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

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QUESTION BANK(DESCRIPTIVE)

Subject with Code: Air Conditioning System Design (20ME3115)
Course & Branch: M. Tech(TE)
Year & Sem : I M.Tech & I-Sem **Regulation:** R20

UNIT-I

Air–conditioning, Requirements of Comfort Air conditioning

1		Write the various psychometric processes? Explain any four processes with neat sketches.	L1	CO1	12M
2		Explain the construction of psychometric chart?	L2	CO1	12M
3	a	Write about the factors affecting optimum effective temperature?	L1	CO3	6M
	b	Sketch comfort chart and show on it the comfort zone?	L3	CO1	6M
4	a	What is meant by psychometric? Explain the psychometric properties?	L1	CO2	6M
	b	(b) Define i) Wet-bulb temperature and Dew – point temperature. ii) Degree of saturation and Relative humidity. iii) Dew point depression	L4	CO4	6M
5		Explain the thermodynamics of human body.	L2	CO1	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?	L3	CO5	12M
7	a	Explain the sensible cooling.	L2	CO1	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	L1	CO2	6M

		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.			
8	a	What is effective temperature? What factors affect effective temperature?	L1	CO6	6M
	b	For a sample of air having 22^0C 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.	L3	CO1	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.	L1	CO3	12M
10		Explain the requirements of comfort air conditioning?	L2	CO1	12M
		UNIT-II **Cooling Load Estimation, Air-Conditioning systems**			
1		Discuss briefly the different types of heat loads which have to be taken into account while designing air conditioning system?	L6	CO2	12M
2	a	Explain fresh air load with its formula.	L4	CO1	6M
	b	(b) Define (i). Duct heat gain (ii).Fan load	L1	CO3	6M
3		Explain about occupant load.	L2	CO5	12M
4	a	Define the i). Latent heat ii). Sensible heat iii). Sensible heat factor	L4	CO1	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	L1	CO1	6M

5	a	Explain summer air conditioning system with neat sketch.	L2	CO6	6M
	b	Explain winter air conditioning system with neat sketch	L2	CO1	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.	L1	CO3	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, Required indoor conditions = 24℃ 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.	L1	CO2	12M
8		Explain about equipment load.	L2	CO1	12M
9	a	Explain heat gain due to infiltration.	L2	CO4	6M
	b	Air at 10℃ DBT and 90% RH is to be brought to 35℃ DBT and 22.5℃ 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.	L1	CO1	6M
10	a	Explain year air round conditioning system with the neat sketch.	L2	CO1	6M
	b	Explain heat gain due ventilation.	L2	CO4	6M
		UNIT-III **Terms in Air–conditioning Systems, Calculation**			
1	a	Draw the psychometric chart representing the condition for all fresh air	L1	CO1	6M

		used and recirculated air?			
	b	An air conditioned auditorium is to be maintained at 27℃ dry bulb temperature and 60% relative humidity. The ambient condition is 40℃ dry bulb temperature and 30℃ 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℃. 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.	L3	CO3	6M
2	a	Define i)RSHF ii) ADP	L4	CO2	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℃ DBT and 50% RH. 180m3/min of air is delivered to the room. Determine the state of supply air.	L3	CO1	6M
3		In air conditioning system, the inside and outside conditions are dry bulb temperature 25℃, relative humidity 50% and dry bulb temperature 40℃, wet bulb temperature 27℃ 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 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	L3	CO2	12M
4		A conference room for seating 100 persons is to be maintained at 220C DBT and 60% 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,	L3	CO1	12M

		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 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.	L3	CO4	12M
6		The following data relates to the office air conditioning plant having maximum 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.	L1	CO2	12M
7	a	Write about recirculated air with reheat coil.	L1	CO3	6M
	b	An air-conditioned space is maintained at 26^0C DBT 50% RH when the outdoor 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	L3	CO1	6M

		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.	L3	CO1	12M
9	a	Calculate by pass factor of heating and cooling coils.	L1	CO1	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.	L1	CO2	6M
10	a	Define i) ESHF ii) GSHF	L4	CO2	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.	L1	CO1	6M
		UNIT-IV **Components**			
1	a	What are the advantages of steam humidifiers?	L1	CO1	6M
	b	Explain the process of humidification by Air- washing method?	L2	CO2	6M
2	a	What is meant by a grill? How to design a grill?	L1	CO4	6M

	b	What is meant by a register? What are the factors affecting grill performance?	L1	CO2	6M
3	a	Explain in detail about fan and its types.	L2	CO1	6M
	b	Describe the types of blowers based on air flow patterns with sketches?	L1	CO1	6M
4	a	What is dehumidification and the necessity of it? What are the common methods of dehumidification?	L1	CO1	6M
	b	Advantages and disadvantages of dehumidifying	L4	CO3	6M
5		Describe about absorption and adsorption?	L1	CO1	12M
6	a	What is humidification and the necessity of it? What are the common methods of humidification?	L1	CO2	6M
	b	Advantages and disadvantages of humidifying?	L4	CO1	6M
7	a	Explain dehumidifying equipment? How they work?	L1	CO1	6M
	b	Write applications for humidifying and dehumidifying?	L1	CO5	6M
8		Explain about Lithium bromide absorption system?	L2	CO1	12M
9		Explain about humidification by injecting the steam?	L2	CO6	12M
10		Moist air enters a refrigeration coil at 35℃DBT and 55 percent RH at the rate of m3/min the barometric pressure is 1,013 bar. The air leaves at 27℃. Calculate the tones of refrigeration required and final RH	L3	CO1	12M
		UNIT-V **Design conditions and load calculations**			
1		Explain about designs of air conditioning system?	L2	CO1	12M
2	a	Explain about duct design and its recommended velocities?	L2	CO3	6M
	b	Explain about Pressure drop?	L2	CO2	6M
3	a	Explain briefly upward flow system?	L2	CO5	6M
	b	Explain about downward flow system?	L2	CO1	6M
4		Explain about Air distribution system?	L2	CO1	12M

5	a	Explain about the static regain method?	L2	CO3	6M
	b	Explain about velocity reduction method?	L2	CO1	6M
6	a	Explain source of noise in air conditioning system?	L2	CO4	6M
	b	Classify noise control methods and explain any three?	L2	CO1	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 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?	L1	CO2	12M
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?	L3	CO1	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	L1	CO1	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	L1	CO3	12M

		only and pressure drops from the junction point to the forward supply points are same.			
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	L3	CO2	12M

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