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Reg. No. : .....

Name : .....

IV Semester B.Tech. Degree Examination, June 2016
(2013 Scheme)
13.404 : FLUID MECHANICS – II (C)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions :

I. a) Write a note on velocity distribution in open channels.
b) Differentiate between positive surges and negative surges.
c) Explain the characteristics of laminar and turbulent boundary layers.
d) Explain scale effect in model studies.
e) Explain 'Cavitation' in turbines. **(5×4=20 Marks)**

PART – B

Answer **one full** question from **each** Module.

Module – I

II. a) A rectangular channel 6m wide and 1m deep has a slope of 1 in 900 and is lined with smooth concrete plaster (n = 0.012). It is required to increase the discharge to a maximum by changing the dimensions of the channel but by keeping the same amount of lining. Compute the new dimensions and percentage increase in discharge. 12
b) Show that the most economical trapezoidal channel is half of a regular hexagon. 8

OR

III. a) A rectangular channel has a width of 1.8 m and carries a discharge of 1.8 m^3/sec. Calculate the critical depth, minimum specific energy and depth alternate to a given depth of 0.2 m. **10**

b) In a hydraulic jump developed in a horizontal rectangular channel, the initial Froude number and energy loss are 8.5 and 5 respectively. Compute the sequent depths, critical depth and discharge intensity. **10**

Module – II

IV. a) A short reach of a 2m wide rectangular open channel has its bed level rising in the direction of flow at a slope of 1 in 10000. It carries a discharge of 4 m^3/sec and its Manning's n is 0.01. At a certain section, the flow depth was measured to be 0.5 m. Compute the rate of change of water depth with distance. Assume g = 10 m/sec^2. **10**

b) A very wide rectangular channel carries a discharge of 8 m^3/sec/m width. The channel has a bed slope of 0.004 and Manning's n = 0.015. At a certain section of the channel, the flow depth is 1m. At what distance from this section, the flow depth will be 0.9m ? Use direct step method employing single step. **10**

OR

V. a) In a wide tidal river, the velocity is 0.75 m/sec and depth of flow is 1.3 m. If a tidal bore is observed to be moving upstream with a velocity of 4 m/sec, determine the velocity and depth of flow after the bore has passed. **10**

b) A 2m wide rectangular channel has a flow with a velocity of 2 m/sec and depth of 1.3 m. The rate of flow at upstream is suddenly increased to an extend that the depth is doubled in magnitude. Estimate the absolute velocity of the resulting surge and the new discharge. **10**

Module – III

VI. a) Explain the phenomenon of boundary layer separation and the different methods to control it. **10**

b) A smooth flat plate 2m wide and 2.5 m long is towed in oil (relative density 0.8) at a velocity of 1.5 m/sec along its length. Find the boundary layer thickness at the trailing edge of the plate and power required for towing the plate. Assume kinematic viscosity of oil as 1 stokes. **10**

OR

VII.a) Assuming that the rate of discharge of a centrifugal pump is dependent on the mass density ρ of fluid, pump speed N (rpm), diameter of impeller D, the pressure p and the viscosity of fluid μ, show using Buckingham's π -theorem that it can be represented by $Q = ND^3\phi\left(\left(\frac{gH}{N^2D^2}\right),\left(\frac{\nu}{ND^2}\right)\right)$ where H is the head and ν is the kinematic viscosity of fluid. 10

b) Explain Froude's model law and its practical significance. 4

c) Explain geometric, kinematic and dynamic similarity. 6

Module – IV

VIII. a) A Francis turbine runner is to be designed for the following data : Net head (H) = 60 m, shaft power = 367.8 kW, speed = 600 rpm, hydraulic efficiency = 85%, overall efficiency = 80%, flow ratio 0.5, breadth ratio = 0.1. Assume the inner diameter as one half the outer diameter. The velocity of flow is constant throughout and discharge is radial. Neglect vane thickness. 14

b) Explain draft-tube theory. 6

OR

IX. a) A centrifugal pump has an impeller having outer diameter of 0.5 m. It discharges at a rate of 8000 l/minute against a head of 8.5 m when running at 600 rpm. The water enters the impeller without whirl and shock. The inner diameter is 0.25 m and vanes are set back at outlet at an angle of 45°. The area of flow is constant from inlet to outlet of the impeller and is 0.06 m^2. Determine (a) manometric efficiency of pump (b) vane angle at inlet and (c) least speed at which the pump commences to work. 12

b) Explain (i) Net positive suction head (ii) Priming of centrifugal pumps. 8
