Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2721003 **Date: 27/05/2016**

Subject Name: Advanced Air conditioning

Time:10:30 am to 01:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** An air conditioned room that stands on a well-ventilated basement measures 3 m wide, 3 m high and 6 m deep. One of the two 3 m walls faces west and contains a double glazed glass window of size 1.5 m by 1.5 m, mounted flush with the wall with no external shading. There are no heat gains through the walls other than the one facing west. Calculate the sensible, latent and total heat gains on the room, room sensible heat factor from the following information. What is the required cooling capacity? Inside conditions: 25° C dry bulb, 50 % RH **07**

Outside conditions: 43° C dry bulb, 24° C wet bulb
U-value for wall: 1.78 W/m^2 K,
U-value for roof: 1.316 W/m^2 K
U-value for floor: 1.2 W/m^2 K,
Effective Temp. Difference (ETD) for wall: 25° C
Effective Temp. Difference (ETD) for roof: 30° C
U-value for glass ; 3.12 W/m^2 K
Solar Heat Gain (SHG) of glass ; 300 W/m^2
Internal Shading Coefficient (SC) of glass: 0.86
Occupancy : 4 (90 W sensible heat/person) (40 W latent heat/person)
Lighting load : 33 W/m^2 of floor area,
Appliance load : 600 W (Sensible) + 300 W(latent)
Infiltration : 0.5 Air Changes per Hour
Barometric pressure : 101 kPa

(b) A winter air conditioning system maintains a building at 21 °C and 40% RH. The outdoor conditions are 0 °C (DBT) and 100% RH. The sensible load on the building is 100 kW, while the latent heating load is 25 kW. In the air conditioning system, 50% of the outdoor air (by mass) is mixed with 50% of the room air. The mixed air is heated in a pre-heater to 25 °C and then required amount of dry saturated steam at 1 atm. pressure is added to the pre-heated air in a humidifier. The humidified air is then heated to supply temperature of 45 °C and is then supplied to the room. Find **07**

a) The required mass flow rate of supply air, b) Required amount of steam to be added, and c) Required heat input in pre-heater and re-heater. Barometric pressure = 1atm

Q.2 **(a)** A motor rotating at 1000 rpm is delivering air at 300 L/s with a static pressure of 150 Pa whilst consuming power of 1.5 K W. What would be the new volume flow rate the new static pressure and the new power consumption if the motor speed is increased to 1200 rpm? **07**

(b) With neat sketch explain construction and working of fan coil unit and represent it on psychometric chart. **07**

OR

(b) Explain the following ESHF, GSHF, ADP, and OASH. **07**

Q.3 **(a)** Explain testing of desert coolers as per BIS. **07**

	(b)	List various factors that affect grill performance. How is selection of outlets done using nomographs?	**07**
		OR	
Q.3	**(a)**	Explain method of heat load calculation for air conditioning of a Mall.	**07**
	(b)	Explain Ventilation with Radiant Heating and Cooling systems and method of optimizing its performance.	**07**
Q.4	**(a)**	Classify evaporative cooling systems and explain any one in detail.	**07**
	(b)	Explain the following systems DX, VAV and dual duct system.	**07**
		OR	
Q.4	**(a)**	Explain the step by step design procedure for following systems 1. Side wall supply 2. Still supply 3. Ceiling diffuser	
	(b)	State factors influencing human comfort and explain how comfort zones are prepared.	**07**
Q.5	**(a)**	With neat sketch describe thermostat control of cold water line. List various control valves installed on water pipe lines to regulate flow rate to maintain temperature.	**07**
	(b)	Explain the following terms relating to cooling tower: range, approach, effectiveness, blow down, packing, drift.	**07**
		OR	
Q.5	**(a)**	What is thermal stratification? How can phenomena of thermal stratification be avoided in air conditioned building.	**07**
	(b)	Explain the following terms : shock losses in ducts, system effect losses, throw, drop, induction	**07**

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