

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VII • EXAMINATION – WINTER • 2014

Subject Code: X 71901**Date: 28-11-2014****Subject Name: Refrigeration and Air Conditioning****Time: 10:30 am - 01:00 pm****Total Marks: 70****Instructions:**

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks. Use of p-h chart and steam tables is permitted.**

- Q.1** (a) A 2-stage vapour compression refrigeration system using R-12 produces 25TR while working between -30°C and 40°C . Pressure in the flash intercooler is the geometric mean of upper and lower pressure. Calculate power required to run the system and COP assuming perfect inter cooling. **07**
- (b) Multi staging in vapour compression refrigeration system is desirable to produce lower temperature-Explain. **07**
- Q.2** (a) A refrigeration system working on Bell-Coleman cycles operates between the pressure limits of 1.05 bar and 8.5 bar. The expansion and compression follows the polytropic processes. The air is drawn from the cold chamber at 283K, compressed and cooled to 303K before entering the expansion cylinder. Determine COP of the system. Assume $n=1.3$, $C_p=1.003 \text{ kJ/kg K}$, $\gamma=1.4$ **07**
- (b) Draw a schematic diagram with three evaporators operating at different temperatures, single compressor and multiple expansion valve arrangement. Develop an expression for power required to run the system and COP. State the drawback of this arrangement. **07**
- OR**
- (b) (i) Draw a neat named schematic of Automatic expansion valve. Explain how it responds to increase in load. **03**
- (ii) Refrigeration system using capillary as an expansion device needs motor of low starting torque-Justify. **02**
- (iii) Drier cum filter is put in the liquid line of vapour compression refrigeration system-Justify. **02**
- Q.3** (a) Draw a schematic of steam-jet refrigeration system. Mention therein the appropriate value of temperature in the flash chamber and in the condenser. State the purpose of makeup water supplied. Write any two applications and any two disadvantages of the system. **07**
- (b) Draw a neat named schematic of Lithium Bromide-Water vapour absorption refrigeration system. Explain its working. Why are analyzer and rectifier not required in this system? **07**
- OR**
- Q.3** (a) Justify the following with reference to the properties of refrigerants.
- (i) Critical temperature should be as high as possible. **02**
- (ii) Specific heat of liquid should be as small as possible and of vapour should be as high as possible. **03**
- (iii) Enthalpy of vaporization and conductivity should be as large as possible, **02**
- (b) Discuss in brief about different methods of food preservation. **07**

- Q.4 (a)** A mixture of dry air and water vapour is at a temperature of 21°C under a total pressure of 730 mm of Hg. Dew point temperature is 15°C. Find (i) partial pressure of water vapour. (ii) relative humidity (iii) specific humidity (iv) enthalpy of air/kg of dry air (v) specific volume of air/kg of dry air. **07**
- (b)** 30 m³/min of a stream of moist air at 15°C dbt and 13°C wbt are mixed with 12 m³/min of a second stream at 25°C dbt and 18°C wbt. Barometer pressure is of one standard atmosphere. Determine the dbt and wbt of the resulting mixture. **07**
- OR**
- Q.4 (a)** Air at 10°C dbt, 90%RH is to be heated and humidified to 35°C dbt, 22.5 wbt. Air is preheated sensibly before passing to the air washer in which water is recirculated. The RH of air coming out of the air washer is 90%. The air is again reheated sensibly to obtain the final desired condition. Find : (i) The temperature to which the air should be preheated. (ii) the total heating required. (iii) the makeup water required in the air washer. (iv) the humidifying efficiency of the air washer. **07**
- (b)** (i) Enlist the requirements of a good air distribution system. **03**
(ii) Explain the terms: throw, drop, spread, terminal velocity. **04**
- Q.5 (a)** (i) Draw a schematic of can ice manufacturing plant. Explain the procedure to produce good quality ice. **05**
(ii) Enlist any ten applications of refrigeration. **02**
- (b)** Write short note on Air handling unit. **07**
- OR**
- Q.5 (a)** Write short note on packaged air conditioning system. **07**
(b) Explain the concept of effective temperature. Discuss the factors governing effective temperature. **07**
