Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **M.TECH**

HTPC103

1st Semester Back Examination – 2016-17
ADVANCED REFRIGERATION ENGINEERING
BRANCH(S): HEAT POWER ENGINEERING
Time: 3 Hours
Max Marks: 70
Q.CODE:Y862

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: (2 x 10)

a) What is dry ice?
b) Define a tonne of refrigeration
c) Differentiate between Relative humidity and Specific humidity
d) Define Dry bulb and wet bulb temperature. What is the difference between WBT and DBT called?
e) What is the unit of refrigeration?
f) Name different types of systems used for cooling aircraft cabin?
g) Inter-cooling during multi-stage compression is effective with NH_3 as a refrigerant than R-12. Why?
h) Where is low temperature refrigeration system used? Give some examples
i) What do you mean by Triple point?
j) A heat pump working on a reversed Carnot cycle has a COP of 5. It works as a refrigerator taking 1 kW of work input. What will be its Refrigerating effect?

Q2 a) What are the different criteria for selection of a good refrigerant? (5)

b) A Carnot refrigerator operates between 300 K and 72 K. Determine the COP of the refrigerator. Please comment if low temperature source reduces to 10 K, what is the effect on COP of the cycle. Draw T-S diagram for the same. (5)

Q3 a) State the advantages of Vapour Compression Refrigeration system over Air Refrigeration system. (10)

b) A refrigeration system is run by an engine. The actual COP of refrigeration system is 70% of ideal and efficiency of the engine is 50% of ideal. The heat is supplied to the engine at 1000°C & rejected to atmosphere at 30°C. The refrigerator has to maintain the temperature of -10°C. If the load on the refrigerator is 40 Torr, find the heat supplied to the engine. Also find out the overall COP of the system.

Q4 a) Draw reversed carnot cycle on P-V and T-S diagrams and find out the expression for COP of the Cycle. Also, discuss the factors affecting the cycle. (5)

b) Explain the working of Claude liquefaction system with suitable sketch. (5)

Q5 a) Derive an expression for the COP of an Ideal Vapour Absorption RefrigerationSystem. (5)

b) In an absorption type refrigerator, the heat is supplied to NH_3 generator by condensing steam at 2bar and 90% dry. The temperature in the refrigerator is to be maintained at -5°C respectively. Find the maximum COP of the system. If the refrigeration load is 20 tonnes and actual COP is 70% of the maximum COP, find the mass of steam required per hour. Take temperature of the atmosphere as 30°C. (5)

Q6 a) Explain the working of Claude liquefaction system with suitable sketch. (5)

b) Air enters a Claude system at 1atm and 25°C and is compressed to 100atm at 100 atm and 240K, 50% of the main flow is diverted to the expander. The remainder flows through the heat exchangers and expanders through the expansion valve to 1 atm. (5)
Adiabatic efficiency of expander = 80%, Mechanical efficiency of expander = 90%. Overall efficiency of compressor = 75%, Effectiveness of heat exchangers = 98.5%
Determine :
i) Liquid yield,
ii) Expander work output per unit mass compressed,
iii) Figure of merit.

Q7 a) Explain the Joule-Thompson coefficient. What do you mean by inversion temperature? Mention the inversion temperatures of few cryogenic fluids (10)

b) Determine the minimum work required to provide 100 W of refrigeration at 20.4 K if the heat is rejected at (i) 77K and (ii) 300 K.

Q8 Write short notes on any (5 x 2)

a) Thermostatic Expansion valve
b) Liquefaction of Air
c) Vortex -Tubes
d) Superheater
e) Magnetic Refrigeration system
f) Fouling
g) Inter-cooling
h) Economiser