GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

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Registration No:

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M.TECH 3rd SEMESTER REGULAR EXAMINATIONS, NOV / DEC 2019

MTEPE3011 – BOILING, CONDENSATION AND TWO-PHASE FLOW

(Thermal Engineering)

Time: 3 Hours **Max Marks : 70**

PART-A **(10 X 2=20 MARKS)**

1. Answer the following questions.

a) Explain pool boiling crisis

b) Give the correct order of the flow regimes as observed in horizontal flow boiling phenomenon. 1. Bubbly flow 2. Droplet flow 3. Annular flow 4. Slug flow 5. Single phase liquid 6. Single phase vapor.

c) How is pool boiling different from flow boiling?

d) What Eckert number.

e) Show the momentum and thermal boundary layers for natural convection on a vertical plate.

f) Why higher heat transfer coefficient is generally associated with drop wise condensation than with film condensation?

g) Pressure drop calculations in two phase flow

h) Explain briefly the physical mechanism of boiling

i) What is the importance of critical heat flux?

j) What is the stability of laminar flow

PART-B **(5 X 10=50 MARKS)**

Answer any five questions from the following.

2. a	Explain briefly the different condition of Finite Bubble Clouds	**5**
b	Describe the types of boiling with proper diagram.	**5**
3. a	An operator working in a petroleum industry supervises a gas-liquid vertical column having liquid and gas viscosities as 95.6×10^{-6} Ns/m2 and 19×10^{-6} Ns/m2. Using McAdams correlation he found out homogeneous viscosity as 2.96×10^{-5} Ns/m2. What is the average quality of the pipeline, he is handling.	**5**
b	Consider the Newtonian film flow inside a tube of 2.5 cm diameter, when water flow rate is 0.5 kg/s. Take liquid and gas densities as 1000 kg/m^3 and 1.2 kg/m^3, respectively. Viscosity of liquid is 0.001 kg/m-s. Find the wall shear stress using falling film theory.	**5**
4. a	A wire of1 mm diameter and 150 mm length is submerged horizontally in water at 7 bar. The wire carries a current of 131.5 A with an applied voltage of 2.15 V. if the surface of the wire is maintained at 180^{0}C calculate the heat flux and boiling heat transfer coefficient.	**5**
b	A nickel wire of 1.5 mm diameter and 500 mm long , carrying current ,is submerged in a water bath which is open to atmospheric pressure. Calculate the voltage at the burnout point if at this point the wire carries a current of 200 A.	**5**
5.a	A vertical tube of 50 mm outside diameter and 2 m long is exposed to steam at atmospheric pressure. the outer surface of the tube is maintained at a temperature of 84^{0}C by circulating cold water through the tubes. Determine (i) The rate of heat transfer to the coolant and (ii) the rate of condensation of steam.	**5**
b	A horizontal tube of outer diameter 25 mm is exposed to dry steam at 100^{0}C. the tube surface temperature is maintained at 84^{0}C by circulating water through it. Calculate the rate of formation of condensate per meter length of the tube.	**5**
6.a	Derive the energy equation in the thermal boundary layer in laminar flow over a flat plate.	**5**
b	A metal-clad heating element is of 8 mm diameter and of emissivity 0.95.The element is horizontally immersed in water bath. The surface temperature of the metal is 260^{0}C under steady	**5**

state boiling conditions. Calculate the power dissipation per unit length for the heater if water is exposed to atmospheric pressure and is at uniform temperature.

7. Consider the droplet annular flow of air and water inside a vertical tube of 20mm diameter.the volumetric flow rate of corresponding liquid and gaseous phases are $0.004m^3/s$ and $0.006m^3/s$ respectively. calculate the flow rate of droplets entrained inside the gaseous core. **10**

8. Write short notes on

a Drift Flux **5**

b Flow Regimes **5**

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