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**B.TECH. (SEM VII)**  
**MODEL PAPER 2022-23**  
**HVAC SYSTEMS**

*Time: 3Hours*

*Total Marks: 100*

**Note:** Attempt all Sections. If you require any missing data, then choose suitably.  
Use of refrigeration table and steam table is permitted.

**SECTIONA**

- 1. Attempt all questions in brief. 2x10=20**
- (a) How can moisture be removed from a refrigeration system?
  - (b) What are the future refrigerants?
  - (c) Differentiate between natural and mechanical ventilation.
  - (d) Explain the importance of sol air temperature in cooling load calculations.
  - (e) What is sol air temperature?
  - (f) What do you understand by the green house effect?
  - (g) Explain the process of chemical dehumidification.
  - (h) Mention the significance of alignment circle on a psychometric chart.
  - (i) Explain the role of duct in air conditioning system?
  - (j) What is auto refrigeration?

**SECTIONB**

- 2. Attempt any three of the following: 10x3=30**
- (a) Describe the different methods of air conditioning duct design.
  - (b) Discuss the different types of heat loads which are taken into account in order to estimate the total heat load of a large restaurant for summer air conditioning.
  - (c) Classify the ducts on the basis of its application, pressure inside it and the velocity of air in the duct.
  - (d) With the neat sketch, explain how centralized air conditioning system differs from the unitary air conditioning system.
  - (e) Differentiate among all water, all air and air water air conditioning system.

**SECTIONC**

- 3. Attempt any one part of the following: 10x1=10**
- (a) What are azeotropic and non-azeotropic mixtures? Explain in brief, their advantages giving examples.
  - (b) Explain classification of refrigeration in details.

- 4. Attempt any *one* part of the following: 10x1=10**
- (a) Explain with a neat sketch, working of an underground heat pump.
  - (b) Define human comfort. Explain the factors affecting human comfort.
- 5. Attempt any *one* part of the following: 10x1=10**
- (a) With the help of neat sketches, explain how unitary system differs from central air conditioner.
  - (b) Explain different components of central air conditioning system.
- 6. Attempt any *one* part of the following: 10x1=10**
- (a) In a heating application, moist air enters a steam heating coil at  $10^{\circ}\text{C}$ , 50% RH and leaves at  $30^{\circ}\text{C}$ . Determine the sensible heat transfer; if mass flow rate of air is 100 kg of dry air per second. Also determine the steam mass flow rate if steam enters saturated at  $100^{\circ}\text{C}$  and condensate leaves at  $80^{\circ}\text{C}$ .
  - (b) Explain the procedure to estimate the cooling load with the help of suitable example
- 7. Attempt any *one* part of the following: 10x1=10**
- (a) The following data refer to a bank for 100 persons in the premises:  
Ambient conditions:  $37^{\circ}\text{CDBT}$  and  $27^{\circ}\text{CWBT}$  Required  
inside conditions:  $22^{\circ}\text{C DBT}$  and 60% RH  
Sensible heat: 110kW  
Latent heat: 55kW  
Ventilation requirement:  $0.0047\text{m}^3/\text{sec}$  per person.  
If the bypass factor for the coil is 0.15, make calculations for:
    - (a) Grand total heat,
    - (b) Effective sensible heat factor,
    - (c) Apparatus dew point, and
    - (d) Volume flow rate of humidified air.
  - (b) Compare the characteristic of backward and forward curved blade vanes with the help of suitable sketch.