R13

III B. Tech II Semester Supplementary Examinations, November/December - 2016
REFRIGERATION & AIR CONDITIONING
(Mechanical Engineering)

Time: 3 hours   Maximum Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**
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PART-A

1. a) What is refrigeration? Define one ton of refrigeration.   [3M]
   b) Represent ideal vapour compression refrigeration system on T-S and P-h diagrams.   [4M]
   c) Discuss the operation of capillary tube in a refrigeration system.   [3M]
   d) State the function of absorber and rectifier in vapour absorption system.   [4M]
   e) Explain in brief, an adiabatic saturation process. Represent the same on a psychrometric chart.   [4M]
   f) Explain selection of the fan using fan characteristic curve.   [4M]

PART-B

2. a) Explain Boot strap evaporative cooling air refrigeration system. Draw its schematic and represent the processes on T-S diagram. Write down the equations for calculating mass flow rate, power and COP of the system.   [7M]

   b) An air craft moving with speed of 1000 km/h uses simple gas refrigeration cycle for air conditioning. The ambient pressure and temperature are 0.35 bar and $-10^{\circ}C$ respectively. The pressure ratio of compressor is 4.5. The heat exchanger effectiveness is 0.95. The isentropic efficiencies of compressor and expander are 0.8 each. The cabin pressure and temperature are 1.06 bar and $25^{\circ}C$. Determine temperature and pressures at all points of the cycle. Also find the volume flow rate through compressor inlet and expander outlet for 100 TR. Take $C_P=1.005$ kJ/kg K; $R=0.287$ kJ/kg K and $C_P/C_V=1.4$ for air.   [9M]

3. a) Explain the effect of evaporator pressure and condenser pressure on the performance of vapour compression refrigeration system using P-h diagram.   [7M]

   b) A four cylinder, single acting R-12 compressor 30 cm x 40 cm runs at 960 rpm. The compressor clearance factor is 0.03 and the law of compression $pV^{1.1}=C$. the operating pressures for the vapour compression refrigeration system are: 8.47 bar ($35^{\circ}C$) and 1.004 bar ($-30^{\circ}C$). The refrigerant temperatures are: entering the compressor $-20^{\circ}C$, leaving the compressor $50^{\circ}C$; entering the condenser $45^{\circ}C$, leaving the condenser $25^{\circ}C$, entering the expansion valve $30^{\circ}C$ and leaving the evaporator dry saturated. Assuming that heat removed in the compressor is 25 kJ/sec. calculate: [9M]
   i)The refrigerating capacity   ii)The compressor power   iii)COP
   iv)Mass of condensing cooling water assuming the rise in temperature to be $10^{\circ}C$
   v)Also tabulate energy balance for 1 kg of refrigerant.

4. a) Give the comparison between air cooled and water cooled condenser. Explain in detail an evaporative condenser.   [8M]
   b) What is an azeotrope? Give some examples to indicate its importance.   [8M]

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5.a) Explain with a neat sketch, the working of a vortex tube? [8M]

b) State the advantages and disadvantages of Electrolux refrigerator over conventional [8M] refrigerators.

6. a) What is an effective temperature? State and explain the factors which govern optimum [7M] effective temperature?

b) The following data apply to an air conditioning system: [9M]
Room sensible heat =41868 kJ/hr(11.63 kW); room latent heat=41868 kJ/hr(11.63kW); inside design condition= 25^0C, 50% RH, outside design condition=35^0C,DBT, 27.8 WBT. Return air from the room is mixed with the outside air before entering the cooling coil in the ratio of 4:1. Return air from the room is mixed with the cooling air, i.e. after the cooling coil in the ratio of 1:4. Cooling coil by pass factor is 0.1. The air may be reheated if necessary before supplying to the conditioned space. Assume ADP as 10^0C and determine,
i) Supply air conditions into the room
ii) Refrigeration load due to the reheat
iii) Total refrigeration capacity
iv) The quantity of fresh air supplied.

7. a) Explain in detail, the filters used in air conditioning systems? [8M]

b) Explain the use of heat pump for heating and cooling cycle with a neat diagram? [8M]

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