

III B.Tech I Semester Supplementary Examinations, November 2006
HYDRAULICS AND HYDRAULIC MACHINERY
(Civil Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Give complete classification of the different types of open channel flow.
(b) Water flows uniformly at a depth of 1.2 meters in a rectangular canal 3 metres wide laid on a slope of 1 metre per 1000 metres. What is the mean shear stress on the sides and bottom of the canal? Based on the Reynolds and Froude numbers, determine the type of flow in the canal. Take Chezy C as 70 and $v = 10^{-6} m^2/S$. [8+8]
2. (a) What is critical flow? Derive the condition for maximum discharge for a given value of specific energy.
(b) The specific energy for a 6 m wide rectangular channel is to be 5 kg-m/kg. If the rate of flow of water through the channel is $24 m^3/s$. Determine the alternate depths of flow. [8+8]
3. Water flows at a steady and uniform depth of 2 m in an open channel of rectangular cross - section having base width equal to 5 m and laid at a slope of 1 in 100. It is desired to obtain critical flow in the channel by providing a hump in the bed. Calculate hump height and sketch the flow profile. Consider the value of Mannings roughosity coefficient $n = 0.02$ for the channel surface. [16]
4. Assuming that the viscous force F exerted by a fluid on a sphere of diameter D depends on the viscosity μ , mass density of the fluid " ρ ", and the velocity of the sphere ν , obtain an expression for the viscous force. [16]
5. (a) Define the term: impact of jets. Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.
(b) Find the force exerted by a jet of water of diameter 100mm on a stationary flat plate, when the jet strikes the plate normally with a velocity of 30m/sec. [8+8]
6. Design a Pelton wheel for the following data. [16]
 - (a) Gross head available = 170m
 - (b) Losses in penstock = 10% of gross head
 - (c) Power to be developed = 600 kw.
 - (d) Speed of the wheel = 360rpm
 - (e) Overall efficiency = 86% Assume any missing data suitably

7. (a) Tests were conducted on a Francis turbine of 0.8m diameter under a head of 9m. The turbine developed 115 KW running at 240 rpm and consuming $1.2 \text{ m}^3/\text{sec}$. If the same turbine is operated under a head of 16m predict its new speed, discharge and power. [10]
- (b) What are the requirements of a governor in hydropower Installation? [6]
8. (a) How are large pumps primed ? [4]
- (b) What are the different devices that are employed to convert high velocity into high pressure? Sketch and explain the answer. [8]
- (c) How does the specific speed help the choice of a correct pump for a given duty? [4]
