Ref. No.: Ex/Arh/T/321/2024

BACHELOR OF ARCHITECTURE EXAMINATION, 2024

(3rd year B. Arch. 2nd Semester)

SUBJECT: SERVICES & EQUIPMENT-II

Time : Three hours **Full Marks: 100**

Instructions: (i) Answer for 100 marks (ii) Use sketches wherever necessary.

Q1. Draw and label a schematic diagram of a Refrigeration cycle. Describe the condition of the refrigerant when it passes through different equipment, accessories and conduit. Explain how this acts as the basic governing principle of Air conditioning. **25**

(a) Describe the conditions that affect the body heat. Mention the standard comfort DBT and RH for summer and winter seasons.

(b) Draw sketch views of 'Psychrometric Chart' to describe the various curves and their significances in dealing with the properties of air.

(c) Citing a suitable example, describe the concept of "U" factor.

Q2. Describe in detail the various outdoor and indoor sources of heat that are taken into account for estimation and calculation of 'cooling load' in airconditioning. **25**
Given:

Ventilation air: 15000 cfm
Outdoor temperature: 80 F and 50% RH
Indoor temperature: 75 F and 45% RH

Calculate (a) Ventilation air (sensible) cooling load in Btu/hr, (b) Ventilation air (Latent) cooling load in Btu/hr and (c) Tonnage of Refrigeration (TR) of the machine for installation

Q3. Describe the various outdoor and indoor sources of heat that one should take into account for estimating the Heat Load for airconditioning. Use diagrams wherever necessary. **25**

Solve the following:

Given: Air required in main supply duct: 6000 cfm
Air velocity permitted: 1600 fpm (This is well within the maximum velocity permitted for general office)
Length of main supply duct: 120 ft.

Find: (i) Main supply duct size &
(ii) Friction loss

[Turn over

Q4. With the help of suitable sketches, describe the various kinds of ducting arrangement in airconditioning. Citing a suitable numerical example, show how the duct sizing is arrived at. Explain the flexibilities offered by the standard charts and formulae in sizing of ducts of equivalent cross-sectional areas. Describe how and under which situations airconditioning ducts can be partially or fully avoided without compromising indoor comfort. **25**

Given: Unconditioned space DBT: 95F, Unconditioned space WBT: 70F, Cold air Supply Duct Temperature: 65F. Find Dew Point Temperature and determine whether condensation will form on the Duct.

Q5. Describe the concepts of 'sensible Heat' and 'Latent Heat'. With the help of 'Psychrometric Chart', describe what happens when 'Latent Heat' is applied and 'Sensible Heat' is applied to air. **25**

Solve the following numerical problem:
Given:
Total air quantity required: 12000 cfm
Return air quantity : 8000 cfm
Return air temperature : 85F DB and 60 WB
Outdoor air quantity : 4000 cfm
Outdoor air temperature : 90F DB and 75F WB

Find: (a) DBT of air mixture and (b) WBT of air mixture

Q6. (A) A 16'-0" X 6'-0" wood sash view window faces west in a house at 40°N latitude. It is wood sash, shaded inside by venetian blinds (light coloured outside) and has normal set-back. The outside temperature is 95F, inside being 80 F. **25**

Find the total rate of heat gain through this window at 4.00 pm on August 01 in Btu/hr

[Given: Solar radiation heat gain factors: (i) wood sash window: 0.85, (ii) inside venetian blinds, slats set at 45° light colour outside: 0.60, (iii) windows shaded by setbacks from external building surface: 0.90, (iv) total instantaneous solar heat gain rate in Btu/hr per sq ft, of unshaded glass for west facing building side at 40°N latitude at 4.00 pm on August 1is 194 and 'U' factor for the window used is 1.13]

(B) Solve the following:
Given: Air required at a Living room outlet: 200 cfm; Air velocity permitted: 500 cfm.
Find out (a) Supply branch duct size (one circular size and two nos. rectangular sizes) to the Living room outlet and (b) Friction loss.

Q7. Using suitable examples (with appropriate sketches), describe how ductable airconditioning is planned for 12 nos. hotel rooms (6 rooms on both side of a spinal corridor) located on an intermediate floor of a building. Assume other relevant data. **25**