Roll No. ☐☐☐☐☐☐☐☐☐☐☐          Total No. of Pages : 02

Total No. of Questions : 09

**B.Tech.(Marine Engineering) (2013 Batch)      (Sem.–7)**
# REFRIGERATION AND AIR CONDITIONING
**Subject Code : BTME-804**
**M.Code : 74248**

Time : 3 Hrs.                                   Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

## SECTION-A

Q.1   **Answer briefly :**

a) Define 1 ton of refrigeration.

b) Differentiate between a refrigerator and a heat pump.

c) How does sub-cooling of refrigerant affect performance of refrigeration system?

d) Enumerate the characteristic features of absorber and absorbent in vapour absorption refrigeration systems.

e) Enumerate the desirable thermodynamic properties of refrigerants used in refrigeration systems.

f) Explain the effect of moisture on refrigeration system performance.

g) Enumerate four types of condensers deployed in refrigeration and air conditioning systems.

h) Explain the working principle of steam jet refrigeration system.

i) Define sensible heat factor.

j) What is the function of ducts used in air conditioning systems?

## SECTION-B

**Q2.** A high altitude flight aircraft is flying at an altitude of 13500 m with a speed of 1.2 Mach. The ambient atmospheric pressure and temperature are 0.1 bar and - 40 °C. The cabin is pressurized to 0.75 bar and has to be maintained at 25 °C. The main compressor pressure ratio is 5 and air enters the cooling turbine at 40°C. The exit from the cooling turbine is at 0.75 bar. The cockpit cooling load is 10 TR. Assume the isentropic efficiency of compressor as 85% and that of cooling turbine as 75%. Ram efficiency is 90%. Determine: mass flow rate of air required, ram air heat exchanger effectiveness, COP of the system, work required, power for pressurization and refrigeration.

**Q3.** Write short note on leak detection and charging of refrigerants in refrigeration systems.

**Q4.** Describe the construction and working of Vortex tube refrigeration system giving a neat sketch.

**Q5.** Give a brief account of environmental effects of conventional refrigerant.

**Q6.** Moist air at standard atmospheric pressure is passed over a cooling coil. The inlet state of the air is 30° C DBT, 50% R.H. while the exit state is 15° C DBT and 80% R.H. Show the process on the psychometric chart and determine amount of moisture and heat removed per kg of dry air.

## SECTION-C

**Q7.** A refrigerant plant using R-12 as refrigerant for producing ice at -5°C from water at 35°C at a rate of 10 tons per day. The evaporator temperature is -15°C while the condenser temperature is 45°C. Assuming simple saturation cycle, determine: RE of the plant, COP, mass flow rate of refrigerant. Determine the dimensions of compressor if its volumetric efficiency is 90% & L/D ratio is 1. Assume compressor speed = 1400 rpm.

**Q8.** A R-12 refrigeration system comprises of three evaporators of capacities 30 ton, 20 ton and 10 ton respectively maintained at the temperatures of –10 °C, 0 °C and 10 °C respectively. The system is provided with multiple expansion valves and back-pressure valves. Condenser pressure is to be maintained at 9.5944 bar. The exit condition from the evaporator is to be dry saturated vapor and liquid is sub-cooled to 30 °C in condenser. Determine : Mass flow rate in each evaporator and total flow rate, power required to drive the system and COP of system.

**Q9.** a) Describe the electrolux vapour absorption refrigeration system giving the constructional details and a neat sketch.

b) Explain the working of split air conditioning systems in Industry giving a neat sketch.

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**