Code No: 136DQ

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, December - 2019
REFRIGERATION AND AIR CONDITIONING
(Mechanical Engineering)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) State different ways of producing refrigeration. [2]
b) Represent ideal vapour compression refrigeration system on T-S and P-h diagrams. [3]
c) In refrigeration system why heat rejected is more than heat absorbed? [2]
d) Define i) Degree of saturation and ii) Coefficient of performance. [3]
e) State the difference between free and forced condenser. [2]
f) Differentiate between primary and secondary refrigerants. [3]
g) State salient features of 3-fluid absorption system. [2]
h) State the function of absorber and rectifier in vapour absorption system. [3]
i) Describe the applications of heat pump. [2]
j) Explain the procedure to construct a RSHF line on a psychometric chart. [3]

PART – B

(50 Marks)

2.a) State different types of refrigeration systems. Explain Bell- Coleman air refrigeration cycle.
b) An air refrigeration open system operating between 100 KPa and 1 MPa is required to produce a cooling effect of 2000 kJ/min. Temperature of the air leaving the cold chamber is -5^0C and at leaving the cooler is 30^0C. Neglect losses and clearance in the compressor and expander. Determine: [5+5]
i) Mass of air circulated per min.
ii) Compressor work, expander work, cycle work.
iii) COP and power in kW required.

OR

3.a) Discuss the advantages of the dense air refrigerating system over an open air refrigeration system.
b) A dense air refrigeration machine operating on Bell-Coleman cycle works between 3.4 bar and 17 bar. The temperature of air after the cooler is 15^0C and after refrigeration is 6^0C, for a refrigeration capacity of 6 tons calculate:
i) Temperature after compression and expansion
ii) Air circulation required in cycle per minute
iii) Work of compression and expansion
iv) Theoretical COP
v) Rate of water circulation required in the cooler in Kg/min if rate of temperature rise is limited to 30^0C. [5+5]

4.a) What is the effect of sub-cooling on the performance of vapour compression refrigeration system?

b) A vapour compression system using R 12 works between -15^{0}C and 35^{0}C as evaporator and condenser temperature respectively. Using P-H chart determine i) COP ii) Mass flow of refrigerant per TR iii) Piston displacement per TR using volumetric efficiency =80% iv) Heat rejected in the e condenser per TR. [5+5]

OR

5.a) Under what circumstances the superheating of vapour before coming to compressor is more objectionable? Give the ways to prevent it.

b) A vapour compression system with ammonia as the refrigerant works between the pressure limits of 2 bar and 12 bar with three stage compression. The vapors leaving the water inter coolers at pressure 4 bar and 8 bar are in a saturated state. If the load is 10 TR, find the power required to drive the three compressors & compare the C.O.P of this system with that of a simple saturation cycle working between the same overall pressure limits. [4+6]

6.a) Explain working principle of evaporative condenser with neat sketch.

b) What are the different types of compressors used in air conditioning practice? Discuss them. [5+5]

OR

7.a) Write short notes on (i) Ozone layer depletion; (ii) Global warming.

b) Explain the working principle of thermostatic expansion valve with the help of a neat diagram. [5+5]

8.a) Explain working of Li-Br vapour absorption refrigeration system with neat sketch.

b) List out the merits and demerits of thermo-electric refrigeration system over other refrigeration system. What are the fields of its applications? [5+5]

OR

9.a) Describe vapour absorption refrigeration system using three fluids.

b) Explain the working principle of vortex tube and explain that the energy exchange phenomenon in vortex tube is not a violation of second law of thermodynamics. [5+5]

10.a) Classify Fan used in air-conditioning system. Explain selection of the Fan using fan characteristic curve.

b) A circular duct of 40cm is selected to carry in air-conditioned space at a velocity of 440 m/min to keep noise level at a desired level. If this duct is to be replace by a rectangular duct of aspect ratio of 1.5 find out size of a rectangular duct for equal friction method when (i) when velocity of air in two duct is same (ii) the discharge rate of air in two duct is same. [5+5]

OR

11.a) Explain the following:
i) Explain the factor affecting human comfort
ii) Flywheel effect of building material

b) Following data is available for an air conditioning system comprising of filter, cooling coil, fan and distribution system using only fresh air for the purpose of maintaining comfort conditions in summer. RSH = 11.63 KW, RLH = 2.33 KW. Outside design condition: 28^{0}C DBT, 20^{0}C WBT. Inside design condition: 21^{0}C DBT, 50% RH. Temperature of air entering the room = 11^{0}C. Calculate (i) RSHF (ii) Coil bypass factor (iii) rate of flow of air kg/hr (iv) Load on cooling coil (v) Coil ADP. [5+5]

---ooOoo---