

B.Tech-VIEP CIVIL ENGINEERING**Term-End Examination****June, 2013****BICE-025 : HYDRAULICS AND HYDRAULIC MACHINES***Time : 3 Hours**Maximum Marks : 70**Note : (i) Answer **any seven** questions.**(ii) Answers to be given in English only.**(iii) Use of calculator is permitted.*

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1. (a) What is the relation between Manning's constant and Chezy's constant. 2
 - (b) Differentiate between the following : 6
 - (i) Laminar and Turbulent flow
 - (ii) Critical and super critical flow
 - (iii) Steady and unsteady flow
 - (c) What is meant by economical section of a channel ? 2
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2. (a) Find the rate of flow of water through a V -shaped channel having total angle between the sides as 60° . Take the value of $C = 50$ and side slope of the bed 1 in 1500. The depth of flow is 6m. 5

- (b) Show that in a rectangular channel 5
- (i) Critical depth is two third of specific energy and
- (ii) Froude's number at critical depth is unity
3. (a) What is the essential difference between gradually varied flow and rapidly varied flow ? Illustrate with neatly drawn sketches ? 4
- (b) Find the slope of the free water surface in a rectangular channel of width 20 m, having depth of flow 5m. The discharge through the channel is $50 \text{ m}^3/\text{s}$. The bed of the channel is having a slope of 1 in 4000. Take $C = 60$. 6
4. A sewer pipe is to be laid at a slope of 1 in 8100 to carry a maximum discharge of 600 litres/s, when the depth of water is 75% of the vertical diameter. Find the diameter of this pipe if the value of Manning's N is 0.025. 10
5. (a) What do you understand by open channel surge ? What are the reasons for it ? Also differentiate deep and shallow water waves. 6
- (b) The depth of flow of water, at a certain section of a rectangular channel of 4 m wide is 0.5 m. The discharge through the channel is $16 \text{ m}^3/\text{s}$. If a hydraulic jump takes place on the down stream side, find the depth of flow after the jump. 4

6. The following data is given for a Francis Turbine. 10
Net head $H = 60$ m; speed $N = 700$ rpm; shaft power = 294.3kW; $\eta_o = 84\%$, $\eta_h = 93\%$ flow ratio = 0.20; breadth ratio $n = 0.1$; outer diameter of the runner = $2 \times$ inner diameter of the runner. The thickness of vanes occupy 5 % of circumferential area of the runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet determine.
- (a) Guide blade angle
 - (b) Runner vane angles at inlet and outlet
 - (c) Diameters of runner at inlet and outlet and
 - (d) Width of wheel at inlet.
7. (a) Differentiate between the followings. 6
- (i) Impulse and reaction turbines
 - (ii) Gross head and Net head of Pelton wheel
 - (iii) Speed ratio, flow ratio and jet ratio
- (b) A turbine develops 500 kW power under a 4
head of 100 metres at 200 rpm. What would be it's normal speed and output under a head of 81 metres ?

8. (a) Draw and discuss the operating characteristics of a centrifugal pump ? 5
- (b) What do you mean by manometer efficiency, mechanical efficiency and overall efficiency of a centrifugal pump ? 5
9. A centrifugal pump has the following dimensions; 10
inlet radius = 80mm; outlet radius =160 mm;
width of impeller at the inlet =50 mm. $\beta_1 = 0.45$
radians, $\beta_2 = 0.25$ radians; width of impeller at
outlet = 50mm.
Assume shockless entry determine the discharge
and head developed by the pump when the
impeller rotates at 90 radians/second.
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