Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 51226

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fourth Semester

Civil Engineering

CE 2253/CE 44/CE 1253 A/080100020/10111 CE 404 — APPLIED HYDRAULICS ENGINEERING

(Regulation 2008/2010)

(Common to PTCE 2253 – Applied Hydraulics Engineering for B.E. (Part-Time) Fourth Semester – Civil Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define open channel flow.
2. State the condition for critical and super-critical flow.
3. Write the empirical relation for Manning's formula with expansion.
4. What is meant by best section?
5. Define the term Afflux.
6. Write about backwater curves.
7. Define the term negative slip.
8. Define the term indicator diagram.
9. Write a short note on cavitation.
10. What are the functions of draft tubes?

PART B — (5 × 16 = 80 marks)

11. (a) (i) A 3 m wide rectangular channel conveys 12m³/s of water at a depth of 2 m. Calculate

(1) Specific energy of flowing fluid

(2) Critical depth, critical velocity and the minimum specific energy

(3) Froude number and state whether flow is subcritical or super critical. (10)

(ii) What do you understand by critical depth of an open channel when the flow in it is not uniform? (6)

Or

(b) (i) Calculate the specific energy of 12 m³/s of water flowing with a velocity of 1.5 m/s in a rectangular channel 7.5 m wide. Find the depth of water in the channel when the specific energy would be minimum. What would be the value of critical velocity as well as minimum specific energy? (10)

(ii) Derive an expression for critical depth and critical velocity. (6)

12. (a) (i) Write about the types of flow in channels. (8)

(ii) Find the rate of flow and conveyance for a rectangular channel 7.5 m wide for uniform flow at a depth of 2.25 m. The channel is having bed slope as 1 in 1000. Take Chezy's constant C = 55. (8)

Or

(b) (i) For a rectangular channel with bottom width 40m and side slopes 2H: IV, Manning's N is 0.015 and bottom slope is 0.0002. If it carries 60 m³/s discharge, determine the normal depth. (10)

(ii) Derive Chezy's formula. (6)

13. (a) (i) Differentiate the 'Gradually varied flow' and 'Rapidly varied flow'. (4)

(ii) Define the terms: (1) Afflux and (2) Back water curve. Derive an expression for the length of the back water curve. (12)

Or

(b) A venturiflume is 1.30 m wide at entrance and 0.65 m in the throat. Neglecting hydraulic losses in the flume, calculate the flow if the depths at the entrance and throat are 0.65 m and 0.60 m respectively. A hump is now installed at the throat, of height 200 mm, so that a standing wave (hydraulic jump) is formed beyond the throat. What is the increase in the upstream depth when the same flow as before passes through the flume? (16)

14. (a) (i) Calculate the vane angle at the inlet of a centrifugal pump impeller having 200 mm diameter at inlet and 400 mm diameter at outlet. The impeller vanes are set back at angle of 45° to the outer rim and the entry of the pump is radial. The pump runs at 1,000 rpm and the velocity of flow through the impeller is constant at 3 m/s. Also, calculate the work done per kN of water and the velocity as well as direction of the water at outlet. (12)

(ii) What is meant by "priming a centrifugal pump" and why it is needed? (4)

Or

(b) (i) A single acting reciprocating pump (with no air vessel) has a plunger of 80 mm diameter and a stroke of 150 mm. It draws water from a sump 3 m below the pump axis through a suction pipe 30 mm diameter and 4.5 m long. If separation occurs at a pressure of 80 kPa below atmospheric pressure, find the maximum speed at which the pump may be operated without separation. Assume that the plunger moves with simple harmonic motion. (8)

(ii) With the aid of an indicator diagram, discuss the effect of acceleration on the work done and pressure head of a reciprocating pump. (8)

15. (a) (i) A jet of water having a velocity of 40 m/s stikes a curved vane, which is moving with a velocity of 20 m/s The jet makes an angle of 30° with the direction of motion of vane at inlet and leaves at an angle of 90° to the direction of motion of vane at outlet. Draw the velocity triangles at inlet and outlet and determine the vane angles at inlet and outlet so that the water enters and leaves the vane without shock. (12)

(ii) Derive the impulse momentum principle. (4)

Or

(b) (i) A Pelton wheel is to be designed for the following specification

Power (brake or shaft)	–	9560 KW
Head	–	350 metres
Speed	–	750 r.p.m
Overall efficiency	–	85%
Jet diameter	–	not to exceed 1/6th of the wheel diameter

Determine the following.

(1) The wheel diameter,

(2) Diameter of the jet, and

(3) The number of jets required,

Take C = 0.985, Speed ratio = 0.45. (10)

(ii) Write down the difference between radial flow and axial flow turbine. (6)
