Code No. 6081

FACULTY OF ENGINEERING
B.E. 3/4 (Civil) I – Semester (Main) Examination, November 2013

Subject: Fluid Mechanics – II

Time:3 Hours **Max.Marks: 75**

Note: Answer all questions from Part A. Answer any five questions from Part B.

PART – A (25 Marks)

1. Derive chezy's formula for uniform flow through a channel. (3)
2. What is meant by critical velocity of flow in an open channel? (2)
3. Give the detailed classification of gradually varied flow profiles. (3)
4. A rectangular channel 5.0 m wide conveys water at 12.00 cumec at a depth of 0.35 m. If a hydraulic jump occurs, find the depth of flow after the jump. (3)
5. Explain the water hammer phenomenon. (2)
6. Derive the equation for momentum thickness of a boundary layer. (3)
7. State the merits and demerits of distorted model. (3)
8. What do you mean by specific speed of a turbine? Why is it called a type characteristic? (3)
9. Sketch a centrifugal pump and label the components. (3)

PART – B (50 Marks)

10.(a) Water flows at 12.5 m^3/s in a channel 2 m wide, at a velocity of 1.25 m/s. Calculate the specific energy head. Find also the critical depth, critical velocity and minimum value of specific energy head corresponding to this discharge in the channel.

(b) What do you understand by most economical channel section? Derive the condition for the rectangular channel of best section. Show that hydraulic mean depth is one-half the depth of flow.

11.(a) Derive the dynamic equation of gradually varied flow.

(b) The loss of energy head in a hydraulic jump is 4.75 m. The Froude's number just before the jump is 8.0. Find (i) percentage loss of energy head due to jump, (ii) discharge per metre width of channel, (iii) Froude's number after the jump, (iv) the depths before and after the hydraulic jump, (v) length of the jump.

12.(a) Define boundary layer and explain the fundamental causes of its existence. Also discuss the various methods of controlling the boundary layer.

(b) What is the significance of critical period of the pipeline in unsteady flow? Water flowing in a long pipe is suddenly stopped by closing a valve at the discharge end. The dia of the pipe is 160 mm and its thickness is 7 mm. The quantity of water flowing in the pipe is 20 lt/sec. Find the rise of pressure due to instantaneous closure of valve at the discharge end. Take modulus of elasticity of the pipe material as 1.962×10^5 N/mm^2 and bulk modulus of water as 1.962×10^3 N/mm^2.

13.(a) What are the various types of similarities that should exist between a model and a prototype? Also state the considerations influencing the selection of a scale for a model.

(b) The velocity and discharge for a 1/50 scale model of a spillway are 0.60 m/s and 0.180 m^3/s, calculate the corresponding velocity and discharge in the prototype.

14.(a) A reaction turbine (outward flow) utilizes 520 cumec of water. The internal and external diameters of the runner are 1.50 m and 2.50 m respectively. The width of the runner is 300 mm at inlet as well as at outlet. If the head on the turbine is 50 m and the speed of the runner is 190 rpm, find the runner vane angles at inlet and outlet and the guide blade angle. Neglect the thickness of the vanes and assume that the turbine is discharging radially at outlet.

(b) Explain in detail the various application of impact of jets. Find the force of impact of jet when it strikes a flat plate at right angles.

15.(a) Explain with neat sketch, the significance of suction pipe in a centrifugal pump and derive the equation to determine the least diameter of impeller.

(b) A centrifugal pump has to work against a head of 25 m at a speed of 850 rpm. The flow component of the velocity at outlet is 2.5 m/s. the outlet vane angle is 40^o. If the discharge of the pump is 0.25 m^3/s, find (i) the diameter of the impeller and (ii) the width of the impeller at outlet. Neglect losses.

16.(a) Write short notes on boundary layer growth and separation.

(b) Stating the significance of Froude's number for hydraulic jump, give the detailed classification of jumps according to Froude's number.

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