Registration No : | | | | | | | | | | |

Total Number of Pages : 03 **B.Tech.**
PME6I102

6th Semester Regular Examination 2017-18
REFRIGERATION & AIR CONDITIONING
BRANCH : MECH
Time : 3 Hours
Max Marks : 100
Q.CODE : C227

Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1 **Answer the following questions : multiple type or dash fill up type** **(2 x 10)**

a) Refrigerant used should be such that its normal boiling point is
(i) Greater than the temperature required
(ii) Less than the temperature required
(iii) Equal to the temperature required
(iv) None

b) The wet bulb temperature of air whose relative humidity is 100% is
(i) less than dew point temperature (dpt) (ii) equal to dpt
(iii) greater than dry bulb temperature(dbt) (iv) in between dbt and dpt

c) Ammonia as a refrigerant has _____ volumetric displacement
(i) high (ii) low
(iii) medium (iv) all of above

d) In ice plant_____ refrigerant is commonly used
(i) R11 (ii) R21
(iii) NH_3 (iv) R134a

e) The domestic refrigerator uses following type of compressors
(i) centrifugal (ii) axial
(iii) screw (iv) reciprocating

f) A refrigerator is having COP of 4. T_{max}/T_{min}._____
If the device is used as heat pump, COP of the system is_____

g) 1 kg/s of air at 15°C is flowing through a heating coil having temperature of 40°C for winter air-conditioning system. The outlet temperature of air is 30°C. BPF and Efficiency of the coil are_____ and _____.

h) A mixture of dry air and water vapor is at a temperature of 21C under total pressure of 736mm Hg. The dew point temperature is 15C. P
Pv, RH are _____ and _____

i) In VARS, generator, condenser and evaporator are maintained at 80°C, 40°C and 20°C respectively. Obtain the maximum COP.

j) During the compression process there is _____ in heat content of the refrigerant gas characteristics of _____ gases.
(i) increase, some (ii) decrease, all
(iii) increase, all (iv) decrease, some

Q2 **Answer the following questions : Short answer type :** **(2 x 10)**

a) Define COP and TR.

b) Why is Reversed Carnot cycle not used in actual practice?

c) Draw the P-h and T-s chart for vapor compression system (wet compression).

d) How are the refrigerants numbered?

e) Mention the types of expansion devices used in refrigeration systems.

f) What are secondary refrigerants? Give one example of a secondary refrigerant.

g) Show cooling & humidification and heating & dehumidification process on psychometric chart.

h) Explain various heat loads to be considered for cooling load calculations.

i) Differentiate between absorbents and adsorbents.

j) Define GSHF and RSHF.

Part – B (Answer any four questions)

Q3 **a)** Derive an expression for COP of a Bell-Colemann cycle (Reversed Bryton). Discuss the merits and demerits of open and close Bell-Colemann cycle **(10)**

b) Explain the working of air craft cooling system (any one type) with schematic and T-s diagram **(5)**

Q4 **a)** A Freon 12 vapor compression system operating at a condenser temperature of 40°C and an evaporator temperature of 0°C develops 15 TR. Using p-h chart, determine : **(10)**

(i) The discharge temperature and mass flow rate of the refrigerant circulated

(ii) The theoretical piston displacement of the compressor and piston displacement per TR of refrigeration

(iii) The theoretical horsepower of the compressor and horsepower per TR

(iv) The heat rejected in the condenser

(v) The Carnot COP and actual COP of the cycle.

b) Discuss the effect of the following on the performance of vapor compression system **(5)**

(i) Effect of suction pressure (ii) Effect of delivery pressure

(iii) Effect of superheating (iv) Effect of subcooling

Q5 **a)** A two stage vapor compression refrigeration system with a flash chamber operates with amoonia as refrigerant. The evaporator and condenser temperatures are -30 and 40°C respectively. If the capacity of the plant is 30 TR, estimate the total work of compression and the COP. **(10)**

Had the compression been done in a single stage, what would have been the percentage increase in the work of compression? What is the percentage of increase in COP owing to the staging of the compression process?

b) Describe multistage compression system with inter-cooling with neat sketch and T-s, h-s diagrams **(5)**

Q6 **a)** With neat sketches explain the Aqua-Ammonia vapor absorption system. Mention differences between vapor compression and vapor absorption system **(8)**

b) Explain with neat sketch, the working of Thermoelectric Refrigeration. Define figure of merit. **(7)**

Q7 **a)** A mixture of dry air and water vapor is at a temperature of 21°C under a total pressure of 736 mm Hg. The dew point temperature is 15°C. Find : **(10)**

(i) Partial pressure of water vapor
(ii) Relative humidity
(iii) Degree of saturation
(iv) Specific humidity
(v) Specific enthalpy of moist air
(vi) Specific volume of air per kg of dry air

b) Obtain the relationship between relative humidity and degree of saturation as below **(5)**

$$\phi = \frac{\mu}{1-(1-\mu)\,p_s/p_b}$$

(10)

Q8 **a)** A building has the following calculated cooling loads;
RSH gain:310 kW, RLH gain: 100 kW
The space to be maintained at 25°C DBT and 50% RH.
Out door air is 28°C and 50% RH and 10% by mass of air supplied to the building is outdoor air. If the air supplied to the space is not to be at a temperature lower than 18°C, find :

(i) Minimum amount of air supplied in m^3/s.
(ii) Volume flow rates of return air, exhaust air and outdoor air
(iii) State and volume flow rate of air entering the cooling coil
(iv) Capacity, ADP, BPF and SHF of the cooling coil.

b) Explain a neat diagram, the winter air conditioning system **(5)**

Q9 **a)** Write short notes on Comfort chart and effective temperature **(5)**

b) Explain Actual Vapor Compression System with p-h and T-s chart **(5)**

c) Explain the chemical requirements of refrigerants **(5)**