

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013****Subject code: 1721003****Date: 31-12-2013****Subject Name: Advanced Air-conditioning****Time: 10.30 am – 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.
4. Use of refrigeration and Air-conditioning charts and tables is permitted

- Q.1**
- (a) The outside air is being cooled to 17 °C DBT, 95% RH. The air then enters to silica gel dehumidifier. The specific humidity leaving the humidifier is 3gm/kg of dry air. The air is then cooled with cooling coil through which the water is flowing. The temperature of water entering the cooling coil is same as the mean surface temperature and is equal to 10 °C .The bypass factor for the cooling coil is 0.3. The cooled air is mixed with the room air in the ratio of 1/3rd of cooled air to 2/3rd room air. The mixed air is being cooled and humidified with an evaporative cooler where the water is completely recirculated. The humidifying efficiency of evaporative cooler is 60 %. The room sensible heat load is 2.84 K W . The temperature of heated water leaving the cooling coil is 3°C less than outlet temperature of air. Calculate (1) The rate of air flow in kg/hr, (2) Room sensible heat factor, (3) The amount of water flow in the evaporative cooler. Take room design condition as 21 °C DBT, 60% RH. **07**
- (b) (1) State the factors affecting by pass factor? **03**
 (2) Explain differences between ASHRAE and CARRIER chart and application of correction of different charts. **04**
- Q.2**
- (a) Explain following terms: Sol air temperature, Equivalent temperature differential, ventilation standards. **07**
- (b) (1) Differentiate between instantaneous heat gain and instantaneous cooling load **03**
 (2) With neat sketch explain absorption, reflection and transmission of solar radiation in glass. **04**
- OR**
- (b) Derive an expression for calculating makeup water and leaving water temperature required for cooling tower. **07**
- Q.3**
- (a) A main circular duct consists of three branches ducts taking equal air volume at equal intervals. Each interval duct has friction loss of 1.2mm of water and state pressure of 4mm of water is necessary at each branch to cope up with friction loss. If the initial velocity in main duct of 1.3m diameter is 9m/s. Find out the velocities and diameter of second and third lengths where the static pressure regain is sufficient to overcome the friction loss in succeeding length of main duct up to the next branch. Assume static pressure regain factor is 0.58. Also find static velocity pressure at appropriate points along the flow. **07**
- (b) Explain fan laws and briefly explain how testing of fan is carried out as per I.S. **07**

OR

- Q.3** (a) A centrifugal fan has a circular inlet duct of 0.45m diameter and a rectangular outlet duct of 0.45m by 0.375m .The static pressure of fan inlet is -12.5 mm of water and the static pressure at the fan outlet is 25mm of water when the fan delivers $115 \text{ m}^3 / \text{sec}$ and absorbs 0.90kW. Assuming standard air density in both ducts and compressibility factor as 1, determine **07**
- (1) Total pressure at fan inlet and outlet,
 - (2) Fan total pressure and fan static pressure,
 - (3) Fan total efficiency and fan static efficiency
- (b) Explain following terms: throw, drop, spread, Decay, induction, static pressure, dynamic pressure **07**

Q.4

- (a) Draw a line diagram to illustrate the control of dampers, cooling coils, heaters, and fans with help of thermostats and humidistats in case of year air-conditioning system. **07**
- (b) Explain the different governing equations for human thermo regulation. **07**

OR

- Q. 4** (a) Explain with neat sketch different types of controls incorporated in refrigeration compressors used in year round air-conditioning systems. **07**
- (b) Define the term effective temperature and explain its importance in air-conditioning system. Describe the factors which effect effective temperature. **07**

Q.5

- (a) Sketch the constant volume variable temperature all air system and describe its working along psychometric analysis. **07**
- (b) Explain different types of outlets and its placement in banks, restaurants. **07**

OR

- Q.5** (a) With neat sketch explain construction and workings of desiccant cooling systems also explain how selection of desiccant cooling system for particular application can be carried out. **07**
- (b) What is ADPI? Explain the design procedure for outlet selection with help of ADPI. **07**
