

Code: 9A01402

B.Tech II Year II Semester (R09) Supplementary Examinations May/June 2017

HYDRAULICS & HYDRAULIC MACHINERY

(Civil Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

- 1 (a) For given discharge, draw the specific energy head diagram. Mark the critical depth and the minimum specific energy head. Explain the salient features.
(b) A rectangular channel which is laid on a bottom slope of 0.0064 is to carry $20 \text{ m}^3/\text{s}$ of water. Determine the width of the channel when the flow is in critical condition. Take n as 0.01.
- 2 (a) What are the characteristics and uses of hydraulic jump?
(b) The depths of water before and after hydraulic jump in a 5 m wide rectangular channel are 1 m and 8 m. Calculate the discharge through the channel and power lost in the jump.
- 3 Explain in detail about Buckingham's pi theorem of dimensional analysis. Give one example.
- 4 (a) Show that in case of jet striking the flat plates mounted on wheels, the efficiency will be maximum when the tangential velocity of wheel is half that of the jet.
(b) A jet of water of diameter 100 mm strikes a curved plate at its center with a velocity of 15 m/s. The curved plate is moving with a velocity of 7 m/s in the direction of the jet. The jet is deflected through an angle of 150° . Assuming the plate smooth find: (i) Force exerted on the plate in the direction of the jet. (ii) Power of the jet. (iii) Efficiency.
- 5 An outward flow reaction turbine has internal and external diameters of the runner as 0.5 m and 1.0 m respectively. The guide blade angle is 15° and velocity of flow through the runner is constant and equal to 3 m/s. If the speed of the turbine is 250 r.p.m, head on turbine is 10 m and discharge at outlet is radial, determine: (i) The runner vane angles at inlet and outlet. (ii) Work done by the water on the runner per second per unit weight of water striking per second. (iii) Hydraulic efficiency.
- 6 (a) Derive expressions for the following unit quantities of a hydraulic turbine:
(i) Unit speed. (ii) Unit discharge. (iii) Unit power.
(b) A turbine is to operate under a head of 30 m at 300 r.p.m. The discharge is $10 \text{ m}^3/\text{s}$. If the efficiency is 90%, determine: (i) Specific speed of the machine. (ii) Power generated. (iii) Types of the turbine.
- 7 (a) Define a centrifugal pump. Explain the working of a single-stage centrifugal pump with sketches.
(b) The internal and external diameters of the impeller of a centrifugal pump are 300 mm and 600 mm respectively. The pump is running at 1000 r.p.m. The vane angles at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.
- 8 (a) What is the significance of a flow mass curve? Describe with a neat sketch, how it is used in fixing the capacity of a reservoir.
(b) Draw a neat sketch of a hydropower plant and explain the various elements.
