d) Explain the following terms:

i) Regimes of pool boiling

ii) Gray surface, black surface

OR

Explain the following terms:

i) Nusselt theory for film wise condensation

ii) Shape factor

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Roll No .....

ME-605

B.E. VI Semester

Examination, June 2016

Heat and Mass Transfer

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each questions are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

v) Assume missing data suitably, if any.

vi) Draw neat and clean sketches/diagram/figures wherever required.

1. a) Define thermal diffusivity and thermal resistance.

b) State Fourier's law Newton's law.

c) Discuss the three modes of heat transfer with examples.

d) Derive Fourier heat conduction equation. State its form in cylindrical and rectangular co-ordinates.

OR

Air at 27°C blows over hot plate 50 × 70cm maintained at 270°C. The convection heat transfer coefficient is 25W/m^2. °C Calculate the heat transfer. Assuming the plate is 2cm thick and that 300W is lost from plate surface by radiation, calculate the inside plate temperature.

2. a) Define the term fin efficiency. Write formula for various types of fins for efficiency.
   b) State brief about transient and periodic conduction in fins.
   c) Write the errors in measurement of temperature in a thermometer well.
   d) What is utility of extended surfaces? For a constant cross-sectional area fin, obtain the temperature distribution and total heat flow rate under steady state conditions when one end of the fin is attached to a body at high temperature and the other end is insulated.

OR

A fin K = 29 w/mk, in the form of a blade is a 60mm long, 500m^2 cross section and 120mm perimeter. The temperature of the root of the fin is 480°C and it is exposed to ambient conditions of 200°C. The fin coefficient is 320 W/m^{2}K. Determine the temperature at the middle of the blade, the rate of heat flow from the blade. Assume negligible heat loss from the tip of the fin.

3. a) Compare free and forced convection.
   b) State the applications of dimensional analysis.
   c) Write the Buckingham pie theorem.
   d) Air at a pressure 6 kN/m^2 and a temperature of 270°C flows over a flat plate of 3mm wide and 1000mm long at a velocity of 8 m/s. If the plate is to be maintained at a temperature of 75°C. Estimate the rate of heat to be removed continuously from the plate.

OR

Dry saturated steam at atmospheric pressure condense on the surface of a horizontal tube of 35mm diameter What should be the surface temperature of the tube if th rate of heat flow is required to be 6 × 10^4 W/m^2? Als determine the heat transfer coefficient under thes conditions.

4. a) State the classification of heat exchangers.
   b) What is Fick's law of mass transfer?
   c) What is meant by fouling factor? How does it affect th performance of a heat exchanger?
   d) Derive the expression for LMTD of a parallel flow hea exchanger.

OR

Show the temperature variation along the length of hea exchanger when:

   i) Hot and cold fluids flow in parallel and counter flow fashion.
   ii) Hot fluid as used for evaporating another liquid.
   iii) Steam condenses on the outside of a condenser tube with water flowing inside the tube as a coolant.

5. a) Define the terms: absorption, transmission and reflection
   b) What is Plank's distribution law? State its applicability.
   c) Compare film wise and drop wise condensation.