

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**ME - SEMESTER- I • EXAMINATION – WINTER 2014**

**Subject Code: 2711003****Date: 12/01/ 2015****Subject Name: Advanced Refrigeration****Time: 02:30 p.m. to 05:00 p.m.****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.

**Figures to the right indicate full marks.**

- Q.1** (a) Describe the graphical method used to obtain the performance characteristics of a condensing unit by matching the characteristics of compressor and condenser. **07**
- (b) Describe using P-h diagram and neat schematic the multiple evaporators VCR cycle with multiple expansion valves and back pressure valves having single compressor. **07**
- Q.2** (a) Aircraft is flying at an altitude of 800 m at a speed of 900 km/hr. The pressure and temperature of air at this altitude are 0.34 bar and 263 K respectively. The air compressed by an air compressor with compression ratio of 5. The cabin pressure is 1.013 bar and temperature is 300 K. Determine the power required for pressurization excluding ram work. Extra power required for refrigeration purpose and refrigeration capacity of the system if the air flow rate is 1 kg/s. Take following data  
efficiency of compressor = 82%, efficiency of expander = 77%  
effectiveness of HE = 0.8, ram efficiency = 84% **07**
- (b) In spite of CFCs being suitable for every specific application from the point of view of their thermodynamic and thermophysical properties these refrigerants are not eco-friendly. Comments on this statement and explain how these refrigerants are being contemplated to be replaced under Montreal Protocol and Kyoto Protocol **07**
- OR**
- (b) Describe with a neat sketch and T-s diagram the Reduced ambient cycle of air refrigeration system. **07**
- Q.3** (a) Explain cascade refrigeration system using neat sketch and P-h diagram. **07**
- (b) In an ammonia system one evaporator is to provide 10 TR of refrigeration at -40°C and another evaporator is to provide 10 TR at -2°C. The system uses two-stage compression with water as well as flash intercooling. The condensing temperature is 40°C. A water intercooler cools the LP vapour to 40°C. The subcooling HEX subcools the liquid refrigerant from 40°C to 5°C before it is fed to main expansion valve. Calculate the power required by the compressors. **07**
- OR**
- Q.3** (a) Describe briefly with neat sketch a cold storage plant **07**
- (b) Why is compound refrigeration system employed when the difference between condenser temperature to evaporator temperature is very large? **07**

- Q.4 (a)** The steam at 7 bar pressure saturated passes to steam ejector water vapour refrigeration system. The temperature of water in flash chamber is 4.5°C. Make up water is supplied at 18°C. The absolute pressure in the condenser is 0.68 bar. The nozzle efficiency 88%, the entrainment efficiency is 65 % and compression efficiency is 92 %. The quality of the motive steam and flashed vapour mixed together at the beginning of compression is 92 % dry. Determine **07**
- (i) Mass of motive steam required per kg of flashed vapour  
(ii) Refrigeration effect per kg of flashed vapour.
- (b)** Explain briefly the following methods of food freezing **07**  
slow freezing and quick freezing
- OR**
- Q.4 (a)** Explain the various methods of transport refrigeration **07**  
**(b)** Draw the T-s and h-s diagrams for a steam jet refrigeration system and write expressions for the nozzle efficiency, the entrainment efficiency and compression efficiency. **07**
- Q.5 (a)** In an aqua ammonia absorption system, the highest and lowest pressures are 16 bar and 3 bar respectively. The concentration of strong solution is 0.4 and degassing range is 0.1. With suitable assumption, find for 10 TR machine the COP of the system. **07**
- (b)** What are the characteristics of good lubricant? Also explain various Lubrication methods. **07**
- OR**
- Q.5 (a)** State the functions of the following components in an absorber system **07**  
absorber, rectifier, analyzer, heat exchangers  
**(b)** Explain the use of ñheat pumpò for heating and cooling cycle with neat diagram **07**

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