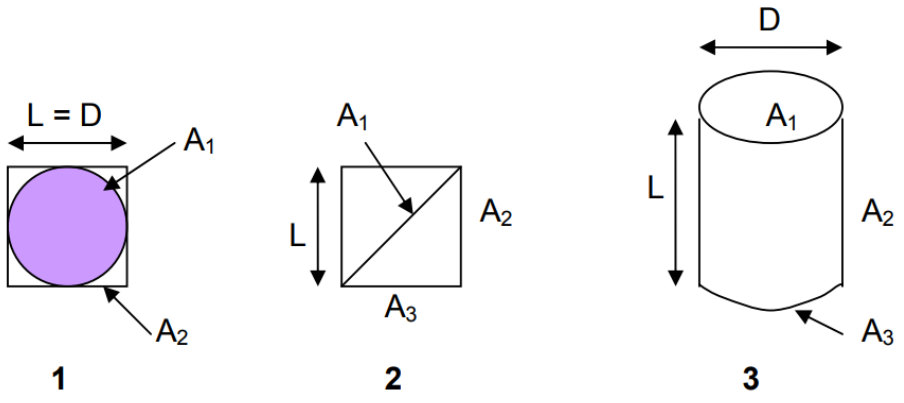
	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE **Winter Examination – 2022** **Course: B. Tech. Branch :Mechanical Engineering Semester : V** **Subject Code & Name: BTMC 501 & Heat Transfer** **Max Marks: 60 Date: 28/01/2023 Duration: 3 Hr.**		
	Instructions to the Students: *1. All the questions are compulsory.* *2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.* *3. Use of non-programmable scientific calculators is allowed.* *4. Assume suitable data wherever necessary and mention it clearly.*		
		(Level/CO)	Marks
Q. 1	**Solve Any Two of the following.**		**12**
A)	Air at 20 °C blows over a 50 cm x 75 cm hot plate at 250 °C. The film heat transfer coefficient is 25 W/m^2 .K. 300 W is lost from the plate surface by radiation. Calculate heat transfer rate and other side plate temperature. Thermal conductivity of the plate material is 43 W/m .K. The plate is 2 cm thick.	**(L3/CO1)**	**6**
B)	What is thermal conductivity? List the factors affecting the thermal conductivity.	**(L1/CO2)**	**6**
C)	An insulating powder is densely packed in the annular space between two concentric spheres with radii 75 mm and 50 mm. The inner sphere is uniformly heated with electric power input of 30 W. Steady state temp attained by the inner sphere is 120 °C and that by outer surface is 30 °C. Neglecting the thermal resistance offered by the spheres: a) Draw analogous electrical cct diagram b) Calculate thermal conductivity of the powder	**(L3/CO1)**	**6**
Q.2	**Solve Any Two of the following.**		**12**
A)	Derive an equation to find heat dissipation from an infinitely long-fin.	**(L2/CO3)**	**6**
B)	Explain in brief, initial and boundary conditions.	**(L1/CO2)**	**6**
C)	Derive general heat conduction equation for Cartesian coordinate system.	**(L1/CO1)**	**6**
Q. 3	**Solve Any Two of the following.**		**12**
A)	Write a note on a) Forced Convection b) Free Convection c) Radiation.	**(L1/CO1)**	**6**
B)	A hot rectangular plate 5 cm X 3 cm maintained at 200 °C is exposed to still air at 30 °C. Calculate percentage increase in convective heat transfer rate if smaller side of the plate is held vertical than the bigger side. Neglect ITG of the thickness. Use Correlation $Nu=0.59\ (Gr.Pr)^{0.25}$	**(L3/CO4)**	**6**

	Air properties at 115 °C: density = 0.91 kg/m^3; C_p=1.009 kJ/kg K; μ=22.65x10^{-6} N s/m^2; k=0.0331 W/m K.		
C)	Water flows at 360 kg/hr. through a metallic tube of 10 mm diameter and 3 m length. It enters the tube at 25 °C. Outer surface of the tube is maintained at a constant temp of 100 °C. Calculate the exit temp of the water. Properties of water: μ=5.62x10^{-4} kg/m s; C_p=4174 J/kg K; k=0.664W/m K. Use the following correlation: N_u =0.023$Re^{0.8}$ $Pr^{0.4}$ for turbulent flow N_u =3.66 for laminar flow	**(L3/CO4)**	**6**
Q.4	**Solve Any Two of the following.**		**12**
A)	Derive the expression for LMTD method for an analysis of parallel flow heat exchanger.	**(L2/CO5)**	**6**
B)	Write a short note on Overall Heat Transfer Coefficient for plate heat exchanger.	**(L1/CO5)**	**6**
C)	A double pipe parallel flow heat exchanger use oil (C_p = 1.88 kJ/kg.K) at an initial temperature of 205°C to heat water, flowing at 225 kg/hr. from 16°C to 44°C. The oil flow rate is 270 kg/hr. a) What is the heat transfer area required for an overall heat transfer coefficient of 340 W/m^2.K. b) Determine the number of transfer unit (NTU). c) Calculate the effectiveness of the heat exchanger.	**(L3/CO5)**	**6**
Q. 5	**Solve Any Two of the following.**		**12**
A)	Determine the view factors F12 and F21 for the following geometries:  1) Sphere of diameter D inside a cubical box of length L = D. 2) Diagonal partition within a long square duct. 3) End and side of a circular	**(L3/CO6)**	**6**

	tube of equal length and diameter, L = D.		
B)	State various shape factor relations (algebra) in radiation heat transfer.	**(L1/CO6)**	**6**
C)	Find out heat transfer rate due to radiation between two infinitely long parallel planes. One plane has emissivity of 0.4 and is maintained at 200 °C. Other plane has emissivity of 0.2 and is maintained at 30 °C. If a radiation shield (ε=0.5) is introduced between the two planes, find percentage reduction in heat transfer rate and steady state temp of the shield.	**(L2/CO6)**	**6**
	***** End *****		

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