J 27088 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2006

CE 04 506—OPEN CHANNEL HYDRAULICS AND HYDRAULIC MACHINERY

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

1. (a) Determine the most efficient section of a trapezoidal channel with side slopes 1 vertical to 2 horizontal, carrying a discharge of 11·25 m^3/s with a velocity of 0·75 m/s. What should be the bed slope of the channel ? Take Manning's $n = 0·25$.

   (b) What is Chezy's formula ? How is it derived ?

   (c) (i) Differentiate gradually varied flow and rapidly varied flow. (2 marks)

   (ii) What are the basic assumptions in gradually varied flow. (3 marks)

   (d) What are the instruments used to measure velocity of flow in channel ? Explain briefly.

   (e) In a horizontal rectangular channel 1·5 m. wide, if the observed depth before and after the jump are 0·2 m. and 1·0 m. respectively, determine the discharge flowing through the channel.

   (f) What are the various applications of hydraulic jump ?

   (g) Explain the working of a reciprocating pump with a neat sketch, marking in it the various parts.

   (h) Write a note on velocity triangle for a Francis turbine.

   (8 × 5 = 40 marks)

2. (a) (i) Analyse the transitions of decreasing channel cross-section with the help of specific energy and discharge diagrams.

   (10 marks)

   (ii) Explain briefly about Parshall flume. (5 marks)

   Or

   (b) An earthen channel with a base width 2 m. and side slope 1 horizontal to 2 vertical carries water with a depth of 1 m. The bed slope is 1 in 625. Calculate the discharge if $n = 0·03$. Also calculate the average shear stress at the channel boundary.

   (15 marks)

3. (a) (i) Derive the dynamic equation of gradually varied flow. (7½ marks)

   (ii) Explain the terms :

   (A) Specific energy of a flowing fluid. (B) Minimum specific energy.

   (C) Critical depth. (D) Critical velocity.

   (E) Alternate depth

   as applied to non-uniform flow.

   (7½ marks)

   Or

Turn over

(b) A rectangular channel 10 m. wide is laid with a break in its bottom slope from 0·01 to 0·0064. If it carries 125 m.^{3}/sec., determine the nature of the surface profile and compute its length. Take n = 0·015.

(15 marks)

4. (a) (i) Explain the term hydraulic jump. Derive an expression for the depth of hydraulic jump in terms of upstream Froude number.

(8 marks)

(ii) A rectangular channel 6 m. wide carries water at 11·5 cumec at a depth of 0·3 m. Is a jump possible ? If so, find the depth after jump.

(7 marks)

Or

(b) A trapezoidal channel having bottom width 8 m. and side slope 1 : 1 carries a discharge of 80 m.^{3}/s. Find the depth conjugate to initial depth of 0·75 m. before the jump. Also determine the loss of energy in the jump.

(15 marks)

5. (a) Differentiate the following in detail :—

(i) Impulse and reaction turbine.

(ii) Axial and radial flow turbine.

(iii) Kaplan turbine and propeller turbine.

(iv) Inward and Outward flow turbine.

(v) Specific speed and Unit speed.

(15 marks)

Or

(b) The following data were obtained from a test on a Pelton wheel :—

(i) Head at the base of the nozzle = 32 m.

(ii) Discharge of the nozzle = 0·18 m.^{3}/s.

(iii) Area of the jet = 1500 sq.m.

(iv) Power available at the shaft = 44 kW

(v) Mechanical efficiency = 94 %.

Calculate the power lost :

(a) in the nozzle ;

(b) in the runner ; and

(c) in mechanical friction.

(15 marks)

[4 × 15 = 60 marks]