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FIFTH SEMESTER B.TECH. (ENGINEERING) [14 SCHEME] DEGREE EXAMINATION, NOVEMBER 2016

CE 14 506—OPEN CHANNEL HYDRAULICS AND HYDRAULIC MACHINERY

Time : Three Hours Maximum : 100 Marks

Part A

Answer any **eight** *questions.*

1. Write a note on velocity distribution in open channels.
2. Show that the relation between minimum specific energy E_{min} and critical depth y_c for a triangular channel can be expressed as $E_{min} = 1.25\, y_c$.
3. State the assumptions involved in the derivation of dynamic equation of gradually varied flow.
4. Explain area – velocity method for streamflow measurement.
5. Differentiate between positive surges and negative surges.
6. Prepare a detailed note on stilling basins with relevant sketches.
7. Enlist the practical applications of hydraulic jump.
8. Explain draft tube theory.
9. Explain governing of turbines.
10. Explain Net positive suction head.

(8 × 5 = 40 marks)

Part B

Module I

11. A rectangular channel 8 m wide and 1.5 m deep has a slope of 0.001 in 1 and is lined with smooth concrete plaster with Manning's constant 0.015. It is desired to enhance the discharge to a maximum by changing the dimensions of the channel but by keeping the same amount of lining. Determine the new dimensions and percentage increase in discharge.

(15 marks)

Or

12. A rectangular channel is 2.5 m wide and carries a flow of 2.75 m^3/sec at a depth of 0.9 m. A contraction of the channel width is proposed at certain section. (i) Find the smallest allowable contracted width that will not affect the upstream flow conditions ; (ii) Find the change in upstream water depth if the width of contracted section is 1.5 m.

(15 marks)

Turn over

Module II

13. A short reach of a 2 m wide rectangular open channel has its bed level rising in the direction of flow at a slope of 1 in 10,000. It carries a discharge of 4 m^3/s and Manning's roughness coefficient is 0.01. The flow in this reach is gradually varying. At a certain section in this reach, the depth of flow is 0.5 m. Compute the rate of change of water depth with distance, at this section. Assume $g = 10$ m/sec^2.

(15 marks)

Or

14. 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 of 0.015. At a certain section, the flow depth is 1 m. Compute the length of water surface profile to a section with flow depth of 0.9 m. Use direct step method employing single stop.

(15 marks)

Module III

15. An overflow spillway has its crest at an elevation of 125.4 and horizontal apron at an elevation of 95.0 m. Take coefficient of discharge of the spillway as 0.735. If the elevation of energy line at upstream is 127.9, compute the tail water elevation to form a hydraulic jump at downstream of the spillway. Neglect energy loss flow over the spillway.

Or

16. In a hydraulic jump occurring in a horizontal rectangular channel, the Froude number before the jump is 10.0 and energy loss is 3.2 m. Estimate the sequent depths, discharge intensity and Froude number after the jump.

(15 marks)

Module IV

17. A rectangular turbine works at 450 r.p.m. under a head of 120 m. Its diameter at inlet is 120 cm and the flow area is 0.4 m^2. The angles made by the absolute and relative velocities at inlet, with the tangential velocity are 20° and 60° respectively. Determine the (i) flow rate ; (ii) hydraulic power developed ; and (iii) efficiency. Assume velocity of whirl at outlet as zero.

(15 marks)

Or

18. A centrifugal pump with 1.2 m diameter runs at 200 r.p.m. and discharges 1,880 c/sec, the average lift being 6 m. The angle which the vanes make at exit with the tangent to the impeller is 26° and radial velocity of flow is 2.5 m/sec. Determine the manometric efficiency and the least speed to start pumping against a head of 6 m. The inner diameter of the impeller is 0.6 m.

(15 marks)

[4 × 15 = 60 marks]