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**S.E. Civil (Part - II) (Engineering) (Semester - IV)
Examination, 2013**

FLUID MECHANICS - II

Sub. Code : 43590

Day and Date : Thursday, 23 - 5 - 2013

Time : 10:00 a.m. to 1:00 p.m.

Total Marks : 100

- Instructions :**
- 1) Q. No. 1 and Q. No. 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.

Q1) Attempt any four:

- a) Compare the discharge through a semi circular channel of dia 4 m with that of a rectangular channel 3 m wide, both running full and having the same cross sectional area. Both the channels may be assumed to have same gradient and of same nature of surfaces.
- b) With neat sketch explain the characteristics of specific energy curve.
- c) A rectangular channel of 3m wide has a discharge of 60 cumecs.. If the Froude number is 0.6 find the depth of flow in the channel. What will the specific energy of flow ? Also calculate critical depth of flow and minimum specific energy.
- d) Explain under what conditions a hydraulic jump can occur. Justify your answer with suitable example with a neat sketch.
- e) Obtain an expression for the discharge over a triangular notch.

[20]

- Q2) a)** A trapezoidal channel is 5 m wide at bottom and has side slopes of 0.5 horizontal : 1 vertical .The bed slope of the channel is 0.0003. Find the discharge of the most economic section. Assume manning's coefficient as 0.02

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- b) A cement lined rectangular channel 6 m wide carries water at a rate of 11.25 cumecs. Assuming Manning's constant as 0.012 calculate (i) the slope required to maintain a depth of 1.2 m, (ii) the slope required to maintain the depth of 0.30 m and (iii) types of flow when depth is 1.20 m and 0.30 m
- d) Write a short note on: Cippoletti weir.

[5 × 3 = 15]

- Q3) a) A wide rectangular channel conveys a discharge of 5 cumecs per meter width with a bed slope of 1:3600 and Manning's $n=0.02$. If the depth at the section is 3.50 m determine how far upstream or down stream of the section the depth would be within 5% of the normal depth. Also state the type of surface profile. [9]
- b) With neat sketch give characteristics of M-1 and S-2 types of surface profiles in gradually varied flow. [6]

- Q4) a) Water is flowing non uniformly through a rectangular channel of 3 m width at a rate of 9.72 cumecs. At a particular section of the channel, the depth of flow is 0.8 m. Determine whether a hydraulic jump will occur, and if so find its height. Also find the loss of energy and power lost in kW the hydraulic jump.
- b) a sharp edged rectangular notch 30 cm long is to be used for gauging a discharge estimated to be 20 liters per second. Find the percentage error in computing discharge that would be introduced by an error of 1 mm in observing the head over the notch Take $c_d = 0.623$. Prove the formula used.
- c) Give advantages of triangular notch over rectangular notch.

[5 × 3 = 15]

Q5) Attempt any four from the following:

- a) Derive the expression for the hydrodynamic force acting on a curved moving semicircular plate due to impact of jet at the centre.
- b) Draw a neat sketch of Francis turbine and explain the function of each component part.
- c) Give detailed classification of pumps along with their suitability.
- d) Explain the concept of boundary layer with the help of flow over flat plate.
- e) What do you understand by terms Drag & Lift? State their mathematical expressions and meaning of each term.

[5 × 4 = 20]

- Q6) a) A jet of water strikes series of semicircular curved vanes at the center. Find work done per second. Following is the data.
Velocity of jet = 20 m/s, Diameter of jet = 5cm. Velocity of vane is half the velocity of jet. [5]
- b) Draw & explain the function of draft tube. What are the types? [5]
- c) Write a note on performance characteristic curves of turbines. [5]
- Q7) a) What are common pump troubles and their remedies. [5]
- b) It is required to deliver 25 lps of water to a height of 20 m through 150 mm diameter and 150 m long pipe by a centrifugal pump. If overall efficiency is 80% and coefficient of friction is 0.045 for the pipe, find the power required to drive the pump. [5]
- c) Explain with neat sketch the separation of Boundary layer. What are the affecting factors. [5]
- Q8) a) For the following velocity distribution in the boundary layer on flat plate, find displacement thickness, momentum thickness and energy thickness.
$$u/U_0 = \frac{1}{2}(y/\delta)$$
 [5]
- b) State and explain Stoke's law. [5]
- c) a In a test section of a wind tunnel a flat plate of 9m × 1.5m. is kept in stream of air having velocity equal to 60 kmph. Find lift, drag and resultant force. Also find angle and power required to hold the plate in position.
Given $\rho_{\text{air}} = 1.15 \text{ kg/m}^3$, $C_D = 0.15$, $C_L = 0.75$ [5]

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