**Rajasthan Institute of Engineering & Technology, Jaipur**

**Department of Mechanical Engineering**

**I Mid Term examination**

**Session: 2018-19**

**V Semester ME**

**Heat Transfer (code: 5ME1A)**

**SET A**

Time: 2 hrs. M.M.:20

**Instruction for students:**

1. No provision for supplementary answer book.

2. All questions are compulsory, each question carrier 5 marks. **All notations have their usual meanings.**

Q.1 (a) What do you understand by Heat Transfer? How it is different than Thermodynamics?

(b) A wall of 10 cm thickness and 3 m2 and conductivity of 8.5 W/m-K. The temperatures of wall sides are 100°C & 30°C. Find temperature Gradient and heat conducted across the wall.

Or

Q.1 Establish the heat conduction equation in Cartesian Co - ordinate System.

Q.2 Establish the relation **(t - t1) / (t2 – t1) = ln (r/r1) / ln (r2/r1)** for conduction through cylindrical wall.

Or

Q.2 Explain Critical Radius of Insulation. A wire of dia. 8mm and length 1.5 m is to be maintained at 60°C, by insulating it by a material of thermal conductivity 0.18W/m-K. The surrounding temperature is 22°C and heat convective coefficient 8.5 W/m2 K. for max. heat dissipation find:-

 (a) Minimum Insulation thickness and heat loss. (b) % increase in heat loss due to insulation.

Q.3 (a) Explain **extended surfaces** and their applications.

 (b) A storage chamber of dimensions 10mx8mx2.0m has its inside maintained at **-20°C** outside temp. is 24°C.Wall and ceiling have 3 layers made up of 60mm thick board (k= 0.2 W/m - °C) on inside, 90mm thick insulated (k=0.04W/m - °C) at mid and 240mm thick concrete (k=1.8W/m - °C) on outside. Neglect heat flow through the floor, determine rate of heat flow towards inside the chamber.

Or

Q.3 Establish that the heat dissipation from an infinite long fin is **Qfin ={√ (PhkAc)} {to - ta}** using standard equations and boundary conditions.

Q.4 Define the term Thermal diffusivity. Estimate the rate of heat flow through a boiler wall of insulation thickness 10mm with conductivity of 0.116 W/m K, if temperature inside and outside boiler wall are 300°C and 30°C respectively. The area of wall is 0.5 m2 .

Or

Q.4 What do you understand from heat exchanger? Classify the heat exchangers on the basis of flow of relative direction of hot and cold fluids.

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**SET B**

Time: 2 hrs. M.M.:20

**Instruction for students:**

1. No provision for supplementary answer book.

2. All questions are compulsory, each question carrier 5 marks. **All notations have their usual meanings.**

Q.1 (a) Explain 3 modes of Heat Transfer. State corresponding laws of Heat Transfer.

(b) A wall of 12 cm thickness and 3 m2 and conductivity of 8.2 W/m-K. The temperatures of wall sides are 106°C & 32°C. Find temperature Gradient and heat conducted across the wall.

Or

Q.1 Establish the heat conduction equation in Polar Co - ordinate System.

Q.2 Show that the thermal resistance of a cylindrical wall is **Rt** = **ln (r/r1) / 2πkl**

Or

Q.2 (i) Explain Steady and unsteady state heat transfer. (ii) A furnace wall is made up of 125mm of fire bricks, 150mm of red brick separated by an air gap. The wall is coated with thick plastic layer of 12mm from outside. The temperature of inner surface is 1100°C and room temperature is 25°C . Calculate the effective thermal resistance of wall. Using following values: -

K fire brick = 1.6W/m°C , K red brick = 0.3W/m°C, K plastic layer = 0.14W/m°C, Air resistance= 0.16 °C/W

Q.3 (a) Show that the Thermal Resistant of a wall with conductivity **k** and area **A** of thickness **δ** is **R =**$\frac{δ}{k A}$**.**

 (b) A storage chamber of dimensions 10mx8mx2.5m has its inside maintained at **-20°C** outside temp. is 25°C.wall and ceiling have 3 layers made up of 60mm thick board (k= 0.2 W/m - °C) on inside, 90mm thick insulated (k=0.04W/m - °C) at mid and 240mm thick concrete (k=1.8W/m - °C) on outside. Neglect heat flow through the floor, determine rate of heat flow towards inside the chamber.

Or

Q.3 Establish that heat dissipation from a fin insulated at tip is **Qfin ={√ (PhkAc)} {to - ta} (tanh ml )** using standard equations and boundary conditions.

Q.4 Find the heat flow rate through composite wall shown in fig. conductivities of slabs A,B,C and D are 150,30,65 and 50 W/m°C respectively.



Or

Q.4 State all the three laws for Heat Transfer.