Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, March 2019

Programme Name: B.Tech-ADE **Semester : VI**
Course Name : Automotive HVAC **Time : 03 hrs.**
Course Code : ADEG-355 **Max. Marks : 100**
Nos. of page(s) : 03
Instructions : Attempt all questions. Question Number 8 and 11 are having internal choices. Assume any missing data and mention it clearly.

SECTION A (20 Marks)

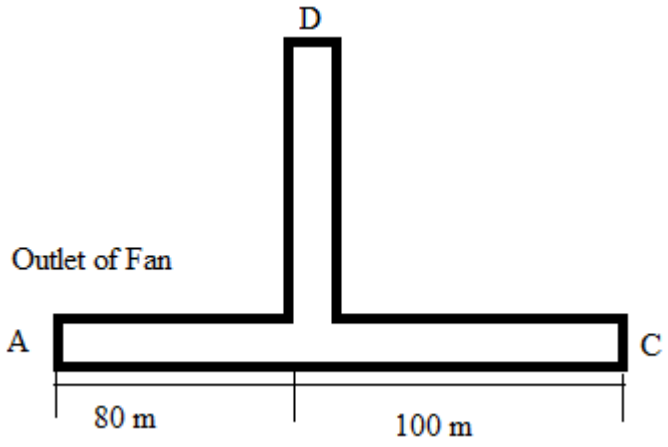
S. No.		Marks	CO
Q1	Draw Reverse Carnot cycle and explain each process in detail.	4	CO1
Q2	In an absorption type refrigeration system, heating, cooling and refrigeration take place at the temperature of 100 ^{0}C, 20 ^{0}Cand -10 ^{0}C. Find the theoretical C.O.P of the system.	4	CO2
Q3	How refrigerants are designated. Designate any two refrigerants from CFC or HFC group and designate them.	4	CO3
Q4	Compare with reference to the equations of SHF, RSHF, GSHF and ERSHF.	4	CO4
Q5	Classify the ducts used in HVAC system and mentioned their applicability too.	4	CO5

SECTION B (40 Marks)

Q6	A refrigeration Plant of 100 tons Capacity use R-22 as refrigerant. The condensing and evaporative pressure are 11.82 bar & 1.64 bar. The refrigerant enters the condenser at dry saturated state and it leaves the condenser, sub cooled by 10 ^{0}C. Actual C.O.P is 70% of theoretical. **Find a) Theoretical and Actual C.O.P b) Mass flow rate of refrigerant c) Compressor Power.** Take following properties of R-22	10	CO1

P (bar)	T (^{0}C)	hf (KJ/kg)	hg (KJ/kg)	sf ((KJ/kg-k)	Sg (KJ/kg-k)
1.64	-30	116.1	393.1	0.8698	1.803
11.82	+30	236.7	414.5	1.125	1.712

Q7	Explain construction and working with neat diagram of following HVAC equipment 1. Thermostatic Expansion Valve 2. Hermetically Seal Compressor.	[5+5]	CO3
Q8	The atmospheric air at 35^0 C and 75% relative humidity enters a cooling coil at a	10	CO4

	rate of 300 m^3/min. The coil dew point temperature is 14^0 C and by pass factor is 0.1. Determine 1) The temperature of Air leaving the coil. 2). The capacity of cooling coil in TR 3). The amount of Vapor removed per minute. 4). Sensible Heat Factor. **OR** The humidity ratio of air of atmospheric air at 38^0 C dry bulb temperature and 760 mm of Hg is 0.016 kg/kg of dry air. Determine 1). Partial Pressure of Water Vapor. 2). Relative Humidity. 3). Dew Point Temperature .4.) Specific Enthalpy 5). Vapor Density. **(Note- Solve this question without Using Psychrometric Chart)**		
Q9	Comprehend the methods for the determination of duct size.	**10**	**CO5**
	SECTION-C (40 Marks)		
Q10	A duct of **2.5 m X 2 m** in size carrying conditioned air runs 80 m from fan outlet. Then it divides into two parts each of 100 m in length and **2.5 m X 2 m** in cross section as shown in figure below. If the discharge at the point **C is 1600 m^3/min,** determine the quantity discharged at **Point D and static pressure at the outlet of the fan.** **Use** $H_f = \frac{4fL}{D_e}\left(\frac{V}{242.1}\right)^2$ Where De is equivalent diameter of Duct and f is friction factor=0.005  	**20**	**CO4**
Q11	The following data refers to summer air condition of a building: Outside Design Condition = 40^0C DBT, 27^0C WBT,	**20**	**CO5**

	Inside Design Condition = 27^0C DBT, 50% RH, Room sensible heat gain = 84000 KJ/h, Room Latent Heat Gain= 21000 KJ/h., By-Pass factor of the coil used = 0.2. The return air from the room is mixed with outside air before entry to the cooling coil in the ratio of 4:1 by mass, **Determine 1) ADP 2) Entry and Exit Conditions of air for the cooling coil 3) Fresh air mass flow rate. 4) Refrigeration load on the cooling coil.**		
	OR The hall is to be maintained at 24^0 C and 60% Relative humidity under the following conditions. Outside Condition = 38^0C DBT, 28^0C WBT. Sensible heat load in the room= 46.4 KW, Latent Heat load in the room= 11.6 KW. Total Infiltration air= 1200 m^3/h, ADP= 10^0C, Quantity of recirculated air from the hall= 60%. If the quantity of recirculated air is mixed with the conditioned air after the cooling coil. Find the following. 1. The condition of air leaving the conditioner coil and before mixing with the recirculated sir. 2. The condition of air before entering the hall; 3. The mass of air entering the cooler 4. The by-pass factor of the cooling coil 5. The refrigeration load on the cooling coil in TR		