Printed Pages: 4 **AG/EAG-404**

(Following Paper ID and Roll No. to be filled in your Answer Books)	
Paper ID : 180416	**Roll No.**

B.TECH.

Theory Examination (Semester-IV) 2015-16

HEAT AND MASS TRANSFER

Time : 3 Hours ***Max. Marks : 100***

Note: **(i)** **All symbols have usual meaning.**

(ii) Assume any relevant data, if missing.

Section-A

1. Attempt all questions. All questions carry equal marks. (2×10 = 20)

(a) State Fourier's law of conduction.

(b) What is coefficient of Thermal conductivity?

(c) What is the difference between free convection and forced convection?

(d) Give examples of use of fins in various engineering applications.

(e) Give examples for free convection.

(f) What is LMTD?

(g) Define the terms reflectivity, transmissivity and absorptivity.

(h) What do you mean by black body and opaque body?

(i) State Planck's distribution law.

(j) What is Convective mass transfer?

Section-B

2. Attempt any five questions. All questions carry equal marks. (10×5 = 50)

(a) Discuss Electrical analogy of Heat conduction.

(b) Derive the energy equation for the laminar boundary layer on a flat plate? What assumptions are involved in the derivation of this equation?

(c) For a counter flow heat exchanger, derive an equation of NTU effectiveness.

(d) Explain the different modes of heat transfer with appropriate expressions.

(e) State and prove Kirchhoff's law.

(f) Explain the following :

(i) Stefan-Boltzmann law

(ii) Geometric configuration factor

(g) A thin metal radiation shield is inserted into two large parallel plates. The radiation shield is equally large parallel to each of the plates. The emissitivities of the outer planes are 0.5 and 0.75 respectively whereas the emissivity of shield surfaces is 0.1. Find the percentage reduction in radiation due to introduction of shield.

(h) Derive an expression for the Logarithmic Mean Temperature Difference for the flow in a counter flow heat exchanger.

Section-C

Attempt any two questions. All questions carry equal marks. (15×2 = 30)

3. (a) Explain briefly the concept of critical thickness of insulation and state any two applications of the same. (7)

(b) A hollow sphere has an inside surface temperature of 40°C and outside surface temperature of 40° C.

Assuming k=15 W/mK of the sphere, calculate the heat loss by conduction for an inside diameter of 5 cm and outside diameter of 20 cm. (8)

4. (a) What is Newton's Law of cooling by convection? What is the physical significance of the following non-dimensionless number in convective heat transfer?

(i) Reynolds number

(ii) Nusselt number

(iii) Grashoff number (8)

(b) A longitudinal copper fin (k= 3.5 W/mK) 6 cm long and 5 mm in diameter is exposed to air stream at 20° C. The convection coefficient is 20 W/m^{2}K. If the fin has a base temperature of 150° C, calculate the heat transfer by the rod and fin efficiency. (7)

5. (a) Give the classification of heat exchangers along with applications. (7)

(b) State and explain Flick's Law of diffusion. List its limitations. (8)