2386

Name:

Reg.No.

# FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2009

## CE.04.506 – Open Channel Hydraulics and Hydraulic Machinery
## (2004 Admission)

**Time: Three hours** **Maximum: 100 marks**

**8 x 5 = 40**

a) Compare Uniform flow with non uniform flow.

b) Derive the most efficient section of a trapezoidal channel.

c) Distinguish between standard step and direct step method.

d) What are gauges? How are they classified?

e) Write short notes on surges.

f) What are stilling basins? Mention the significance of stilling basins along with neat sketch.

g) Explain about multistage pumps.

h) Write short notes on draft tube and characteristic curves of pump.

**Part B**

**4 x 15 = 60**

II a) i) Show that in a rectangular channel a) Critical depth is two third of specific energy b) Froude number at critical depth is unity. (8)

ii) Derive the differential equation of gradually varied flow in open channels and list all assumptions. (7)

(OR)

b) Find the rate of change of depth of water in a rectangular channel of 12m wide and 2m deep when the water is flowing with a velocity of 1.5m/s. The flow of water through the channel bed slope 1 in 300 is regulated in such a way that energy line is having a slope of 1 in 8000. (15)

III a) The data pertaining to a stream gauging operation at a gauging site are given below. The rating of the current meter is v=0.52N+ 0.03 m/s. Calculate the discharge in the stream. (8)

| Distance from left water edge (m) | Depth (m) | Revolutions of a current meter kept at 0.6*depth | Duration of observation(s) |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 1.0 | 1.1 | 39 | 100 |
| 3.0 | 2.0 | 58 | 100 |
| 5.0 | 2.5 | 112 | 150 |
| 7.0 | 2.0 | 90 | 100 |
| 9.0 | 1.7 | 45 | 100 |
| 11.0 | 1.0 | 30 | 100 |
| 12.0 | 0 | 0 | 0 |

(OR)

b) Determine the length of 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 1in 11000. Take Manning's co efficient N = 0.03 (15)

IV a)i) By applying momentum equation to open channel flow, show that the sequent depths and flow rate are related by $2q^2/g=y1y2\ (y1+y2)$. State the assumptions made in the derivation. (10)

ii) Write a note on applications of hydraulic jump. (5)

(OR)

b) i) What is specific energy curve? Draw specific energy curve and then derive expressions for critical depth and critical velocity. (10)

ii) Define hydraulic jump. Explain the classification of hydraulic jumps in horizontal floor. (5)

V a) i) Discuss the working principle of Submersible pump. (5)

ii) The internal and external diameters of the impeller of a centrifugal pump are 300mm and 600mm respectively. The pump is running at 1000 rpm. The vane angles at inlet and outlet are $20^0$ and $30^0$ respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water. (10)

(OR)

b) A Francis turbine with an overall efficiency 70% is required to produce 147.15kw. It is working under a head of 8m. The peripheral velocity is $0.3\sqrt{2gh}$ and the radial velocity of flow at inlet is $0.96\sqrt{2gh}$. The wheel runs at 200rpm and the hydraulic losses in the turbine are 20% of the available energy. Assume radial discharge, determine: (15)

i) Guide blade angle

ii) Wheel vane angle at inlet

iii) Diameter of the wheel at the inlet and

iv) Width of wheel at inlet