R20 Regulation *Subject code: 3P6CB*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech VI Semester Regular/Supplementary Examinations, July 2024

HEAT TRANSFER

(Mechanical Engineering)

Maximum Marks: 70 Date:22.07.2024 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

	Part-A	CO	Bloom Tx
All the following questions carry equal marks (10X2M=20 Marks)			
1	Compare steady and unsteady heat transfer.	1	II
2	What is coefficient of thermal conductivity?	1	I
3	Define efficiency of the fin.	2	I
4	Give the governing differential equation for the one-dimensional transient heat flow.	2	I
5	Mention the limitations of Dimensional analysis.	3	I
6	Sketch boundary layer development in a circular pipe.	3	II
7	Write the significance of Grashoffs number in free convection.	4	I
8	List the assumptions made during LMTD analysis.	4	I
9	Define Drop wise condensation.	5	I
10	State Stefan - Boltzmann law.	5	I
	Part-B		
Answer All the following questions. (5X10M=50Marks)			
11	A furnace wall consists of three layers. The inner layer of 10 cm thickness is made of firebrick (k =1.04W/mK). The intermediate layer of 25 cm thickness is made of masonry brick (k = 0.69 W/mK) followed by a 5cm thick concrete wall (k = 1.37 W/mK). When the furnace is in continuous operation the inner surface of the furnace is at 800°C while the outer concrete surface is at 50°C. Calculate the rate of heat loss per unit area of the wall, the temperature at the interface of the firebrick and masonry brick and the temperature at interface of the masonry brick and concrete. [10M]	1	IV
	OR		
12	Derive the heat conduction in cubical system. [10M]	1	IV
13	A 6 cm long fin made up of copper rod (k = 300 W/mK), 6 mm in diameter is exposed to an environment at 20°C. The base temperature of the rod is maintained at 160°C. The heat transfer co-efficient is 20 W/m^{2}K. Calculate the heat given by the rod and the efficiency and effectiveness of rod. [10M]	2	IV
	OR		

14	What is lumped system analysis? when is it applicable? Mention the assumptions and derive the equation for lumped system analysis in the form of Fourier and Biot number. [10M]	2	III
15	Air at 25°C flows over 1 m x 3 m (3 m long) horizontal plate maintained at 200°C at 10 m/s. Calculate the average heat transfer coefficients for both laminar and turbulent regions. Take Re (critical) = 3.5×10^5. [10M]	3	IV
	OR		
16	What are repeating variables? How are they selected for dimensional analysis in Buckingham π-theorem. [10M]	3	III
17	Explain the development of hydrodynamic and thermal boundary layer on a vertical plate in natural convection, with necessary sketches. [10M]	4	IV
	OR		
18	It is desired to use a double pipe counter flow heat exchanger to cool 3 kg/s of oil (Cp = 2.1 kJ/kgK) from 120°C. Cooling water at 20°C enters the heat exchanger at a rate of 10 kg/s. The overall heat transfer coefficient of the heat exchanger is 600 W/m^2K and the heat transfer area is 6 m^2. Calculate the exit temperatures of oil and water. [10M]	4	IV
19	A. A furnace wall emits radiation at 2000 K, treating as black body radiation, Calculate (i) Monochromatic radiation flux density at 1μm wavelength (ii) Wavelength at which emission is maximum and the corresponding emissive power (iii) Total emissive power. [7M] B. What is radiosity and irradiation? [3M]	5	IV
	OR		
20	Explain the various regimes in boiling heat transfer. [10M]	5	III