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S.E. (Civil) (Part - II) (Semester - IV) Examination, December - 2014

FLUID MECHANICS - II (Revised)

Sub. Code : 43590

Day and Date : Monday, 01 - 12 - 2014 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **Question Nos. 1 and 5 are compulsory.**
2) **Attempt any other two questions from each section.**
3) **Assume any other data, if necessary.**
4) **Figures to the right indicate full marks.**

SECTION - I

Q1) a) Draw specific energy curve and specific force curve. What is the significance of these curves? **[5]**

b) A municipal sewer has vertical walls 1m apart and a semicircular invert. The centre of the invert is at 0.8 m below the surface level of channel and is laid at a bed slope of 1 in 2500. Compute the discharge. Take C = 66. **[5]**

c) A weir is constructed across a very wide rectangular river carrying discharge of $5m^3/s/m$ width, which has normal depth of flow 3.0 m & bed slope 0.0005. Estimate the length of GVF profile between depths 4.5 m and 3.5 m. Take n = 0.035 **[5]**

d) What are different types of notches & weirs? Compare them. Draw sketches. **[5]**

Q2) a) A lined rectangular channel with n = 0.015 is 5m wide and has depth of flow 2m with bed slope of 1 in 1600. Retaining the shape & area of flow of channel, to what maximum extent the discharge can be increased without changing the slope? **[5]**

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b) Find critical depth and minimum specific energy of flow with discharge $5m^3/s$ in [5]

i) A rectangular channel of base width 2.5m.

ii) A triangular channel with side slopes 1:1

c) Derive the dynamic equation of GVF. What are the assumptions made? What is the significance? [5]

Q3) a) A wide rectangular channel has a change in bed slope from mild slope of 1:2500 to a steep slope of 1:100. The channel carries a discharge of $16m^3/s/m$. Find the depths of flow in the mild & steep reaches. Sketch and classify the surface profiles. Take n = 0.01. [5]

b) Classify the types of hydraulic jumps according to initial Froude No. Draw sketches. Mention the % loss of energy in each type. [5]

c) A horizontal rectangular channel 5.0m wide carries a discharge of $20m^3/s$. If initial depth of flow is 0.5 m, determine whether a jump will occur or not. If yes, determine sequent depth of jump, length of jump and power lost in jump. [5]

Q4) a) For a very wide rectangular channel carrying discharge 5.0 $m^3/s/m$ & laid on bed slope 1 in 2500, find the length of GVF profile between critical depth and 99% of normal depth if there is sudden drop. Take n = 0.03. Draw sketch. [5]

b) Draw a neat sketch of an ogee spillway and mention its hydraulic characteristics. [5]

c) A rectangular weir is provided to control the flow of water from a reservoir. The length of the weir is 10.0 m & $C_d = 0.62$. Determine the time required to reduce the water level from 101.2 to 100.6 m. The crest level of the weir is 100.0 m and area of the reservoir is 4.7 hectares. Derive the equation used. [5]

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i) A rectangular channel of base width 2.5m.

ii) A triangular channel with side slopes 1:1

c) Derive the dynamic equation of GVF. What are the assumptions made? What is the significance? [5]

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SECTION - II

Q5) Attempt any four : [4× 5]

a) Define : nominal thickness of Boundary layer and obtain the expressions for displacement thickness of BL and momentum thickness of BL.

b) What are the common pump troubles and their remedies?

c) Experiments were conducted in a wind tunnel with an airstream of velocity 15 m/s on a flat plate 0.8 × 0.8 m. The density of air was 1.16kg/m^3. For the plate kept inclined (to the direction of air stream) the coefficients of lift and drag were 0.72 and 0.14 respectively. Determine the forces of lift and drag, and the power exerted by the air stream on the plate.

d) What is laminar sublayer? Explain the terms : hydrodynamically smooth and rough surfaces.

e) Determine the capacity of CF pump and the motor for the following installation.

i) discharge : 30 lps,

ii) delivery head : 10 m

iii) suction head : 2 m

iv) head loss in delivery pipe : 5 m

v) head loss in suction pipe : 2 m

vi) efficiency of pump : 60%

vii) efficiency of motor :90%

Q6) a) A jet of water 35 cm in diameter at a velocity of 4m/s strikes a plate at an angle of 60°. What thrust is exerted normal to the plate? How the discharge is divided? **[6]**

b) With neat sketch explain the characteristic curves of a centrifugal pump. **[6]**

c) Explain the phenomenon of cavitation in fluid machinery. **[3]**

Q7) a) A jet of 40 mm diameter and velocity 20 m/s strikes tangentially on a smooth curved vane which deflects the jet through an angle of 120°. Calculate the thrust when,

i) The axis of symmetry of the vane is horizontal and

ii) The tangent of the inlet tip is horizontal.

Also find the thrust when vane is moving with 10 m/s in the horizontal direction. **[6]**

b) Explain with suitable sketch the working of Pelton wheel. **[9]**

Q8) a) The internal and external diameter of the impeller of a centrifugal pump are 20 cm and 40 cm respectively. The pump is running at 1200 rpm. The vane angles of impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Draw inlet and outlet velocity triangles and Determine work done by impeller. **[9]**

b) Explain in brief classification and selection criterion of turbine. **[6]**