : $4 \times 3\frac{1}{2} = 14$

(a) Bypass Factor

(b) Industrial Air-Conditioning

(c) Electrolux Refrigerator

(d) Cascade System

(e) Heat Pump

(f) Filters in Air-Conditioning System