INDAIN MARITIME UNIVERSITY
(A Central University, Government of India)
END SEMESTER EXAMINATIONS – DECEMBER 2018
B. Tech (Marine Engineering)
Semester – III
Applied Thermodynamics – II (UG11T3303)

Date: 02.01.2019 Maximum marks: 100
Time: 3hrs Passing marks : 50

PART – A

All Questions are compulsory

Q.1. **10 x 3 = 30 Marks**

a) Define stoichiometric Air Fuel Ratio and Excess Air.

b) Define the term Free Convection and Forced Convection.

c) Which of the arrangement of heat exchanger is better- parallel flow or counter flow. Explain the reason.

d) What is nozzle efficiency? What is the theoretical velocity at the exit of the nozzle?

e) What is Fourier Law? Why does the Fourier Law has a negative sign?

f) What is thermal resistance? Explain with an example.

g) Write down three combustion equations.

h) Explain the term LMTD.

i) What does a Mach number signify?

j) What is Newton's Law of cooling?

PART –B

Attempt any five Questions 14 x 5 = 70 Marks

2. The product of combustion of an unknown hydrocarbon C_xH_y have the following composition as measured by an Orsat Apparatus. CO_2= 8.0%, $CO^=$ 0.9% O_2= 8.8% and N_2= 82.3%. Determine (a) The composition of the fuel (b) The Air fuel ratio (c) The percentage of excess air used (14)

3. a) What is stagnation State? What do you mean by stagnation properties? (6)

b) Air at 8.6 bar and 190°C expands at the rate of 4.5 kg/sec through a convergent Divergent nozzle into a space at 1.03 bar. Assuming that inlet velocity is negligible, calculate the throat and exit cross sectional areas of the nozzle. (8)

4. a) Dry saturated steam at a pressure of 11 bar enters a convergent-divergent nozzle and leaves at a pressure of 2 bar. If the flow is adiabatic and frictionless, determine (a)The exit velocity of steam (b)Ratio of cross section at exit and at throat. (8)

b) What is overall heat transfer co-efficient? How will you find its value when heat is flowing from liquid A to liquid B through a dividing wall of thickness 'x'? (6)

5. a) Derive an expression for heat transfer through a hollow cylinder. (6)

b)A furnace wall is composed of 220 mm of fire brick 150 mm common brick, 50 mm magnesia, 3 mm steel plate outside. If the inside surface temperature is 1500°C and outside surface temperature is 90°C, estimate the temperature between the layers and calculate heat loss in KJ/h-m^2 assume K for fire brick = 4 KJ/m-h-°C, K for common brick = 2.8 KJ/ m-h-°C, k for magnesia = 0.24 KJ/m-h-°C and K for steel = 240 KJ/m-h-°C. (8)

6. a) At a certain time, the temperature distribution in a long cylindrical fire tube of inner radius 30 cm and outer radius 50 cm is given by $t = 800 + 1000r - 5000r^2$, where 't' is in degree centigrade and 'r' is in m. The thermal conductivity of the tube material is 58 W/m-K. Find the rate of heat flow at inside and outside surfaces per unit length. (8)

b) Explain Prandtl Number and Nusselt Number. (6)

7. a)A mild steel tank of wall thickness 10 mm contains water at 90°C when the atmospheric temp. is 15°C. The thermal conductivity of mild steel is 50W/mK and the heat transfer co-efficient for the inside and outside of the tank are 2800 and 11 W/m^2K. Calculate (a) rate of heat loss per unit area of tank surface, (b) The temp. of the outside surface of the tank. (8)

b) Explain black body radiation and thermal radiation. (6)

8. a) Derive an expression for LMTD. (6)

b) Exhaust gases flowing through a tubular heat exchanger at the rate of 0.3 kg/sec are cooled from 400°C to 120°C by water initially at 10°C. The specific heat capacities of exhaust gases and water may be taken as 1.13 and 4.19 KJ/kgK respectively and overall heat transfer co-efficient from gases to water is $140 W/m^2K$. Calculate the surface area required when the cooling water flow is 0.4 kg/sec. (a) for parallel flow (b) for counter flow. (8)

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