Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course : Air conditioning system Design
Semester: VIII
Program: B.Tech Mechanical Engineering — **Time 03 hrs.**
Course Code: MHEG-454 — **Max. Marks: 100**

Instructions: psychometric chart and RAC data book is allowed

SECTION A

S. No.		Marks	CO
Q 1	Statement of questions		CO1
Q 1	Define relative humidity, specific humidity, and dew point temperature and decide theoretical method for determining their values.	5	CO1
Q 2	Enumerate the major difficulties encountered during designing an air conditioning system for ships.	5	CO2
Q 3	Enlist the circumstances evaporative under which, cooling is more economical for summer air conditioning.	5	CO2
Q 4	Define the term 'bypass' factor used for cooling or heating coil and find the expression for that.	5	CO1
	SECTION B		
Q 5	A fan system of 80% effectiveness is used for supplying cool air to a green house. The maximum allowable temperature in the green house is limited to 32°C .The cooling load is 3000 kj /hr-m² of the green house floor area. Design DBT and WBT of outdoor air are 35°C and 16°C respectively. SHF=0.5 If the green house is 100 m long and 77 m wide, find the air flow requirements.	10	CO4
Q 6	Discuss the different methods used for designing the duct of an air conditioning system. Explain the advantage of each over other.	10	CO3
Q 7	An air-conditioning system is designed for industrial process for hot and wet summer conditions. Outdoor conditions…… 30 ° C DBT and 75% RH Required Conditions…… 22° C DBT and 70% RH	10	CO4

	Amount free air circulated…….200 m^3/min Coil dew point temperature……. 14˚C The required condition is achieved first by cooling and dehumidifying and then by heating. Find the followings. (a) The cooling capacity of the cooling coil and its bypass factor. (b) Heating capacity of the heating coil in KW and surface temperature of the heating coil if the by-pass factor is 0.2. (c) The mass of water vapour removed by eliminator per hour.		
Q.8	An air refrigerator used for food storage provides 50 tons of refrigeration. The temperature of air entering the compressor is 7° C and the temperature before entering into the expander is 27° C. Assuming 30 % more power required then theoretical. Find (i) Actual C.O.P of the cycle. (ii) KW capacity required to run the compressor. The quantity of air circulated in the system is 150 kg/min. The compression and expansion process follows the law $pv^{1.3}$ = constant.	**10**	**CO4**
	SECTION-C		
Q9	(a)Explain the different methods of ac systems used in rail road cars. Or (a) Explain the heat transfer phenomenon of evaporative cooling. (b) A reciprocating compressor is to be designed for a domestic refrigerator of 100 W cooling capacity. The refrigerator operates at an evaporator temperature of –23.3° C and a condensing temperature of 54.4 °C. The refrigeration effect at these conditions is 87.4 kJ/kg. At the suction flange the temperature of the refrigerant is 32°C and specific volume is 0.15463 m ³/kg. Due to heat, transfer within the compressor the temperature of the refrigerant increases by 15°C. The indicated volumetric efficiency of the compressor is 0.85 and the leakage loss factor is 0.04. The rotational speed of the compressor is 2900 RPM. Find a) The diameter and stroke of the compressor in cms ; b) Find the COP of the system if the actual mean effective pressure of the compressor is 5.224 bar.	**20**	**CO2/ CO4**
Q 10	The following data refer to an air-cooling system Sensible heat load = 120,000 kJ/hr Latent heat load = 80,000 kJ/hr Indoor design condition = 25˚C DBT and 55% R.H. Outdoor design condition = 40˚C and 28˚C WBT. Return air is mixed with the outside air before cooling in the ratio is 4:1 (80 % to 20 %). The mixture of air is then treated in the cooling coil whose bypass factor is 0.1 and its ADP is 10˚C. Then the return air is also mixed with dehumidified air coming out of cooling coil in the proportion of 4:1. Air may be required to be	**20**	**CO3**

	heated if necessary. Determine. (i) Condition of an air supplied to the air-conditioning system (ii) Refrigeration capacity of the coil in the tons. (iii) Quantity of fresh air required.		