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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Civil Engineering

Semester End Examination; May/June - 2018

Hydraulics and Hydraulics Machines

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a.	Define most economical section. Derive the conditions of most economical rectangular section.	6
b.	A rectangular channel carries water at the rate of 400 litres/s, when the bed slope is 1 in 2000. Find the most economical dimensions of the channel, if $c = 50$.	6
c.	Find the discharge through a circular pipe of diameter 3 m, if the depth of water in the pipe is 1 m and the pipe is laid at a slope of 1 in 1000. Take the value of Chezy's constant as 70.	8
2 a.	Define specific energy. Draw the specific energy curve with a neat sketch.	6
b.	Derive the expression for critical depth and critical velocity.	6
c.	A hydraulic jump forms at the downstream end of spillway carrying 17.93 m^3/s discharge. If the depth before the jump is 0.80 m, determine the depth after the jump and consequent energy loss.	8

UNIT - II

3 a.	State Buckingham's π-theorem. Why this theorem is considered superior over the Rayleigh's method for dimensional analysis?	10
b.	Water is flowing through a pipe of dia 30 cm at a velocity of 4 m/s. Find the velocity of oil in another pipe of dia 10 cm, if the condition of dynamic similarity satisfied between the two pipes. The viscosity of water and the oil is given as 0.01 poise and 0.025 poise. The specific gravity of oil is 0.8.	10
4 a.	Explain : (i) Froude's number (ii) Mach number (iii) Hydraulic similarities (iv) Distorted and Undistorted models	10
b.	A 1:15 model of a flying boat is towed through water. The prototype is moving in sea-water of density 1024 kg/m^3 at a velocity of 20 m/s. Find the corresponding speed of the model. Also, determine the resistance due to waves on the model, if the resistance due to waves on prototype is 600 N.	10

UNIT - III

5 a.	Show that the force exerted by a jet of water on an inclined fixed plate in the direction of the jet is given by $f_x = \rho a v^2 \sin^2 \theta$	10

b. A nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. Find; 10

(i) Force on the plate (ii) Work done (iii) Efficiency of jet

6 a. Show that the efficiency of a free jet striking normally on a series of flat plates mounted on the periphery of a wheel can never exceed 50%. 10

b. A jet of water of diameter 50 mm moving with a velocity of 25 m/s impinges on a fixed curved plate tangentially at one end at an angle of 30° to the horizontal. Calculate the resultant force of the jet on the plate, if the jet is deflated through an angle of 50°. Take g =10 m/s^2. 10

UNIT - IV

7 a. Describe briefly the functions of various components of a pelton turbine with a neat diagram. 10

b. Two jet strikes the bucket of a pelton wheel which is having a shaft power as 15450 kW. The diameter of each jet is given as 200 mm. If the net head of the turbine is 400 m, find the overall efficiency of the turbine. Take C_v = 1.0. 10

8 a. With a neat sketch, explain the working principle of a Kaplan turbine. 10

b. A Kaplan turbine is to be designed to develop 9100 kW. The net available head is 5.6 m. If the speed ratio is 2.09, flow ratio is 0.68, overall efficiency is 86% and the diameter of boss is 1/3 of the diameter of the runner, find the diameter of the runner, its speed and specific speed of the turbine. 10

UNIT - V

9 a. What are the uses of draft tubes? Explain the different types of draft tubes with a neat sketch. 10

b. A conical draft tube having diameter at the top as 2 m and the pressure head as 7 m of water (vacuum), discharges water at the outlet with a velocity of 1.2 m/s at the rate of 25 m^3/s. If the atmospheric pressure head is 10.3 m of water and the losses between the inlet and outlet of the draft tubes are negligible, find the length of the draft tube immersed in water. Total length of tube is 5 m. 10

10 a. Define specific speed of a pump. Derive the expression for specific speed of a centrifugal pump. 10

b. A centrifugal pump is to discharge 0.118 m^3/s at a speed of 1450 rpm against a total head of 25 m. The impeller diameter is 250 mm, its width at the outlet is 50 mm and the Manometric efficiency is 75%. Determine the Vane-angle at the outlet of the impellor. 10

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