

- Q.20 Explain critical thickness of insulation for sphere. (CO3)
- Q.21 Describe the Total emissive power and monochromatic emissivity. (CO4)
- Q.22 Write a short note on followings: (CO4)
- Absorptivity
  - View factor

#### SECTION-D

**Note:** Long answer type questions. Attempt any two questions out of three questions. (2x8=16)

- Q.23 Explain the following laws in detail with their mathematical expressions: (CO4)
- Plank's law (CO4)
  - Kirchoff's law
- Q.24 Derive an expression for 1-d steady state heat conduction through a sphere. (CO2)
- Q.25 Write a note on followings: (CO3)
- Newton's law of cooling
  - Physical Properties of insulating material.

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#### 4th Sem / Chemical Engineering

#### Subject : Heat Transfer Operations - I

Time : 3 Hrs.

M.M. : 60

#### SECTION-A

**Note:** Multiple choice questions. All questions are compulsory (6x1=6)

- Q.1 The formula of heat flux( $q$ ) is \_\_\_\_\_? (CO1)
- $q=A/Q$
  - $q=Q \times A$
  - $q=Q/A$
  - $q=Q+A$
- Q.2 Which of the following materials typically has the lowest thermal conductivity? (CO2)
- Solid metal
  - Liquid
  - Gas
  - None of these
- Q.3 What is the CGS unit of heat transfer co-efficient? (CO3)
- Cal/m-k
  - Cal/m<sup>2</sup>-k
  - Cal/m.sec-k
  - Cal/m<sup>2</sup>.sec-k
- Q.4 What is the term for the ratio of radiation emitted by body to the Radiation emitted by black body at the same temperature? (CO4)
- Transmissivity
  - Emissivity
  - Absorptivity
  - Reflectivity

- Q.5 For forced convection Nusselt number is the function of  $Nu=f(\_,\_) \quad (CO3)$   
 a)  $Re, Pr$                       b)  $Gr, Re$   
 c)  $Gr, Pr$                       d)  $Re, Le$

- Q.6 The formula for critical radius of insulation for cylinder is \_\_\_\_\_?  $(CO3)$   
 a)  $k/h$                               b)  $2k/h$   
 c)  $k/2h$                             d)  $h/k$

Where  $k$  is thermal conductivity of insulating material,  $h$  is heat transfer co-efficient of outer surface

**SECTION-B**

**Note:** Objective/ Completion type questions. All questions are compulsory.  $(6 \times 1 = 6)$

- Q.7 According to Fourier's law of heat conduction the heat flux is \_\_\_\_\_ proportional to thermal conductivity. (directly/indirectly)  $(CO1)$
- Q.8 What is conduction.  $(CO1)$
- Q.9 Reynold's number  $(Re) = \frac{\text{Viscous force}}{\text{Inertia force}}$  (True/False)  $(CO3)$
- Q.10 Insulating materials with low thermal conductivity are effective in reducing heat transfer. (True/False)  $(CO3)$
- Q.11 In heat transfer,  $a+r+t = 1$ , (True/False)  $(CO4)$

Where,  $a$  is Absorptivity  
 $r$  is reflectivity  
 $t$  is Transmissivity

- Q.12 Write any one example of radiation mode of heat transfer.  $(CO1)$

**SECTION-C**

**Note:** Short answer type questions. Attempt any eight questions out of ten questions.  $(8 \times 4 = 32)$

- Q.13 Explain the convection mode of heat transfer with example.  $(CO1)$
- Q.14 Describe the concept of optimum thickness of insulation.  $(CO3)$
- Q.15 Describe the Fourier's law of heat conduction with assumption used.  $(CO2)$
- Q.16 The heat flux (heat transfer per unit area) is  $20 \text{ W/m}^2$  from outside to inside across an insulating plane wall with thermal conductivity  $(k) = 0.08 \text{ W/m-k}$  and thickness  $0.16 \text{ m}$ . The temperature of inside wall is  $268 \text{ K}$  ( $-5^\circ \text{C}$ ). Calculate the outside wall temperature in Kelvin.  $(CO2)$
- Q.17 What is heat transfer? Write any four examples of heat transfer.  $(CO1)$
- Q.18 Differentiate between natural and forced convection.  $(CO3)$
- Q.19 Describe the following dimensionless number:  $(CO3)$   
 a) Prandtl number  
 b) Grashof's number