

Code: R7220104

R07

B.Tech II Year II Semester (R07) Supplementary Examinations December/January 2015/2016

**HYDRAULICS & HYDRAULIC MACHINERY**

(Civil Engineering)

(For 2008 regular admitted batch only)

Time: 3 hours

Max. Marks: 80

Answer any FIVE questions  
All questions carry equal marks

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- 1 (a) Derive the geometrical conditions for the most economical section of rectangular channel.  
(b) Compute the value  $n$  of a trapezoidal channel section having bottom width 10 m,  $y_n = 2.5$  m, side slope of 2 horizontal to 1 vertical.
- 2 (a) What is direct method of finding length of water profile in open channel?  
(b) Water at a velocity of 8 m/s and at a depth of 1 m is flowing through a rectangular channel 8 m wide. Determine whether a hydraulic jump will occur, and if so, calculate the depth of water after the jump and power lost.
- 3 (a) The efficiency ( $\eta$ ) of a fan depends on the  $\rho$  (density),  $\mu$  (viscosity) of the fluid,  $\omega$  (angular velocity),  $d$  (diameter of the rotor) and the  $Q$  (discharge). Express  $\eta$  in terms of non-dimensional parameters. Use Buckingham pi-theorem.  
(b) A geometrically similar model of a spillway built to 1/50 scale is tested. The discharge and velocity of flow over the model were measured as  $2.5 \text{ m}^3/\text{s}$  and  $1.5 \text{ m/s}$  respectively, find the corresponding discharge and velocity of flow in the prototype.
- 4 (a) Using the impulse-momentum principle, derive an expression for the force exerted by a moving jet of fluid on a stationary curved vane.  
(b) Water impinged on a series of curved vanes entering at  $30^\circ$  and leaving at  $120^\circ$  to the direction of motion of vanes. The velocity of water at entry is  $30 \text{ m/s}$  and the vane velocity both at its inlet and exit tips is  $15 \text{ m/s}$ . Determine the vane angles for no shock conditions, the work done per unit weight of fluid and the hydraulic efficiency of the system. Neglect friction effects.
- 5 (a) Write down the expressions for work done and efficiencies of Francis turbine.  
(b) Explain any two types of draft tubes with neat diagrams.
- 6 (a) Where is servo meter used in governing mechanism of turbines? Explain it in detail.  
(b) How do you compare the performance of a turbine under different working conditions?
- 7 (a) Explain the role of cavitation in centrifugal pumps.  
(b) Two geometrically similar pumps are running at the same speed of  $1440 \text{ rpm}$ . One pump has an impeller diameter of  $40 \text{ cm}$  and lifts  $1000 \text{ liters per minute}$  of water against a head of  $20 \text{ m}$ . Determine the head and the impeller diameter of the second pump to deliver  $50\%$  discharge.
- 8 (a) Distinguish between run-of- river plants and storage plants.  
(b) Describe the advantages and disadvantages of hydropower over thermal power.

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