

Code: 9A01402

B. Tech II Year II Semester (R09) Supplementary Examinations, November/December 2012

**HYDRAULICS & HYDRAULIC MACHINERY**

(Civil Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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- 1 (a) Derive the condition for the best side slope of the most economical trapezoidal channel.  
(b) Design a concrete lined channel to carry a discharge of 500 cumecs at a slope of 1 in 4000. The side slopes of the channel may be taken as 1:1. The manning's roughness coefficient for the lining is 0.014. Assume permissible velocity in the section as 2.5 m/s.
- 2 (a) What do you mean by mild slope, critical slope and steep slope of channels?  
(b) A sluice spans a channel of rectangular section 15 metres wide and has an opening 0.60 metre wide and discharges 40 cumecs of water. If a hydraulic jump is formed on the downstream side of the sluice, determine the probable height of the crest above the upper edge of the sluice. Find also the loss of energy head due to the jump formed.
- 3 (a) What do you mean by dimensionally homogenous equation? Give few examples.  
(b) What is meant by hydraulic similarity between a model and prototype?
- 4 (a) A jet has a direct impact on a plate moving in the direction of the jet. Find the force of impact and the work done by the jet per second on the plate. Can this case occur in practical cases. Explain.  
(b) A jet with a velocity  $V$  strikes a single curved vane moving in the same direction as the jet with a velocity  $u$ . The velocity of the vane is  $(V - u)$ . The vane causes the flow direction to be completely reversed. Show that  $V = 3u$  for maximum efficiency. Determine this maximum efficiency.
- 5 (a) With the help of velocity diagrams, derive the equations of theoretical power developed by a Pelton wheel and its hydraulic efficiency. Obtain the conditions for maximum hydraulic efficiency  
(b) An outward flow reaction turbine has inner and outer diameter of the wheel as 1000 mm and 2000 mm respectively. The water enters the vane at an angle of  $20^\circ$  and leaves the vane radially. If the velocity of flow remains constant at 10 m/sec and the speed of the wheel is 300 rpm, find the vane angles at inlet and outlet.
- 6 (a) What are different unit quantities? What are their equations?  
(b) What are the constant efficiency curves of a turbine? What are their uses?
- 7 (a) Why should the suction lift of a centrifugal pump not exceed a certain limit? Explain.  
(b) A centrifugal pump is to discharge 120 lps at a speed of 1400 rpm against a head of 30 m. The manometric efficiency of the pump is 75%. Determine the vane angle at outlet if the diameter and width of impeller are 25 cm and 5 cm respectively.

- 8 (a) What is a surge tank? List out different types of surge tanks. Draw a surge tank and explain different functions of it.
- (b) Write a detailed note on the selection of suitable type of turbine for a hydroelectric scheme.

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