G 518 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

Branch : Civil Engineering

CE 010 404—OPEN CHANNEL FLOW AND HYDRAULIC MACHINES (CE)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Define the term most economical section of a channel.
2. Draw and describe back-water curve.
3. What are the various applications of hydraulic jump.
4. Define unit speed, unit discharge and unit power as related to turbines.
5. What are the functions of air vessel provided in a reciprocating pump ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Show that the condition for the discharge to be maximum for a given specific energy in an open channel flow is the same as that for the specific energy to be minimum for the given discharge.
7. Derive the differential equation of the gradually varied flow.
8. With the help of neat sketches, explain briefly the different types of jump.
9. Explain the velocity triangle for a Francis turbine.
10. With the help of a neat sketch, explain the components of a centrifugal pump.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. Water flows at a uniform depth of 2 m in a trapezoidal channel having a bottom width of 6 m, side slopes 2H to 1V. If it has to carry a discharge of 65 m^3/s, compute the bottom slope required to be provided. Take Manning's n = 0.025.

Or

12. A uniform flow of 300 cfs occurs at a depth of 5 ft in a long rectangular channel 10 ft. wide. Compute the minimum height of a flat-top hump that can be built on the floor of the channel in order to produce a critical depth. What will result if the hump is lower or higher than the computed minimum height ?

13. A trapezoidal channel having bottom width 6m, side slope 2H : 1V, Manning's roughness coefficient 0.025 and bottom slope 0.0015, carries a discharge of 10m^3/s. Compute the back water profile created by a dam which backs up the water to a depth of 2.0 m immediately behind the dam. Use the direct step method for computation.

Or

14. A river 100m wide and 4m deep has stable bed and vertical banks with a surface slope of 1 in 2500. Estimate the length of the backwater curve produced by an afflun of 2m. Assume Manning's n = 0.035. Adopt step method.

15. With usual notations show that in the case of rectangular channel the relation between the depth before the jump and depth after the jump can be expressed as $Y_2 = \frac{Y_1}{2}\left[-1 + \sqrt{1 + 8\,F_1^2}\right]$.

Or

16. A rectangular channel carrying super critical flow is provided with a hydraulic jump type of energy dissipater. If it is expected to dissipate 5 m of head of water in the formation of the jump and if inlet Froude's number is 8.2, find the subsequent depths.

17. (a) Prove that the force exerted by a jet of water on a fixed semi-circular plate in the direction of the jet when the jet strikes at the centre of the semi-circular plate is two times the force exerted by the jet on a fixed vertical plate.

    (b) What is a draft tube ? Explain briefly different types of draft tubes ?

Or

18. (a) Derive an expression for specific speed of a turbine ?

(b) A Pelton turbine is having a mean runner diameter of 1. 0 m and is running at 1000 r.p.m. The net head is 100 m. If the side clearance is 20° and the discharge is 0.1 m^3/s, find the power available at the nozzle and hydraulic efficiency of the turbine.

19. A single stage reciprocating pump has a piston are 0.185 m^2 and stroke is 0.3 m. Delivery pipe cross-sectional area is 0.37 m^2 and water is lifted to a height of 12 m. Find the percentage slip, coefficient of discharge and theoretical power required to drive the pump if it is running at 60 r.p.m. and actual discharge is 50 litres per sec.

Or

20. A centrifugal pump works at a speed of 1000 r.p.m. and manometric head is 14.5 m. The vane angle at outlet is 30° with the periphery. The diameters of the impeller at outlet is 30 cm and the width is 5 cm. Find the discharge of the pump if the manometric efficiency is 95 %.

(5 × 12 = 60 marks)