UNIVERSITY OF PUNE

[4363]-104

T. E. (CIVIL) Examination –May 2013

FLUID MECHANICS II

(2008 Pattern)

[Time : 3 Hours] **[Max. Marks : 100]**

Total No. of Questions : 12 **[Total No. of Printed Pages :4]**

Instructions :

(1) Answer Section I :Q1or Q2, Q3 or Q4, Q5 or Q6

(2) Answers Section II: Q7 or Q8, Q9 or Q10, Q11 or Q12

*(3) Answers to the **two sections** should be written in **separate answer-books**.*

(4) Neat diagrams must be drawn wherever necessary.

(5) Black figures to the right indicate full marks.

(6) Your answers will be valued as a whole.

(7) Use of electronic pocket calculator is allowed

(8) Assume suitable data, if necessary.

SECTION I

Q1) a) An airfoil planform area 16 m^2 has an angle of attack 7^0 . The airfoil is travelling with a velocity of 240km/h in air. If the coefficients of lift and drag for this angle of attack 0.7 and 0.01, respectively, find (a) the lift force, b) the drag force, (c) the resultant force. The density of air is 1.22 kg/ m^2. [08]

b) Explain Magnus effect in detail [06]

c) With the help of examples distinguish between the streamlined and bluff bodies. [04]

OR

Q2) a) Explain with a neat sketch water hammer phenomenon an elastic pipe due to the sudden closure. [06]

b) Derive an expression for effective bulk modulus of elasticity of fluid taking into account the elasticity pipe material. [06]

c) A tank 12 m long and 6 m wide and the bottom has uniform slope. The depth of water is 1.8 m at the shallow end 3 m at the deep end. The tank is to emptied through an orifice of an effective area 300 cm^2 placed at the bottom of the deep end. Find how long it will take to reduce the deep end from 3.0 to .03 m? [06]

Q3) a) A jet of water having a velocity of 25 m/s impinges on a curved vane which is moving in the same direction as that of the jet with a velocity of 10 m/s. the jet makes an angels of 20^0 with the direction of motion of vane at entry and leaves the vane at an angle of 90^0 to the direction of motion of vane at outlet. If the water enters and leaves the vane without shock, find the vane angels at inlet and Outlet. Also find the work done per second per unit weight of water striking the vane. [08]

b) Explain with the help of neat sketches 3 types of impeller for centrifugal pump. [08]

OR

Q4) a) Derive an expression for force exerted by a jet on a flat fixed plate held inclined to the jet. [08]

b) A centrifugal pump delivers water against a head of 18 m. the external and internal diameter of the impeller are 450 mm and 250 mm respectively. Find the minimum starting speed of pump. [08]

Q5) a) What is cavitation? What are its effect? Where it is likely to occur? What are the measures to reduce its effects? [06]

b) A pelton wheel having wheel diameter of 1.2 m rotates at 600rpm. Water is supplied at the rate of 0.6 m^3 /s under a head of 450 m. If the buckets deflect the jet through an angle 160^0 , find the power developed and hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.97 and neglect the frictional losses in the bucket. [10]

OR

Q6) a) Sketch a layout of typical hydroelectric power generation plant and explain in brief function of each element. [08]

b) A turbine operating under a head of 35 m develops 10000 kW at a speed of 150rpm. Determine the speed and power developed by the turbine when the [08]

head on the turbine is reduced to 18m.

SECTION II

Q7) a) A trapezoidal channel is 5 m wide at bottom and has a side slope of 0.5 H : 1V. The bed slope of the channel is 0.0003. Find the discharge of the most Economical section. Assume Manning's coefficient 0.2. [08]

b) Explain energy and momentum equation as applied to open channel flow. [10]

OR

Q8) a) A rectangular channel is designed for a terrain with Chezy's constant as 56. The discharge is 1000 lit/s and the width of flume is 3 m. Find the bed slope required when the depth of flow is 60 cm. Find the conveyance K of the channel. [08]

b) Show that for most economical trapezoidal section a semi-circle can be drawn with water surface as the diameter and touching all the three sides of the section. [06]

c) What are the characteristics of uniform flow in open channel? [04]

Q9) a) Derive the relation between sequent depths y_1 and y_2 in a hydraulic jump [08]

b) A rectangular channel 3 m wide is laid to a slope of 0.0085 in which uniform flow occurs at a depth of 1.6m. Find the height of hump so that there is no afflux. If the upstream depth is to raised up to 2 m what should be height of the hump? Take n = 0.013 [08]

OR

Q10) a) What are different types of flumes used for measurement of discharge in An open channel? Explain in detail any one of them. [08]

b) A 3.6 m wide rectangular channel conveys 9 m^3 /s of water with a velocity of 6 m/s (i) Is there a condition for hydraulic jump to occur? If so calculate the height, length and strength of the jump (ii) What is the loss of energy per kg of water? [08]

Q11) a) A rectangular channel 15 m wide carries water with normal depth of 3.2 m. The end slope of the channel is 1 in 3600. If the water level is to be raised to 4.8 m above the channel bed by constructing a weir across the channel. [10]

Determine how far upstream of this section the depth of flow will be 10 % of normal depth. Use step by step method and take only 2 steps. Take Manning's as 0.016. Classify and sketch the profile.

b) Write short notes on M2 and S2 profile. [06]

OR

Q12) a) A wide rectangular channel carries a discharge of 2 m^3 /s/m. At a section the depth of flow is 1.9 m. How far upstream or downstream of this section, the depth will be within 5% of the normal depth of flow? Bed slope of the channel is 1/8000 and Manning's n = 0.025. Use step method and us 2 step only. [08]

b) Derive Gradually Varied Flow Equation in its usual form. [08]