Q.P. Code:16ME8806 **R16**

Reg. No. | | | | | | | | | | |

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR

(AUTONOMOUS)

M.Tech I Year I Semester (R16) Supplementary Examinations June 2017

REFRIGERATION AND AIRCONDITIONING

(THERMAL ENGINEERING)

(For Students admitted in 2016 only)

Time: 3 hours Max. Marks:60

(Answer all Five Units 5 X 12 =60 Marks)

UNIT-I

1 a. What is the effect of suction & condenser temperature on the performance of vapor compression refrigeration system? 5M

b. A two stage compression ammonia refrigeration system operates between overall pressure limits of 14 bar and 2 bar. The temperature of the de super heated vapor and sub cooled liquid refrigerant are limited to 30^0 C. The flash tank separates dry vapor at 5 bar pressure and the liquid refrigerant then expands to 2 bar. Estimate COP of the system and power required to drive the compressor, if the mechanical efficiency of the drive is 80% and the load on the evaporator is 10 TR. 7M

OR

2 a. Discuss the relative merits and demerits of flash and water inter cooler employed in multiple compression? 5M

b. The following data refers to a three stage compression with three stage expansion valve and flash inter cooling. Condenser pressure=12 bar, Evaporator pressure=2 bar, Flash inter cooler pressures= 4bar and 8 bar, Load on the evaporator=10 TR. Find the power required to drive the system and compare the COP of the system with that of simple saturation cycle working between the same temperature limits? 7M

UNIT-II

3 a. With a neat sketch explain the working principle of Electrolux vapor absorption refrigeration system? 5M

b. In an absorption refrigerator, the heat is supplied to ammonia generated by condensing steam at 2 bar and 90% dry. The temperature in the refrigerator is to be maintained at -5^0 C. Find the maximum possible COP. 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 atmosphere temperature as 30^0 C. 7M

OR

4 a. Differentiate simple and actual vapor absorption refrigeration systems? 5M

b. Explain working of Lithium bromide water absorption refrigeration system with a neat sketch? 7M

UNIT-III

5 a. With a neat sketch explain the working principle of a vortex tube refrigeration system? 5M

b. The following data refers to a boot strap air cycle evaporative refrigeration system used for an aero plane to take 20 TR of refrigeration load. Ambient air pressure and temperature are 0.8 bar and 15^0 C, Mach number of the flight =1.2, ram efficiency=90%, pressure of air bled off the main compressor and in the secondary compressor=4 bar and 5 bar, Isentropic efficiency of the main compressor, secondary compressor and cooling turbine=90%, 80% and 80%, Temperature of air leaving the first heat exchanger, second heat exchanger and evaporator=170^0C, 155^0 C and 100^0 C, Cabin temperature and pressure=25^0Cand 1 bar. Determine i) mass of air required to take the cabin load ii) power required for the refrigeration system iii) COP of the system? 7M

OR

6 a. With a neat sketch explain the working principle of a thermo electric refrigeration system? 5M

b. A simple evaporative air refrigeration system is used for an aero plane to take 20 TR load. The ambient air conditions are 20^0 C and 0.9 bar. The ambient air is rammed isentropically to a pressure of 1 bar. The air leaving the main compressor at 3.5 bar is first cooled in the heat exchanger having effectiveness of 0.6 and then in the evaporator where its temperature is reduced by 5^0 C. The air from the evaporator is passed through the cooling turbine and then it is supplied to the cabin which is to be maintained at a temperature of 25^0 C and at a pressure of 1.05 bar. If the internal efficiency of the compressor is 80% and that of the cooling turbine is 75%. Determine i) Mass of air bled off the main compressor ii) power required for the refrigeration system iii) COP of the system. 7M

UNIT-IV

7 a. What is effective temperature and what factors affect it? The latent heat load in an auditorium is 25% of the sensible heat load. Then what is the value of sensible heat factor? 5M

b. Air at 10^0 C and 90% relative humidity is to be heated and humidified to 25^0C and 40% relative humidity by the following three processes.
i).pre heating
ii) adiabatic saturation in a recirculated air washer
iii) reheating to a final state.
Calculate: a) Heating required in two heaters b) make up water required in washer and temperature of washer. Assume effectiveness of washer as 80%. 7M

OR

8 a. State the factors that determine human comfort?The bypass factor of single cooling coil in an air conditioner is 0.7. Then what is the bypass factor value, if three such cooling coils with the same ADP are kept one behind the other? 5M

b. Air at 40^0 C DBT and 15% Relative humidity is passed through the adiabatic humidifier at the rate of 200 m^3/min. The outlet conditions of air are 25^0C DBT and 20^0 C WBT. Find: i) DPT ii) Relative humidity of exit air iii) Amount of water vapour added to the air per minute. 7M

UNIT-V

9 a. Represent Desert air conditioning, summer and winter air conditioning processes on the psychrometric chart? 5M

b. The following data relates to an air-conditioned space in winter season:

Outdoor conditions	10^0C DBT, 8^0C WBT
Indoor conditions	20^0C DBT, 60%RH
Amount of air circulation	0.3 m^3/min/person
Seating capacity of the office	50 persons

The required condition is first achieved by heating and then by adiabatic humidifying.

Find: i) Heating capacity of coil ii) surface temperature iii) capacity of humidifier. If by pass factor of coil is 0.32. 7M

OR

10 a. Distinguish adiabatic dehumidification and adiabatic saturation on psychrometric chart? 5M

b. An A/C auditorium is to be maintained at 27^0 C DBT and 55%RH. The ambient conditions are 39^0 C DBT and 28^0 C WBT. The total sensible heat load is 1,20,000 KJ/hr and the total latent heat load is 45,000 KJ/hr. 60% of the return air is recirculated and mixed with 40% of makeup air after the cooling coil. The condition of air leaving the cooling coil is 17^0 C. Determine: i) RSHF ii) Condition of air entering the auditorium iii) Amount of makeup air iv) ADP v) Bypass factor of cooling coil 7M

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