CourseName:Heat and Mass Transfer

Course Outcome:

1. Students will be able to mathematically formulate and analyze heat transfer system by conduction mode
2. Students will be able to apply the conduction heat transfer knowledge on fins which are used in various applications
3. Students will be able to apply the knowledge of fluid flow and convection heat transfer to analyze the thermal system
4. Students will be able to analyzeradiative heat transfer system
5. Students will be able to perform thermal design of various heat exchangers

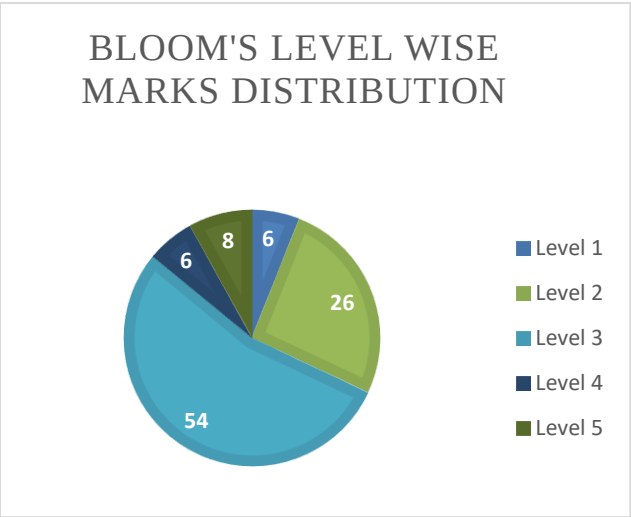
Model Question Paper
Total Duration (H:M): 3:00
Course: Heat and Mass Transfer (BMET- 501)
Maximum Marks: 100

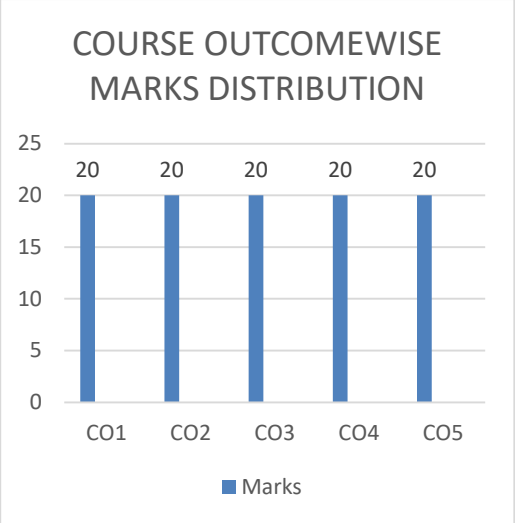
Note: (1)*Use of non-programmable scientific calculator is allowed.*

(2)*Attempt all questions.*

Q.No	Questions	Marks	CO	BL
1a)	Derive the expression for critical thickness of insulation for cylinder.	6	CO1	L3
1b)	Derive the three-dimensional general heat conduction equation in cartesian co-ordinates and reduce them as Poisson's, Fourier and Laplace equation by specifying required condition.	6	CO1	L3
1c)	A steel pipe with 50mm outer dia is covered with a 6.4 mm asbestos insulation (k=0.166 W/mk) followed by a 25 mm layer of fiber glass insulation(k=0.0485W/mk) the pipe wall temperature is 311 K. Calculate the interface temperature between the asbestos and fiberglass .	8	CO1	L5
2a)	Why fins are used and state some of its practical applications. Mention various types of fins in use.	6	CO2	L4
2b)	What is Transient heat conduction Lumped capacitance method?Discuss in detail.	6	CO2	L2
2c)	Derive the general heat conduction equation for fins of uniform cross section area and state the boundary conditions for the solutions of the governing equation for (a) Infinite long fin (b) Find with insulated tip.	8	CO2	L3

3a)	Discuss the boundary layer theory for free and forced convection in detail with diagram? Explain about different boundary layers.	6	CO3	L3
3b)	Define dimensionless numbers related to free and forced convection and also state their significance.	6	CO3	L1
3c)	A 200 W bulb of spherical shape of 7 cm dia is subjected to flow of air at 30^0C.The velocity of air is 0.4 m/s the surface temperature of bulb is 120^0C. Calculate the rate of heat transfer by convection from bulb surface. At mean temperature. $T_m = 75^0$C the properties of air are $\upsilon = 2.06x10^{-6}$ m^2/s k= 0.03 W/mK Pr = 0.7 Assume $Nu = 0.365\ Re^{0.6}\ Pr^{0.33}$	8	CO3	L3
4a)	Define Black body, total emissive power,Shape factor, Radiosity and Irradiation.	10	CO4	L2
4b)	Two large parallel plates having emissivity of 0.5 each exist at temperature of 1200K and 500K.Find (a)heat transfer rate /m^2 of the plate.(b)heat transfer rate if a radiation shield with an emissivity of 0.05 on both sides is placed between the two plates.	10	CO4	L3
5a)	Write short notes on Condensation and its types,boiling regimes andFick's law of diffusion.	10	CO5	L2
5b)	In a double pipe heat exchanger hot water flows at a rate of 5000kg/h and gets cooled from 95℃ to 65℃.At the same time 50000kg/h of cooling water at 30℃ enters the heat exchanger. The flow condition are such that overall heat transfer coefficient remains constant at 2270 W/m^2 K. Determine the heat transfer area required and effectiveness, assume parallel flow and for both the streams C_P =4.2 kJ/kgK.	10	CO5	L3





BL–Bloom'sTaxonomyLevels(1-Remembering,2-Understanding,3 –Applying,4–Analysing,5 –Evaluating,6-Creating)

CO–CourseOutcomesPO–ProgramOutcomes;PICode–PerformanceIndicatorCode