Sanjay Ghodawat University, Kolhapur

2020-21

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EXM/P/09/00

Year and Program: **Final Year B. Tech.**	**School of Technology**	**Department:** **Aeronautical Engg.**
Course Code: AET403	**Course Title: Heat Transfer**	**Semester : VII**
Day : Tuesday **Date: 22.12.2020**	**End Semester Examination**	**Time:2 Hrs.** **Max Marks:50**

Instructions: 1) All Questions are compulsory.
2) Heat and Mass Transfer Data Handbook Permitted

		Marks	Bloom's Level	CO
Q.1	**Answer the following (any Two)**–			
a)	Explain the following: i) Thermal resistance ii) Thermal diffusivity iii) Fourier law of heat conduction iv) Newton's law of cooling.	8	L1	1
b)	Explain i) Convective heat transfer coefficient ii) Mixed mode of heat transfer with a sketch. The 0.5 m x 0.75 m hot plate is maintained at a temperature of 250 ^{o}C with air at 20^{o}C flowing over it with a convection heat transfer coefficient of 25 W/m^{2}K. Determine the convective heat transfer rate. The plate made of carbon steel having thermal conductivity k = 43 W/m-K has a thickness is 2 cm and looses 300 W at plate surface by radiation. Determine the inside plate temperature.	8	L3	1
c)	Explain lumped system analysis. An aluminium plate [k = 160 W/ (mK), ρ = 2790 kg/m^3, C_P = 880 J / (kgK)] of thickness 3 cm and at a uniform temperature of 225^{o}C is suddenly immersed at time t = 0 in a well stirred fluid maintained at a constant temperature T_∞ = 25^{o}C. The heat transfer coefficient between plate and fluid is 320 W / (m^{2}K). Determine time required for center of plate to reach 50^{o}C.	8	L3	1
Q.2	**Answer the following (any two) –**			
a)	Explain hydrodynamic and thermal boundary layer. Water flows through an automobile radiator at 55 ^{o}C. The radiator tube is 0.5cm inside diameter 50cm long and the velocity is 1m/sec. The surface of the radiator is at 25 ^{o}C. Determine the convective heat transfer coefficient and also heat transfer rate.	8	L3	2

b)	Explain Indirect contact and direct contact type Heat Exchangers with figures. A counter flow concentric tube heat exchanger is used to cool engine oil having specific heat $Cp = 2130\ J/kg\ K$ from 160°C to 60°C. The cooling medium used being water flows at the rate of $2\ kg/s$ through a tube of inside diameter 0.5 m while oil flows at the rate of $2\ kg/s$ through outer annulus having diameter $0.7\ m$. What should be the length of the heat exchanger required in order to meet its cooling requirement, when the value of the overall heat transfer coefficient is 250 $W/m^{2^o}C$.	8	L3	3
c)	Explain Multi-Pass Heat Exchanger Arrangements and correction factor. A two shell pass, four tube pass heat exchanger with flow arrangement as water on the shell side and brine on the tube side. Water is cooled from 18°C to 6°C with brine entering at -1°C and leaving at 3°C. The overall heat transfer coefficient is 600 W/m^{2o}C. Calculate the heat transfer area required for a design heat load of $Q = 24000\ W$.	8	L3	3

Q.3 Answer the following (any two) –

a)	Discuss i) Absorptivity, reflectivity and transmissivityii) Diffuse radiation surfaceiii) Emissive power iv) Monochromatic emissive power v) Gray surface vi) Emissivity	9	L2	4
b)	Explain i) Altitude angle and Azimuth angle ii) Aerodynamic heating iii) Thermal protection system.	9	L2	5
c)	Explain i)Slender body and blunt body configurationsof ballistic reentry designwith sketches and ii) Combustion chamber design.	9	L2	5

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