

**FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE
EXAMINATION JUNE 2007**

CE 04 506 – OPEN CHANNEL HYDRAULICS AND HYDRAULIC MACHINERY
(2004 Admissions)

Time : Three Hours

Maximum : 100 Marks

- I. (i) Derive an expression for the discharge through a channel by Chezy's formula.
 (ii) Derive an expression for critical depth and critical velocity.
 (iii) Explain the terms : (i) Slope of the bed. (ii) Hydraulic mean depth. (iii) Wetted perimeter.
 (iv) Differentiate between Critical, Subcritical and Super - critical flow in a open channel.
 (v) Obtain an expression for unit speed, unit discharge and unit power for a turbine.
 (vi) Define and explain hydraulic efficiency, mechanical efficiency and overall efficiency of a turbine.
 (vii) Define Cavitation? What are the effects of Cavitation?
 (viii) What is an air vessel? Describe the function of the air vessel for reciprocating pump,
 (8 × 5 = 40 marks)
- II. (a) Find the diameter of a Circular sewer pipe which is laid at a slope of 1 in 8000 and carries a discharge of 800 litres/s when flowing half full. Take the value of Manning's $N=0.020$.
 Or
 (b) A trapezoidal Channel has side sloper of 3 horizontal to 4 vertical and slope of its bed is 1 in 2000. Determine the optimum dimensions of the channel, if it is to carry water at $0.5\text{m}^3/\text{s}$. Take Chezy's constant as 80.
 (15 marks)
- III. (a) Find the slope of the free water surface in a rectangular channel of width 20 m, having depth of flow 5 m. The discharge through the channel is $50\text{ m}^3/\text{s}$. The bed of the Channel is having a slope of 1 in 4000. Take the value of Chezy's constant. $C=60$.
 Or
 (b) Determine the length of the back water curve caused by an afflux of 2.0m in a rectangular channel of width 40m and depth 2.5m. The slope of the bed is given as 1 in 11000. Take Manning's $N=0.03$.
 (15 marks)

(15 marks)

Turn over

- IV. (a) (i) Prove that the loss of energy head in a hydraulic jump is equal to $(d_2 - d_1)^2 / 3$
Where d_1 and d_2 are the conjugate depths.
- (ii) Obtain the relationship between the Froude Numbers of flow before and after the hydraulic jump in a horizontal rectangular Channel.

Or

- (b) The depth of flow of water, at a certain section of a rectangular channel of 5 m wide is 0.6 m. The discharge through the Channel is $15 \text{ m}^3/\text{s}$. If a hydraulic jump takes place on the downstream side, find the depth of flow after the jump and loss of energy per kg of water due to hydraulic jump.

(15 marks)

- V. (a) A Pelton wheel has a mean bucket speed of 10 metres per second with a jet of water flowing at the rate of 700 litres/sec under a head of 30 metres. The buckets deflect the jet through an angle of 160° . Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of Velocity as 0.98.

Or

- (b) The length and diameter of a suction pipe of a single acting reciprocating pump are 5 m and 10 cm respectively. The pump has a plunger of diameter 15 cm and a stroke length of 35 cm. The Centre of the pump is 3 m above the water surface in the sump. The atmospheric pressure head is 10.3 m of water and pump is running at 35 r.p.m. Determine:

- (i) Pressure head due to acceleration at the beginning of the suction stroke.
- (ii) Maximum pressure head due to acceleration, and
- (iii) Pressure head in the cylinder at the beginning and at the end of the stroke.

(15 marks)

(4 × 15 = 60 marks)