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Reg. No. : .....

Name : .....

Fourth Semester B.Tech. Degree Examination, May 2013
(2008 Scheme)
Branch : Civil
08.404 : FLUID MECHANICS – II

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions.

I. a) Show that the minimum specific energy (E_{min}) and critical depth (Y_c) for a given discharge in a triangular channel are related as $E_{min} = 1.25\ Y_c$.

b) Explain the different factors affecting Manning's roughness coefficient.

c) What is 'specific force' ? Explain the characteristics of a specific force curve.

d) Explain the VSBR classification of hydraulic jumps.

e) What are the functions of 'surge tanks' ? Sketch the different types of surge tanks.

f) Show that the maximum efficiency of a jet striking a single plate moving in the direction of the jet is 8 /27.

g) Explain with a neat sketch, the working of a centrifugal pump.

h) What is suction specific speed of a turbine ? Obtain a relation connecting suction specific speed and Thoma's cavitation factor, for turbines.

(8×5=40 Marks)

PART – B

Module – I

II. a) A lined channel (n = 0.014) is of trapezoidal section with one side vertical and other side with a slope 1.5 H:IV. If the channel is to deliver 9 m^3/sec when laid on a slope of 0.0002, calculate the dimensions of the efficient section which requires minimum lining. 10

P.T.O.

b) In a flow through a rectangular channel for a certain discharge, the Froude numbers corresponding to the two alternate depths are F_1 and F_2. Show that these Froude's number values are related as $\left(\frac{F_2}{F_1}\right)^{2/3} = \frac{\left(2+F_2^2\right)}{\left(2+F_1^2\right)}$. 10

OR

III. a) Show that the head loss in a hydraulic jump formed in a rectangular channel may be expressed as : $\Delta E = \frac{(V_1 - V_2)^3}{2g(V_1 + V_2)}$, where V_1 and V_2 are the velocity of flow just before or after the jump. 10

b) In a hydraulic jump occurring in a horizontal rectangular channel, the energy loss and Froude number after the jump are 9.00 and 0.12 respectively. Estimate the initial depth and discharge intensity. 10

Module – II

IV. a) A very wide rectangular channel carries a discharge of 8 m^3/sec per m width. The channel has a bed slope of 0.004 and Manning's roughness coefficient 0.015. At a certain section of the channel, the flow depth is 1m. What gradually varied flow profile exist at this section ? At what distance from this section the flow depth be 0.9 m ? Use direct step method employing single step. 14

b) A model of an open channel is built to a scale of 1/100. If the model has Manning's n = 0.023, to what value of prototype roughness coefficient would this correspond ? 6

OR

V. a) The efficiency 'η' of a propeller depends on density 'ρ', dynamic viscosity 'μ' of fluid, angular velocity 'ω', diameter 'D' of the rotor and discharge Q. Express 'η' in terms of dimensionless parameters using Buckingham's π-theorem. 10

b) Water stands for a depth of 2.8 m on the upstream side and 0.3 m on the downstream side of a sluice gate. The velocity of flow at upstream is 0.75 m/sec. Assuming the channel is a rectangular one and neglecting the frictional force at the channel bottom, estimate the force acting on the gate per m width. 10

Module – III

VI. a) An inward flow reaction turbine discharges radially and the velocity of flow is constant and equal to the velocity of discharge from the turbine. Show that the hydraulic efficiency (η_n) can be expressed by : $\eta_n = \dfrac{1}{\dfrac{1+0.5\tan^2\alpha}{\left(1-\dfrac{\tan\alpha}{\tan\theta}\right)}}$. **10**

b) A reaction turbine works at 450 rpm under a head of 115 m. The diameter of the intet is 1.2 m and flow area is 0.4 m^2. At inlet the absolute and relative velocities makes angles of 20° and 60° respectively with the tangential velocity. Determine the power developed and hydraulic efficiency. Assume velocity of whirl at outlet to be zero. **10**

OR

VII. a) A centrifugal pump delivers water against a net head of 10 m at a design speed of 1000 rpm. The vanes are curved backwards and makes 30° with the tangent at outer periphery. The impeller diameter is 30 cm and has a width of 5 cm at the outlet. Determine the discharge of the pump of manometric efficiency is 95%. **10**

b) A pump operates at a maximum efficiency of 82% and delivers 2.25 cumec under a head of 18 m while running at 3600 rpm. Compute the specific speed. Assuming the efficiency is same for all speeds determine the discharge, head and power input to the pump at a shaft speed of 2400 rpm. **10**