H.T.No. | | | | | | | | | | |

Code No: CE1511 **GEC-R14**

II B. Tech II Semester Supplementary Examinations, January 2017

HYDRAULICS AND HYDRAULIC MACHINES

(Civil Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: All Questions from **PART-A** are to be answered at one place.
Answer any **FOUR** questions from **PART-B.** All Questions carry equal Marks.

PART-A

6 × 2 = 12M

1. What is critical depth with respect to flow in open channels?
2. What is "Mach number"?
3. Write the equation for the force exerted by a stationary plate on the jet of fluid in the direction normal to the plate.
4. Write the expression for overall efficiency of a turbine.
5. Write the expression for specific speed of pelton wheel.
6. List the component parts of a centrifugal pump.

PART-B

4 × 12 = 48M

1. a) A 2.0-m wide rectangular channel carries water at 20^0C at a depth of 0.5 m. The channel is laid on a slope of 0.0004. Find the hydrodynamic nature of the surface if the channel is made of

   i) Very smooth concrete and ii) rough concrete. (4M)

   b) For the above two cases, estimate the discharge in the channel using

   i) The Chezy formula with Darcy- Weisbach f, and

   ii) The, Manning's formula. (8M)

2. Explain different types of similarities to be established for complete similarity to exist between the model and its proto type. (12M)

3. A jet of water 50 mm in diameter having a velocity of 20 m/s, impinges tangentially on a series of vanes, which when stationary deflect the jet through an angle of 120^0. Calculate the magnitude of the resultant force on the vanes when they are (a) stationary, (b) moving with a velocity of 10 m/s in the same direction as the jet. Also determine the work done per second and the efficiency in case b. (12M)

4. a) A Pelton wheel has to be designed for the following data: Power to be developed = 6000 kW. Net head available = 300m; Speed = 550 r.p.m; Ratio of jet diameter to wheel diameter = 1/10; and overall efficiency = 85 %. Find the number of jets; diameter of the jet, diameter of the wheel; and the quantity of water required. (8M)

   b) Describe the working of a Pelton wheel. (4M)

5. A Vertical shaft Kaplan turbine operating under a head of 9.8 m has a runner diameter of 9.3m. At the optimum regime the turbine runs at 51.7 r.p.m and develops 45000 kW power discharging 535 m^3 /s water. Determine the values of unit speed, unit discharge, unit power and specific speed of the turbine. If the critical value of cavitation coefficient for the runner is 0.95, determine the location of the runner with respect to the tail race water level. The atmospheric and saturated vapour pressures may be taken as 0.98 kg(f)/cm^2 and 0.25 kg(f)/cm^2 respectively. (12M)

6. A Centrifugal pump has to discharge 225 liters of water per second against a head of 25 m when the impeller rotates at a speed of 1500 r.p.m. Determine (a) the impeller diameter, and (b) the vane angle at the outlet edge of the impeller. Assume that η_{mano} = 0.75; the loss of head in pump in meters due to fluid resistance is 0.03 V_1^2, where V_1 m/s is the absolute velocity of water leaving the impeller, the area of the impeller outlet surface is (1.2 D_1^2) m^2, where D_1 is the impeller diameter in m, and water enters the impeller without whirl. (12M)

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