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Reg. No. : .....

Name : .....

Fourth Semester B.Tech. Degree Examination, April/May 2012
(2008 Scheme)
Branch : Civil
08.404 : FLUID MECHANICS – II

Time : 3 Hours Max. Marks : 100

Instructions *: 1)* ***All*** *questions under Part* ***A*** *are* ***compulsory*** *and* ***each*** *question carries* ***5*** *marks.*

2) Answer ***three*** *full questions from Part* ***B****, selecting* ***one*** *from* ***each*** *Module.* ***Each*** *full questions under Part* ***B*** *carries* ***20*** *marks.*

PART – A

I. a) Prove that the most efficient section for a triangular channel is one with 90° vertex angle.

b) Prove that for a given specific energy, the discharge is maximum when the flow is critical.

c) Define hydraulic jump and discuss its uses.

d) Discuss the assumptions made in the derivation of dynamic equation of gradually varied flow.

e) Define :

i) Geometric

ii) Kinematic and

iii) Dynamic similarity with reference to model study

f) Describe the functions of a draft tube in a hydraulic turbine.

g) What do you mean by priming of a centrifugal pump ? Explain briefly any one method of priming.

h) Explain the function of air vessel in a reciprocating pump. **(8×5=40 Marks)**

P.T.O.

PART – B

MODULE – I

II. a) For a trapezoidal channel with bottom width 40 m and side slopes 2 H : 1V, Manning's n is 0.015 and bottom slope is 0.0002. If it carries 60 m^3/s discharge determine the normal depth. **10**

b) Determine the dimensions of an economical trapezoidal section of an open channel with side slopes 2H : 1 V laid at a slope of 1 in 1600 to carry a discharge of 36 m^3/s assuming Chezy's coefficient C = 50. **10**

III. a) A trapezoidal channel has a bottom width of 6 m and side slopes of 2 horizontal to vertical. If the depth of flow is 1.2 m at a discharge of 10 m^3/s, compute the specific energy and the critical depth. **10**

b) A stationary hydraulic jump occurs in a rectangular channel with the initial and sequent depths being equal to 0.2 m and 1.2 m respectively. Estimate i) the discharge per unit width and ii) the energy loss. **10**

MODULE – II

IV. a) A rectangular flume 2 m wide carries discharge at the rate of 2 m^3/s. The bed slope of the flume is 0.0004. At a certain section the depth of flow is 1m. Calculate the distance of the section downstream where the depth of flow is 0.9 m. Solve by single step method. Assume rugosity coefficient as 0.014. **10**

b) The resistance force F of a ship is a function of its length L, velocity V, acceleration due to gravity g and fluid properties like density ρ and viscosity μ. Write this relationship in a dimensionless form. **10**

V. a) A 5 : 1 scale model of a car is tested in wind tunnel. The velocity with prototype is 75 km/hr. The model drag is 300N. Find out the drag and power required for prototype. The air is used with model as well as prototype also. **8**

b) A 45° deflection angle reducing bend lies in a horizontal plane and tapers from 60 cm diameter to 30 cm diameter at the outlet. The pressure at the inlet is 15 kPa and the flow through the bend is 0.5 m^3/s of water. Assuming friction loss of 20% of kinetic energy at inlet, compute the magnitude and direction of the resultant force exerted by the water on the bend. **12**

MODULE – III

VI. a) A jet of water moving at 20 m/s impinges on a symmetrical curved vane shaped to deflect the jet through 120° (that is the vane angles θ and ϕ are each equal to 30°). If the vane is moving at 5 m/s, find the angle of the jet so that there is no shock at inlet. Also determine the absolute velocity of exit in magnitude and direction, and the work done per unit weight. 12

b) Show that the maximum hydraulic efficiency for a pelton wheel is given by $(\eta_h)_{max} = \frac{1}{2}(1+k\cos\phi)$ where k is the ratio of relative velocities at outlet and inlet respectively, ϕ is the angle of the bucket at outlet tip. 8

VII. a) A centrifugal pump while running at 1000 rpm discharges 80 litres/s against a net head of 16 m. The manometric efficiency of the pump is 0.85. If the vane angle at the outlet is 35° and the velocity of flow is 1.5 m/s, estimate the outer diameter of the impeller and its width at that diameter. 10

b) A single acting reciprocating pump has a plunger of diameter 250 mm and stroke of 350 mm. If the speed of the pump is 60 rpm and it delivers 16.5 litres per second of water against a suction head of 5 m and a delivery head of 20 m, find the theoretical discharge, coefficient of discharge, the slip, the percentage slip of the pump and the power required to drive the pump. 10