JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD M. Tech II Semester Examinations, February - 2017

CONVECTIVE HEAT TRANSFER

(Thermal Engineering)

Time: 3hrs

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Max.Marks:75

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1.4.

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

What are the advantages of non-dimensionalizing the convection equations? 1.a) [5]

Write any five empirical correlations for forced convection. b) [5]

What is natural convection? How does it differ from forced convection? What force causes natural convection currents?

What is the approximate criterion for transition to turbulence in a free convection boundary layer? [5]

What is Prandtl number? How Prandtl number is useful in heat transfer. e) [5]

PART – B $5 \times 10 \text{ Marks} = 50$

What is a similarity variable and what is it used for? For what kinds of functions can we 2.a) expect a similarity solution for a set of partial differential equations to exist?

Engine oil at 60°C flows over the upper surface of a 5m long flat plate whose b) ...temperature is 20°C with a velocity of 2m/sec. Determine the total drag force and the rate of heat transfer per unit width entire plate.

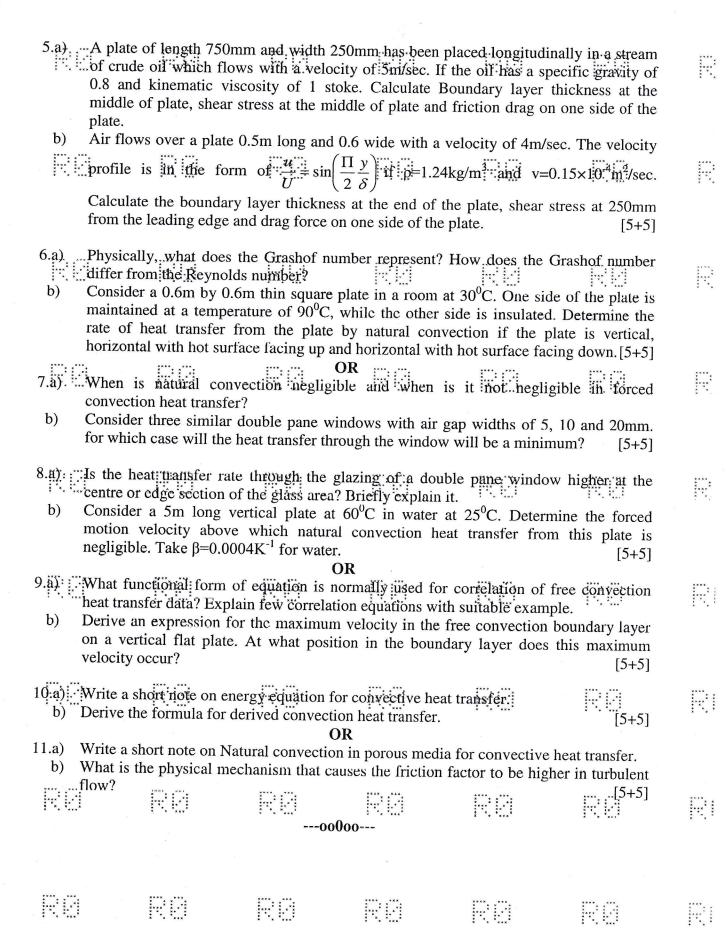
What is external forced convection? How does it differ from internal forced 3.a) convection? Can a heat transfer system involve both internal and external convection at the same time?

Consider a 5cm diameter shaft rotating at 2500 rpm in a 10cm long bearing with a clearance of 0.5mm. Determine the power required to rotate the shaft if the fluid in the gap is air, water and oil at 40°C at 1 atm.

If velocity distribution in laminar boundary layer over a flat plate is assumed to be 4.a) given by second order polynomial u=a+by+cy². Determine its form using the necessary boundary conditions.

boundary conditions.

Air is flowing over a flat plate 5m long and 2.5m wide with a velocity of 4m/sec at 15°C. If ρ =1.208kg/m³ and v=1.47×10⁻⁵m²/sec. Calculate the length of plate over which the boundary layer is laminar and thickness of the boundary layer (laminar), shear stress at the location where boundary layer ceases to be laminar. [5+5]



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