

Code: CE4T4

**II B.Tech - II Semester – Regular / Supplementary Examinations  
April 2019**

**HYDRAULICS AND HYDRAULIC MACHINERY  
(CIVIL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

**PART – A**

Answer *all* the questions. All questions carry equal marks

11 x 2 = 22 M

1.

- a) Distinguish between Steady and Uniform flow.
- b) Differentiate between gradually varied flow and rapidly varied flow.
- c) What is meant by dimensional homogeneity?
- d) What are the dimensionless numbers?
- e) Write about impact of jet.
- f) Write various applications to radial flow turbines.
- g) Define utilization factor .
- h) Draw inlet and outlet velocity triangles for a Pelton wheel.
- i) Define manometric head.
- j) Write about NPSH.
- k) Define cavitation and water hammer.

PART – B

Answer any **THREE** questions. All questions carry equal marks.

$$3 \times 16 = 48 \text{ M}$$

2. a) Find the discharge in a trapezoidal channel with a bed width of 10m, side slope of 1:1 and depth of flow of 2.0 m under uniform flow condition. The bottom slope of 0.0001 and  $n=0.02$ . Also, find the Chezy's coefficient at this depth. 8 M
- b) Derive the expression for the energy loss during a hydraulic jump also write down the assumptions made. 8 M
3. a) What is meant by geometric, kinematic and dynamic similarities? Are these similarities truly attained? If not why? 8 M
- b) State and derive Rayleigh's theorem. Why Buckingham  $\pi$  theorem is considered superior over the Rayleigh's method for dimensional analysis. 8 M
4. a) A 15 cm diameter jet of water with a velocity of 15 m/s strikes a plane normally. If the plate is moving with a velocity of 6 m/s in the direction of the jet, calculate the work done per second on the plate and the efficiency ( $\eta$ ) of energy transfer. 8 M

- b) Derive an expression for the force exerted by the jet of water on a stationary inclined plate. 8 M
5. a) A centrifugal pump runs at 800 rpm and delivers 5000 L/min against a head of 7 m. The impeller has an outer diameter of 25 cm and a width of 5 cm at the outlet. If the backward curved vane at the outlet makes an angle of  $45^\circ$ , determine the manometric efficiency. What is the specific speed of the pump? 8 M
- b) Obtain an expression for the work done by impeller of a Centrifugal pump on water per second per unit weight of water. 8 M
6. a) Show that for the maximum efficiency, the bucket speed of a pelton wheel should be equal to one half of the jet speed. 8 M
- b) A hydraulic turbine under a head of 25 metres develops 7260 kW running at 110 rpm. What is the specific speed of the turbine? What type of turbine is this? Find also the normal speed and output if the head on the turbine is reduced to 20 metres. 8 M