Code: 13A01402 **R13**

B.Tech II Year II Semester (R13) Supplementary Examinations December/January 2015/2016

HYDRAULICS & HYDRAULIC MACHINERY

(Civil Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) State the different types of channels.
(b) Give any one empirical formula for the Chezy's constant.
(c) What is the purpose of energy curves?
(d) Write any two examples of various types of water surface profiles.
(e) State the expression for maximum efficiency of jet striking moving curved vane at centre.
(f) What are the different types of efficiencies in hydraulic turbines?
(g) What is the purpose of providing a draft tube?
(h) What is meant by priming of a pump?
(i) State and give the formulae for any two dimensionless numbers.
(j) Define drag and lift.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) What do you understand by hydraulically efficient channel section? Derive an expression for hydraulically efficient trapezoidal channel section

(b) The velocity distribution in a rectangular channel of width B and depth of flow y was approximated as $v = k_1\sqrt{y}$ in which k_1 = a constant. Calculate the average velocity for the cross-section and correction coefficients α and β.

OR

3 (a) Derive an expression for the calculation of critical depth in a triangular channel

(b) A rectangular channel is 4.0 m wide and has n = 0.015. Find the bed-slope required to maintain a uniform flow in this channel with a depth of 1.25 m and a Froude number, (i) F = 2.0. (ii) F = 1.0. (iii) F = 0.5. Also find the limit slope and the corresponding critical depth.

UNIT – II

4 (a) Explain in detail the procedure followed in direct-step method to solve GVF problems.

(b) A rectangular channel with a bottom width of 4.0 m and a bottom slope of 0.0008 has a discharge of 1.50 m^3/s. In a gradually varied flow in this channel, the depth at a certain location is found to be 0.30 m. Assume n = 0.016, determine the type of GVF profile.

OR

5 (a) Briefly explain about the characteristics of jump in a rectangular channel.

(b) A spillway discharges a flood flow at a rate of 7.75 m^3/s per meter width. At the downstream horizontal apron the depth of flow was found to be 0.50 m. What tail water depth is needed to form a hydraulic jump? If a jump is formed, find its (i) Type. (ii) Length. (iii) Head loss. (iv) Energy loss as a percentage of the initial energy and (v) Profile.

Contd. in page 2

UNIT – III

6 (a) Show that the force exerted by a jet on a moving curved vane is greater than that on a moving flat plate.

(b) A metal plate of 10 mm thickness and 200 mm square is hung so that it can swing freely about the upper horizontal edge. A horizontal jet of water of 20 mm diameter impinges with its axis perpendicular and 50 mm below the edge of the hinge, and keeps it steadily inclined at 30^0 to the vertical. Find the velocity of the jet if the specific weight of the metal is 75.54 kN/m^3.

OR

7 (a) Show that in the case of a Pelton wheel maximum hydraulic efficiency occurs when the bucket speed is half that of the velocity of the jet.

(b) An inward flow reaction turbine with radial discharge with an overall efficiency of 85% is required to develop 180 kW. The head is 10 m; peripheral velocity is 0.96$\sqrt{}$ 2gh; radial velocity of flow is 0.36 $\sqrt{}$2gh. The wheel is to make 180 rpm. The hydraulic losses in the turbine are 25% of the available energy. Determine: (i) The angle of the guide blade at inlet. (ii) The wheel vane angle at inlet.

UNIT – IV

8 (a) With the help of a neat sketch explain the construction and working of a Kaplan turbine.

(b) A Francis turbine working under a head of 16 m at a speed of 210 rpm develops 75 kW when the rate of flow of water is 1.8 m^3/s. The runner diameter is 1 m. If the head on this turbine is increased to 16 m, determine its new speed, discharge and power.

OR

9 (a) What is meant by cavitation in the case of centrifugal pumps? What are the effects and precautions against cavitation? How do you calculate cavitation in centrifugal pumps?

(b) A centrifugal pump running at 1000 rpm delivers water against a head of 14.5 m. The vanes are curved at an angle of 30^0 with its periphery. If the impeller diameter at the outlet is 30 cm and outlet width is 5 cm, determine the discharge. Take the Manometric efficiency as 95%.

UNIT – V

10 (a) State the Buckingham – Pi theorem and mention the advantages of dimensional analysis.

(b) A model 1/10 of prototype of a flying boat is towed in fresh water (ρ_m = 1000 kg/m^3). The prototype is moving in a sea water (ρ_p = 1030 kg/m^3) with a speed of 72 km/hr. Find the corresponding speed of the model. Also find out the resistance due to waves on model if the wave resistance experienced by prototype is 750 N.

OR

11 (a) Explain in brief the various methods adopted to avoid boundary layer separation.

(b) The velocity distribution in a boundary layer is given by u/U = y/δ. Find out displacement, momentum and energy thickness.

*****