Reg. No. :

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B.E./B.Tech. DEGREE EXAMINATIONS, NOV./DEC. 2020 AND APRIL/MAY 2021

Fourth Semester
Civil Engineering

CE 6403 – APPLIED HYDRAULIC ENGINEERING
(Regulations 2013)

(Common to PTCE 6403 – Applied Hydraulic Engineering for B.E. (Part-Time) – Fourth Semester – Civil Engineering (Regulations – 2014))

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Differentiate prismatic and non prismatic channels.
2. What are the conditions for most economical rectangular channel section ?
3. State the dynamic equation of gradually varied flow.
4. Classify the channel bottom slopes.
5. What are surges in an open channel flow ?
6. Define Impulse momentum principle.
7. What are the types of casing in centrifugal pump ?
8. Define negative slip.
9. Draw typical velocity triangles for inlet and outlet of pelton wheel.
10. What are the causes of cavitation ?

PART – B **(5×13=65 Marks)**

11. a) A most economical trapezoidal section is required to give a maximum discharge of 20 m^3/s of water. The slope of the channel bottom is 1 in 1500. Taking C = 70, in Chezy's equation, determine the dimension of the channel.

(OR)

b) i) Derive the relationship between flow depth and breadth of a rectangular channel, to be an economical section. **(6)**

ii) A rectangular channel which is laid on a bottom slope of 1 in 160 is to carry 20 m^3/s of water. Determine the width of the channel when the flow is in critical condition. Take Manning's constant n = 0.014. **(7)**

(OR)

12. a) i) Show that the hydraulic radius is half the flow depth for the most economical trapezoidal channel section. **(6)**

ii) Determine the most economical rectangular section of a rectangular channel carrying water at the rate of 0.6 cumecs. The bed slope of the channel is 1 in 2000. Assume Chezy's constant C = 50. **(7)**

(OR)

b) i) A river 100 m wide and 3 m deep has an average bed slope of 0.0005. Estimate the length of Gradually Varied Flow profile produced by a low weir which raises the water surface just upstream of it by 1.5 m. Assume N = 0.035. Use direct step method with three steps.

ii) A rectangular flume 2m wide discharges at the rate of 2 m^3/sec. The bed slope of the flume is 1 in 2500. At a certain section the depth of flow is 1 m. Calculate the distance of the section downstream where the depth of flow is 0.9 m. Slove by single step method. Assume rugosity coefficient as 0.014.

13. a) The Froude number before the jump is 10.0 in a hydraulic jump occurring in a rectangular channel and the energy loss is 3.20 m. Estimate the

i) Sequent depth **(6)**

ii) The discharge per unit width. **(7)**

(OR)

b) A rectangular channel carries a flow with a velocity of 0.65 m/s and depth of flow 1.4 m. The discharge is abruptly increased three fold by a sudden lifting a gate on the upstream. Estimate the velocity and the height of resulting surge.

14. a) i) Distinguish between impulse and reaction turbines. **(7)**

ii) Define the following for a turbine : **(3×2=6 Marks)**

1) Manometric Efficiency

2) Volumetric Efficiency

3) Mechanical Efficiency.

(OR)

b) A Kaplan turbine runner is to be designed to develop 8600 kW. The net available head is 6.6 m. If the speed ratio = 2.09, flow ratio = 0.60, overall efficiency 84% and the diameter of t he boss is 1/3 the diameter of the runner. Find the diameter of the runner, its speed and the specific speed of the turbine.

15. a) What is a reciprocating pump ? Describe the principle and working of a reciprocating pump with a neat sketch.

(OR)

b) i) With the help of neat sketches, explain the features of a volute type and a diffusion type centrifugal pump. **(6)**

ii) A centrifugal pump delivers salt water against a net head of 15 m at a speed of 100 rpm. The vanes are curved backward at 30° with the periphery. Obtain the discharge for an impeller diameter of 30 cm and outlet width of 5 cm at a manometric efficiency of 90%. **(7)**

PART – C **(1×15=15 Marks)**

16. a) Write in detail about the application of hydraulic devices (any five). **(5×3=15 Marks)**

(OR)

b) A Pelton wheel is required to develop 9530 kW when working under a head of 300 m. The speed of the Pelton wheel is 550 r.p.m. The co-efficient of velocity is 0.97 and the speed ratio is 0.48. Assuming jet ratio as 10 and overall efficiency as 85%. Design the following :

i) The number of jets. **(5)**

ii) The diameter of the wheel **(5)**

iii) The quantity of water required. **(5)**

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