SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY :: PUTTUR
(AUTONOMOUS)

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QUESTION BANK

Subject with Code: Air Conditioning System Design (19ME3114)
Course & Branch: M. Tech(TE)
Sem : I-Sem   **Regulation: R19**

UNIT-I

1		Write the various psychometric processes? Explain any four processes with neat sketches.	12M
2		Explain the construction of psychometric chart?	12M
3	a	Write about the factors affecting optimum effective temperature?	6M
	b	Sketch comfort chart and show on it the comfort zone?	6M
4	a	What is meant by psychometric? Explain the psychometric properties?	6M
	b	(b) Define i) Wet-bulb temperature and Dew – point temperature. ii) Degree of saturation and Relative humidity. iii) Dew point depression	6M
5		Explain the thermodynamics of human body.	12M
6		The atmospheric air at 25^0C DBT and 12^0C wet bulb temperature is flowing at the rate of 100 m3/min through the duct. The dry saturated steam at 100^0C is injected into the air stream at the rate of 72kg per hour. Calculate the specific humidity and enthalpy of leaving air. Also determine the dry bulb temperature, wet bulb temperature and relative humidity of leaving air?	12M
7	a	Explain the sensible cooling.	6M
	b	20 cu m of air at 30℃ and 60% RH. I is cooled to 22℃ DBT maintaining its specific humidity constant. Find the followings 1. Heat removed from the air 2. RH of the cooled air 3. Wet bulb temperature of the cooled air. Assume the air pressure 1.033 bar.	6M
8	a	What is effective temperature? What factors affect effective temperature?	6M

	b	For a sample of air having 22^{0}C DBT, relative humidity 30% at barometric pressure of 760mm Hg. Calculate 1. Vapour pressure, 2. Humidity ratio 3. Vapour density, and 4. Enthalpy using theoretical formulas.	6M
9		100 cu m of air per minute at 30℃ DBT and 60% RH is cooled by passing through cooling coil until its temperature becomes 20℃ DBT. Find the followings.1. Capacity of cooling coil in tons of refrigeration 2. RH of the cooled air3. Wet bulb temperature of the cooled air. Assume air pressure is 1 bar.	12M
10		Explain the requirements of comfort air conditioning?	12M

UNIT-II

1		Discuss briefly the different types of heat loads which have to be taken into account while designing air conditioning system?	12M
2	a	Explain fresh air load with its formula.	6M
	b	(b) Define (i). Duct heat gain (ii).Fan load	6M
3		Explain about occupant load.	12M
4	a	Define the i). Latent heat ii). Sensible heat iii). Sensible heat factor	6M
	b	The amount of air supplied to an air conditioned hall is 300 m3/min. The atmospheric conditions are 35℃ DBT and 55% RH. The required conditions are 20℃ DBT and 60% RH. Find out the sensible heat and latent heat removed from the air per minute. Also find sensible heat factor for the system	6M
5	a	Explain summer air conditioning system with neat sketch.	6M
	b	Explain winter air conditioning system with neat sketch	6M
6		An air conditioning plant is to be designed for a small office for winter conditions with the following data: Outdoor conditions = 10℃ DBT and 8℃ WBT, Required indoor conditions = 20℃ DBT and 60% RH,Amount of air circulations = 0.3 m3/min/person, Seating capacity of the office =50 persons. The required condition is achieved first by heating and then by adiabatic humidifying. Find 1. Heating capacity of the coil in kW and the surface temperature, if the by-pass factor of the coil is 0.32; and 2.capacity of the humidifier.	12M
7		A small office hall of 25 persons capacity is provided with summer air conditioning system with the following data Outdoor conditions = 34℃ DBT and 28℃ WBT,	12M

Required indoor conditions = 24°C DBT and 50% RH, Volume of the air supplied = 0.4 m3/min/person, Sensible heat load in room =125600 kJ/h, Latent heat load in the room =42000 kJ/h, Find the sensible heat factor of the plant.

8		Explain about equipment load.	12M
9	a	Explain heat gain due to infiltration.	6M
	b	Air at 10°C DBT and 90% RH is to be brought to 35°C DBT and 22.5°C WBT with the help of winter air conditioner. If the humidified air comes out of the humidifier at 90% RH, draw the various processes involved on a skeleton psychometric chart and Find 1. The temperature to which the air should be preheated and 2. The efficiency of the air-washer.	6M
10	a	Explain year air round conditioning system with the neat sketch.	6M
	b	Explain heat gain due ventilation.	6M

UNIT-III

1	a	Draw the psychometric chart representing the condition for all fresh air used and recirculated air?	6M
	b	An air conditioned auditorium is to be maintained at 27°C dry bulb temperature and 60% relative humidity. The ambient condition is 40°C dry bulb temperature and 30°C wet bulb temperature. The total sensible heat load is 100000 KJ/h and the total latent heat load is 40000 KJ/h. 60% of the return air is re circulated and mixed with 40% of make-up air after the cooling coil. The condition of air leaving the cooling coil is at 18°C. Determine 1. Room sensible heat factor 2. The condition of air entering the auditorium 3. The amount of make-up air 4. Apparatus dew point.	6M
2	a	Define i)RSHF ii) ADP	6M
	b	A room has a sensible heat gain of 24 kW and a latent heat gain of 5.2 KW and it has to be maintained at 26°C DBT and 50% RH. 180m3/min of air is delivered to the room. Determine the state of supply air.	6M
3		In air conditioning system, the inside and outside conditions are dry bulb temperature 25°C, relative humidity 50% and dry bulb temperature 40°C, wet bulb temperature 27°C respectively. The room sensible heat factor is 0.85. 50% of the room air is rejected to atmosphere and an equal quantity of fresh air added before air enters the air	12M

conditioning apparatus. If the fresh air added is 100m3/min, Determine: a. Room sensible and latent heat load b. Sensible and latent heat load due to the fresh air c. Apparatus dew point d. Humidity ratio and dry bulb temperature of air entering air conditioning   apparatus. Assume by pass factor as zero, density of air as 1.2 kg/m3 at a total pressure of 1.01325 bar

4   A conference room for seating 100 persons is to be maintained at 220C DBT and 60%   12M
relative humidity. The outdoor conditions are 400C DBT and 270C WBT. The various loads in the auditorium are as follows: Sensible and latent heat loads per person, 80W and 50W respectively: lights and fans, 15000W: sensible heat gain through glass, walls, ceiling, etc., 15000W. The air infiltration is 20m3/min and fresh air supply is 100m3/min. Two-Third of re circulated room air and one-third of fresh air are mixed before entering the cooling coil. The by-pass factor of the coil is 0.1.   Determine Apparatus Dew Point, the Grand Total Heat Load and Effective Room Sensible Heat Factor.

5   The room sensible and latent heat loads for an air conditioned space are 25kW and 5   12M
kW respectively. The room condition is 250C DBT and 50% RH. The outdoor condition is 40^0C DBT and 50% RH. The ventilation requirement is such that on mass flow rate basis 20% of fresh air is introduced and 80% of supply air is re circulated. The by-pass factor of cooling coil is 0.15. Determine i) Supply air flow rate ii) Outside air sensible heat   iii) Outside air latent heat
iv) Grand total heat   v) Effective Room Sensible Heat Factor.

6   The following data relates to the office air conditioning plant having maximum   12M
seating capacity of 25 occupants. Outside design conditions = 34^0C DBT, 28^0C WBT, Inside design conditions   = 24^0C DBT, 50 % RH, Solar heat gain = 9120 W, Latent heat gain per occupant = 105 W, Sensible heat gain per occupant = 90 W, Lightening load   = 2300 W, Sensible heat load from other sources = 11630 W, Infiltration load = 14 m3/min. Assuming 40 % fresh air and 60% of re circulated air passing through the evaporator coil and the by-pass factor of 0.15. Find the dew point temperature of the coil and capacity of the plant.

7   a   Write about recirculated air with reheat coil.   6M

    b   An air-conditioned space is maintained at 26^0C DBT 50% RH when the outdoor   6M

conditions are 35^0C DBT and 28^0C WBT. The space has a sensible heat gain of 17.6kW and the air to the space is supplied at a condition of 8^0C saturated. Determine i) The mass and volume flow rate of the air supplied. ii) Latent heat in the room iii) The cooling load of the refrigerator plant is 15% of total mass of air supplied to the space is fresh air and the remaining air is re circulated.

8		An air conditioning hall is to maintained at 27℃ DBT and 21℃ WBT. It has a sensible heat load of 46.5 KW and latent heat load of 17.5 KW. The air supplied from the atmosphere at 27℃ WBT is 25 m3/min, directly into the room through ventilation and infiltration. Outside air to be conditioned is passed through the cooling coil whose apparatus dew point is 15℃. The quantity of re circulated is 60%. This quantity is mixed with the conditioned air after the cooling coil. Determine: 1. Condition of air after the coil and before the re circulated air mixes it.2. Condition of the air entering the hall I.e., after mixing with re circulated air.3. Mass of the fresh air entering the cooler4. By pass factor of the cooling coil5. Refrigerating load of the cooling coil.	12M
9	a	Calculate by pass factor of heating and cooling coils.	6M
	b	A quantity of air having a volume of 300 m3 at 300C dry bulb temperature and 25^0C wet bulb temperature is heated to 40^0C dry bulb temperature. Estimate the amount of heat added, final relative humidity and wet bulb temperature. The air pressure is 1.01325bar.	6M
10	a	Define i) ESHF ii) GSHF	6M
	b	The amount of air supplied to an air conditioned hall is 300 m3/min. The atmospheric conditions are 35^0C DBT and 55% RH. The required conditions are 20^0C DBT and 60% RH. Find out the sensible heat and latent heat removed from the air per minute. Also find sensible heat factor for the system.	6M

UNIT-IV

1	a	What are the advantages of steam humidifiers?	6M
	b	Explain the process of humidification by Air- washing method?	6M
2	a	What is meant by a grill? How to design a grill?	6M
	b	What is meant by a register? What are the factors affecting grill performance?	6M

3	a	Explain in detail about fan and its types.	6M
	b	Describe the types of blowers based on air flow patterns with sketches?	6M
4	a	What is dehumidification and the necessity of it? What are the common methods of dehumidification?	6M
	b	Advantages and disadvantages of dehumidifying	6M
5		Describe about absorption and adsorption?	12M
6	a	What is humidification and the necessity of it? What are the common methods of humidification?	6M
	b	Advantages and disadvantages of humidifying?	6M
7	a	Explain dehumidifying equipment? How they work?	6M
	b	Write applications for humidifying and dehumidifying?	6M
8		Explain about Lithium bromide absorption system?	12M
9		Explain about humidification by injecting the steam?	12M
10		Moist air enters a refrigeration coil at 35°CDBT and 55 percent RH at the rate of m3/min the barometric pressure is 1,013 bar. The air leaves at 27°C. Calculate the tones of refrigeration required and final RH	12M

UNIT-V

1		Explain about designs of air conditioning system?	12M
2	a	Explain about duct design and its recommended velocities?	6M
	b	Explain about Pressure drop?	6M
3	a	Explain briefly upward flow system?	6M
	b	Explain about downward flow system?	6M
4		Explain about Air distribution system?	12M
5	a	Explain about the static regain method?	6M
	b	Explain about velocity reduction method?	6M
6	a	Explain source of noise in air conditioning system?	6M
	b	Classify noise control methods and explain any three?	6M
7		An air conditioning system is to be designed for a small restaurant when following data is available Heat flow through walls, roofs and floor =22000kj/hr, Solar heat gain through glass =7000kj/hr, Equipment sensible heat gain 0500kj/hr, Equipment latent	12M

heat gain =2500 kj/hr, Amount of fresh air supplied =1600 m3/hr, Infiltration   load =400 m3/hr,The hall seating capacity =50,Servants serving the meals =5,Outside design conditions =35^{0}C DBT and 26^{0}C WBT, Inside design conditions =27^{0}C DBT and 55% RH. The temperature of air supplied to the dining hall should not fall below 17^{0}C. The fan in the system is fixed before air conditioning system. The power motor connecting the fan is10 kw. Find the following (i) Amount of air delivered to the dining hall in m3/hr   (ii) Percentage of re circulated air   (iii)Refrigeration load on the cooling coil in tons of refrigeration   (iv)Also find ADP of the cooling coil and its bypass factors?

8	a	General noise level in a factory measured as 10 power -11 watts per cm2. (i) Calculate the level in db. (ii) If a new machine is installed and resulting sound level is 55db, what would be its level at the same distance from the machine in a quiet background?	6M
	b	A fan which has a noise level of 43 db is operating in a room having originally a noise level of 35 db. Find the combined noise level in the room	6M
9		A duct distribution system supplying air to a house is shown in fig .quantities supplied per min, at different points are also shown, the lengths given in the fig include the proper allowance for various bends and other losses, Use equal pressure drop method along the main line only and pressure drops from the junction point to the forward supply points are same.	12M
10		An air conditioning system is to be designed for a restaurant when following data is available, Solar heat gain through walls, roofs and floor =5.87 kj/hr, Solar heat gain through glass =5.52 kj/hr, Outside design conditions =400C DBT and 280C WBT, Inside design conditions =250C DBT and 50% RH	12M

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