B. Civil Engg (2nd Year, 1st Sem Supple) Exam, 2018

Time: 3 Hours | **HYDRAULICS II** | **Full Marks: 100**

Answer any FIVE questions.
Different parts of the same question should be answered together.
Assume any relevant data if necessary with suitable justifications.
Use of Moody diagram is permitted.

1. Derive an expression for fully-developed velocity profile in case of pipe flow, and using the same expression, prove that the centre-line velocity is twice of the average flow velocity. [20]

2. a) Stating all assumptions used, Derive Chezy's equation, and relate Chezy's coefficient with Manning's coefficient of roughness.

   b) An irrigation channel of rectangular section is to carry a flow of 10 m^3/sec on a longitudinal slope of 1 in 5000. Find the dimensions of the most economical section of channel, taking Chezy's coefficient equal to 50. Also find hydraulic depth, Froude number and the state of flow. [10+10]

3. (a) Derive an expression of discharge through venturi meter mounted on a horzontal pipeline.

   (b) A right-angled V-notch is fitted in a channel. If it shows a reading of 40 cm head over notch, find corresponding discharge. Further, if an error of 2 mm is made while measuring the head over notch, calculate the percentage error in the measured discharge. Take Cd=0.62. [10+10]

4. a) Prove that in case of transmission of power through pipe, maximum efficiency will be 66.67%.

   b) A 200 mm diameter and 2 km long pipe line (roughness size = 0.045 mm) consists of three 90° elbows (k = 0.9), three gate valve fully open (k = 0.2) and one foot valve (k = 1.5). The pipe line carries water at a flow rate of 400 m^3/hr and discharges freely into air. Neglecting entry loss, determine the total head loss in the system. (Use Moody diagram/suitable correlation) [6+14]

5. a) State the laws of fluid friction and derive Darcy-Weisbach formula for pipe flow.

   b) A horizontal pipeline of diameter 0.3 m carrying sea water passes through a 60° bend. At the exit end of bend, the gage pressure is 0.5 MPa. Determine the magnitude and direction of force exerted on the bend, when the flow is 800 litres/sec. [10+10]

6. a) Describe the working principle of Pelton turbine and derive an expression for maximum hydraulic efficiency of it.

   b) A Pelton wheel has a mean bucket speed of 10 m/sec and is supplied with water at a rate of 800 litre/sec under a head of 40 m. If the bucket deflects the jet through an angle of 160 degree find the power and efficiency of turbine. Neglect friction and take coefficient of velocity 0.98.

[12 + 8]

7. a) Explain with a neat sketch, different components of centrifugal pump.

b) A centrifugal pump has an impeller of 0.5 m outer diameter and 0.25 m inner diameter. The pump runs at 600 rpm against a head of 10 m. The impeller vanes are set at a blade angle of 30° at the outlet. If the velocity of flow is constant at 2 m/s, calculate

(i) The velocity and direction of water at outlet.
(ii) The blade angle at the inlet
(iii) Manometric efficiency of the pump **[10+10]**

8. Write short notes on: (any **FOUR**) **[4 × 5]**

a) Types of open channel flows
b) Minor losses in pipes
c) Cavitation and priming of centrifugal pump
d) Momentum and energy correction factors
e) Hydraulic Grade line and total energy line
f) Impulse and reaction turbines
g) Froude number, tranquil and torrential flow
h) Moody diagram