INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

ASSIGNMENT QUESTIONS
2017 - 2018

Course Name	:	**HEATTRANSFER**
Course Code	:	A60331
Class	:	III B. Tech II Semester
Branch	:	MECHANICAL ENGINEERING
Year	:	2017 – 2018
Course Coordinator	:	Mrs. N. SanthiSree, Assistant Professor, Department of Mechanical Engineering
Course Faculty	:	Mrs. N. SanthiSree, Assistant Professor Mr.S. Srikrishnan, Assistant Professor

COURSE OVERVIEW:

Heat transfer is the flow of thermal energy driven by thermal non-equilibrium, commonly measured as a heat flux, i.e the heat flow per unit time at a control surface. This course focuses on the problems and complexities of heat transfer and emphasizes on analysis using correlations. The course assumes basic understanding of thermodynamic and fluid mechanics and exposure to differential equations and methods of solutions. Topics include modes of heat transfer and their laws, boundary conditions, conduction heat transfer –three dimensional, one dimensional steady and unsteady without heat generation, variable thermal conductivity ,fin analysis, lumped heat capacity systems, free and forced convection with dimensional analysis, laminar boundary layer theory, heat exchangers, heat transfer with phase change and radiation heat transfer.

S. No	Question	Blooms Taxonomy Level	Course Outcome
	ASSIGNMENT I		
1	a) Discuss basic laws of 3 modes of heat transfer b) Derive general conduction equation in Cartesian coordinates	Remember	1
2	Derive an expression for heat transfer in fins in case of (i) Rectangular plate fin of uniform cross section (ii) insulated end.	Remember	2
3	A Hollow heat cylinder with r1=30 mm and r2=50 mm , k=15W/mK is heated on the inner surface at a rate of 10^5 W/m^2 and dissipates heat by conduction from the outer surface to a fluid at 100 ^0C with h=400 W/m^2K.Find the temperature inside and outside surfaces of the cylinder. And also find rate of heat transfer through the wall.	Understand	3
4	A Steel tube of length 20cm with internal and external diameters of 10 and 12cm is quenched from 500^0 C to 30^0C in a large reservoir of water at 10^0C it is less owing to a film of vapor being produced at the surface, and an effective mean value between 500^0C and 100^0C is $0.5kW/m^2$. The density of steel is $7800kg/m^3$ and the specific heat is 0.47kJ/kg K. Neglecting internal thermal resistance of the steel tube, determine the quenching time.	Understand	3

5	Water flows through a 20mm ID at a rate of 0.01kg/s entering at 10^0C.The tube is wrapped from outside by an electric element that produces a uniform flux of 156kW/m^2.If the exit temperature of water is 40^0C, estimate (a)the Reynolds number,(b)the heat transfer coefficient, (c)the length of the pipe needed, (d)the inner tube surface temperature at exit, (e)the friction factor, (f)the pressure drop in the tube, and (g)the pumping power required if the pump efficiency is 60%. Neglect entrance effects. Properties of water at mean temperature of 25^0C are: ρ =997kg/m^3, c_p=4180J/kgK, m=910x10^{-6}Ns/m^2 and k=0.608W/mK.	Understand	5
ASSIGNMENT-II			
1	A 50cm long fine wire of 0.02mm diameter is maintained constant at 54^0C by an electric current when exposed to air at0^0C. Find the electric power necessary to maintain the wire at 54^0C.	Understand	5
2	Estimate the power required to boil water in a copper pan, 0.35m in diameter. The pan is maintained at 120^0C by an electric heater. What is the evaporation rate? Estimate the critical heat flux	Understand	6
3	In an oil cooler, oil enters at 160^0C. If the water entering at 35^0C flows parallel to oil, the exit temperatures of oil and water are 90^0C and 70^0C respectively. Determine the exit temperatures of oil and water if the two fluids in opposite directions. Assuming that the flow rates of the two fluids and U_0 remain unaltered. What would be the minimum temperatures to which oil could be cooled in parallel flow and counter flow operations?	Understand	8
4	A brass (k=111W/mK) condenser tube has a 30mm outer diameter and 2mm wall thickness. Sea water enters the tube at 290K and the saturated low pressure steam condenses on the outer side of the tube. The inside and outside heat transfer coefficients are estimated to be 4000 and 8000W/m^2K, respectively and a fouling resistance of 10^{-4}(W/m^2K) on the water side is expected. Estimate the overall heat transfer coefficient based on inside area?	Understand	6
5	A black body emits radiation at 2000K. Calculate (i) the monochromatic emissive power at 1 μ.m wavelength,(ii) wavelength at which the emission is maintained and (iii)the maximum emissive power	Understand	2

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