

Total No. of Questions : 8]

SEAT No. :

PB-2360

[Total No. of Pages : 6

[6263]-210

B.E. (Mechanical)

**HEATING, VENTILATION, AIR CONDITIONING AND
REFRIGERATION**

(2019 Pattern) (Semester - VII) (402041)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of scientific calculator is allowed.
- 5) Assume suitable data, if necessary.

Q1) a) Explain with a neat sketch Thermostatic Expansion Valve. [6]

b) Explain with neat schematic Simple Ejector Refrigeration System. [5]

c) Discuss the following terms used in thermodynamics analysis of Simple Ejector Refrigeration Cycle. [6]

- i) Entrainment Ratio
- ii) Entrainment efficiency
- iii) Nozzle Efficiency

OR

Q2) a) Explain with neat sketch flooded type evaporator. [6]

b) Explain with neat schematic the frost control circuit used in VCR cycle. [6]

c) Explain with neat schematic CO₂ trans critical cycle. [5]

P.T.O.

Q3) a) Explain in detail the “decrement factor” and “time lag”. **[8]**

b) A conference room for sitting 100 persons is to be maintained at 22 °C DBT and 60% relative humidity. The outdoor conditions are 40 °C DBT and 27 °C WBT. The various loads in the auditorium are as follows:**[10]**

Sensible and latent heat loads per person 80 W and 50 W respectively; lights and fans, 15000 W;

sensible heat gain through glass ceiling etc. 15000 W.

The air infiltration is 20 m³/min and fresh air supply is 100 m³/min.

Two-third of recirculated room air and one-third of fresh air are mixed before entering the cooling coil.

The bypass factor of the coil is 0.1.

Determine

- i) Apparatus dew point,
- ii) Grand total heat load and
- iii) Effective room sensible heat factor

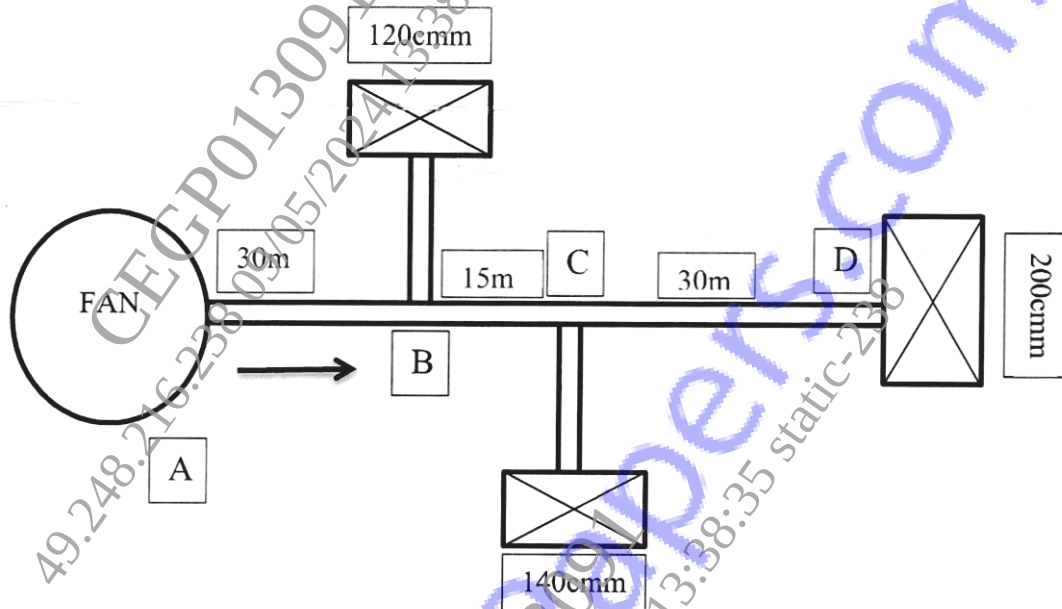
OR

Q4) a) What is CLTD method? How it connects with time lag and decrement factor? **[8]**

b) Atmospheric air at 30 °C dew point temperature and 75% relative humidity, enters a cooling coil at a rate of 200 m³/min. The coil dew point temperature is 14 °C and the by-pass factor of the coil is 0.1. Determine: **[10]**

- i) The temperature of air leaving the cooling coil;
- ii) The capacity of the cooling coil in TR and in kW;
- iii) The amount of water vapour removed per minute; and
- iv) The sensible heat factor for the process

- Q5) a)** Define the following as applied to “Air Distribution System” Intake, Outlet, Grille, Register, Diffuser, Filter, Throw and Primary Air. [8]
- b)** Using equal Friction pressure drop method and friction chart estimate the diameter and velocity pressure in AB, BC, CD, BE, CF Duct sections. Take the assumption if any. [10]



OR

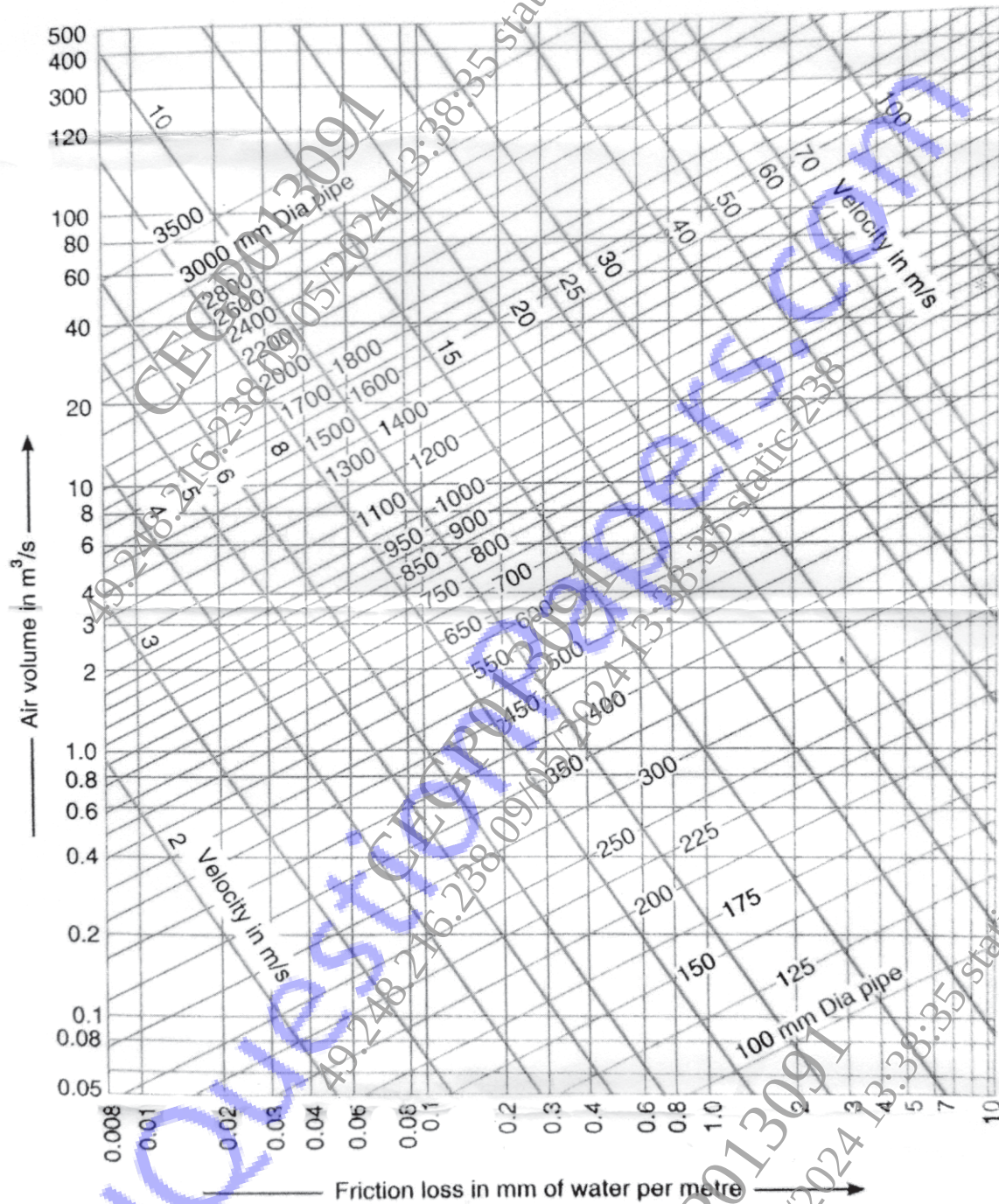
- Q6) a)** Explain FAN Laws. With neat sketch explain the working of AHU. [8]
- b)** A circular Duct of ϕ 400 mm is selected to carry air at a velocity 440 m/min. If duct is replaced by rectangular Duct of aspect ratio 1.5. Find the size of rectangular duct for equal friction when;
- Velocity in two Duct is same.
 - Discharge in two Duct is same.
- If $f = 0.015$, Find the pressure loss per 100m length of Duct. Take density of air = 1.15 kg/m^3 . [10]

- Q7) a)** Explain with neat sketch Variable Refrigerant Flow (VRF) air conditioning system. [6]
- b)** Explain with neat sketch all year round air conditioning system. [6]
- c)** State the factors to be considered while selecting a system of air conditioning. [5]

OR

- Q8) a)** What is Heat pump? Write down different circuits of heat pump and Industrial applications of heat pump. [6]
- b)** Explain with neat diagram Direct evaporative cooling air conditioning system. [6]
- c)** Compare all air-air conditioning system with all water air conditioning system. [5]

Friction Chart for Circular Ducts



▽▽▽▽