Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Refrigeration and air conditioning (MHEG 484) **Semester: VII**

Programme: B.Tech Mechanical Engineering

Time: 03 hrs. **Max. Marks: 100**

Instructions: Use of RAC Data book is allowed

SECTION A

S. No.		Marks	CO
1	Explain the term "Tonne of refrigeration".	**4**	**CO1**
2	Derive chemical formula of R114,R123, R11, R22 .	**4**	**CO4**
3	Differentiate between primary and secondary refrigerants.	**4**	**CO4**
4	Define the term bypass factor used for cooling and heating coil and Write the expression for the bypass factor of heating coil.	**4**	**CO6**
5	Define the following a. Dew point temperature b. GSHF c. ERSHF d. Relative humidity	**4**	**CO5**

SECTION B

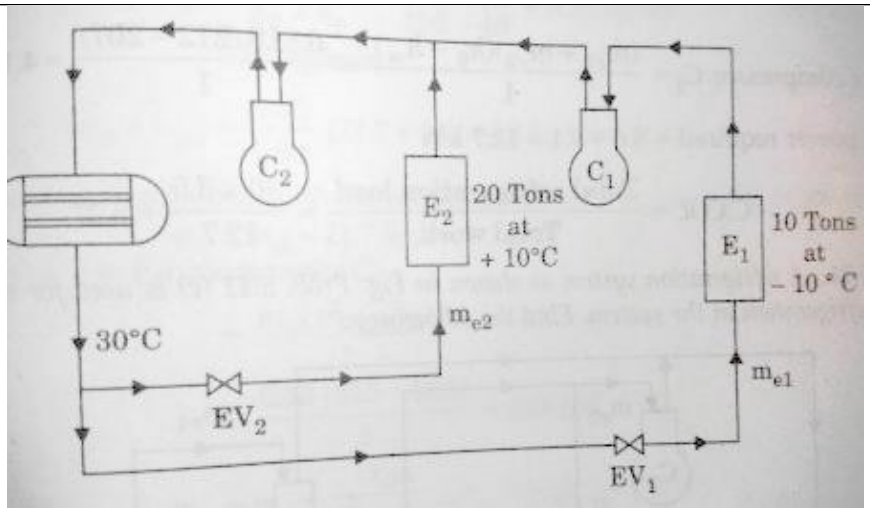
6	In an absorption type refrigerator, the heat is supplied to the ammonia generator by condensing steam at 2 bar and 90% dry .The temperature to be maintained in the refrigerator at -5℃.The temperature of the atmosphere is 30 ℃ .Find the maximum COP possible of the refrigerator .If the refrigeration load is 20 tons and actual COP is 70 % of the maximum COP ,find the mass of steam required per hour. OR With the help of suitable daigramm explain the working of a electrolux vapour absorption system.	**10**	**CO3**
7	A two stage single acting reciprocating compressor takes in air at the rate of 0.2 m^3/s.Intake pressure and temperature are 0.1 MPa and 16°C respectively.The air is compressed to a final pressure of 0.7 MPa.The intermediate pressure is ideal and inter-cooling is perfect .The compression index is 1.3 and the compressor runs at 15 rps .Neglecting clearance Determine (a) intermediate pressure (b) the total volume	**10**	**CO2**

	of each cylinder (c) the power required to drive the compressor (d) the rate of heat absorption in the inter cooler.		
8	With the help of neat diagram discuss the working of year round air conditioning system OR A Carnot refrigeration cycle absorbs heat at 270 K and rejects it at 300 K. Calculate e. The C.O.P of this refrigeration cycle. f. If the cycle is absorbing1130 kJ/min at 270K how many kJ of work is required per second? g. If the Carnot heat pump operates between same temperature limits. What will be C.O.P of the system? h. How many kJ/min will the heat pump deliver at 300 K if it absorbs 1130kJ/min at 270K.	**10**	**CO5/ CO1**
9	An ammonia ice plant operates between condenser temperature of 35°C and an evaporator temperature of -15°C.It produces 5 tons of ice per day from water at 25°C to ice at -5°C.The NH_3 enters the compressor as dry saturated vapour and leaves the condenser as saturated liquid. Determine (a) The capacity of the refrigerating plant (b) mass low rate of the refrigerant (c) Discharge temperature of NH_3 from the compressor. (iv) Power of the compressor motor if the isentropic efficiency of the compressor is 85% and the mechanical efficiency of the compressor is 90%. Take latent heat of ice =335 kJ/kg- K Specific heat of ice =1.94 KJ/ kg –K Use following properties of NH_3 Specific heat of water=4.2 KJ/kg- K	**10**	**CO1**

Saturation temperature °C	Enthalpy kJ/kg		Entropy kJ/kgK		Specific heat KJ/kg-K	
	h_f	h_g	s_f	s_g	C_{pf}	C_{pg}
-15	112.3	1426	0.457	5.549	-	-
35	347.5	1471	1.282	4.930	4.6	2.8

SECTION-C

10	An air conditioning system is to be designed for a restaurant with following data: Outdoor condition: 40℃ DBT and 29℃ WBT Indoor condition : 24℃ DBT and 50%RH Solar heat gain: 11.4 kW , occupants number: 25 Sensible heat gain per person: 60W Latent heat gain per person: 55W Internal heat gain (a) 15 lamps of 100 W and 10 tubes of 80 W Other sensible heat gain =11.63 kW , in filtered air: 15m^3/ min Dew point temperature of the coil: 10.8℃ If 25 % of fresh air is mixed with 75% of recirculated air and then passed through cooling coil Find (a) Amount of total air required (b) Condition of supply air to the room (c) Capacity of conditioning plant. Assume the bypass factor to be 0.2. Draw the schematic diagram of the system and show the system on psychrometric chart and insert the temperature and enthalpy values at the salient points.	**20**	**CO5**
11	A compound refrigeration system using R 12 as a refrigerant consists of three evaporators of capacities 20 tons at -5℃ , 30 ton at 0° C and 10 ton at 5 ℃ . The vapours leaving the evaporators are dry saturated .The system is provided with individual expansion valve and flash inter coolers .The condenser temperature is 40 ℃ and the liquid refrigerant leaving the condenser is sub cooled to 30℃ .Assuming isentropic compression at each stage .Find (a) mass of refrigerant passing through each compressor (b) the power required to drive the compressor and (c) C.O.P of the system. OR A compound refrigeration system is used for multiload purpose as shown in the figure R12 is used as a refrigerant .Find the power required in KW to run the system and C.O.P of the system.	**20**	**CO2**


C2
E2
20 Tons
at
+ 10°C
C1
E1
10 Tons
at
– 10 ° C
30°C
me2
me1
EV2
EV1