Total No. of Questions : 12]

SEAT No. :

P3339

[Total No. of Pages : 4

[5353]-505

T.E. (Civil) (Semester - I)

FLUID MECHANICS - II (Theory)

(2015 Pattern) (End Sem)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Neat diagrams must be drawn wherever necessary.*
2) *Figures to the right indicate full Marks.*
3) *Use of non-programmable electronic pocket calculator is allowed.*
4) *Assume suitable data, if necessary.*
5) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.*

Q1) a) Distinguish between Bluff body and Streamlined body. **[2]**

b) A standard cricket ball of diameter 7.13 cm is bowled at speed of 101 km/hr by fast bowler. Determine the drag force on the ball by taking the following values for C_D and fluid properties. -

For a sphere: $C_D = 0.5$ for $10^4 < Re \leq 3\times10^5$ and $C_D = 0.2$ $Re > 3\times10^5$ Density of air = 1.21 Kg/m^3 and Dynamic viscosity of air = 1.81×10^{-5} N.s/m^2 **[6]**

OR

Q2) a) Explain in brief unsteady flow with suitable practical examples of it. **[2]**

b) In a pipe of 600 mm diameter and 3000 m length. provided with a valve at its end, water is flowing with a velocity of 2.1 m/s. Assuming velocity of pressure wave C = 1500 m/s. Find: i) The rise in pressure if the valve is closed in 20 seconds, and ii) The rise in pressure if the valve is closed in 2.5 seconds.

Assume the pipe to be rigid one and take bulk modulus of water K = 2 GN/m^2. **[6]**

Q3) Explain in brief the various types of flow in open channels. **[6]**

OR

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Q4) Explain in brief with neat sketches the following terms : **[6]**

a) Depth Discharge Diagram

b) Specific Energy Curve

Q5) Derive the conditions for the most economical trapezoidal channel section. **[6]**

OR

Q6) A horizontal rectangular channel 4 wide carries a discharge of 15.50 m^3/s. **[6]**

a) Determine whether a jump may occur at an initial depth of 0.5m or not.

b) If a jump occurs, determine the sequent depth to this initial depth.

c) Also determine the energy loss in the jump.

Q7) a) A jet of water having velocity of 45 m/s impinges without shock on series of vanes moving at 15 m/s. the direction of motion of vanes being inclined at 20° to that of jet. The relative velocity at outlet is 0.9 of that at inlet and absolute velocity of the water at exit is to be normal to the motion of the vanes. **[9]**

Find i) Vane angles at entrance and exit ii) Work done on vanes per unit weight of water supplied by the jet and iii) The hydraulic efficiency.

b) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m. works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5m/s. The vanes are set back at an angle of 40° at outlet. **[9]**

If the outer diameter of the impeller is 500mm and width at outlet is 50mm, Determine :

i) Vane angle at inlet

ii) Work done by the impeller on water per second, and

iii) Manometric efficiency.

OR

Q8) a) Explain the principle and working of a centrifugal pump with neat sketch. **[6]**

b) What do you mean by manometric efficiency, mechanical efficiency and overall efficiency of a centrifugal pump? **[6]**

c) Derive expression for the "work done by the jet" in case of flat plate inclined and moving in the direction of jet. **[6]**

Q9) a) Obtain an expression with reference to hydraulic turbine for unit speed, unit power and unit discharge. **[8]**

b) A Pelton wheel has mean bucket speed of 10 meters per second with jet of water flowing at the rate of 700 litres/s under a head of 30 meters. The bucket deflect the jet through an angle of 160°.

Calculate the power given by the water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98. **[8]**

OR

Q10)a) What is Cavitation? How it can be avoided in case of a hydraulic turbine? **[4]**

b) What is draft tube? What are the functions of draft tube? **[4]**

c) A turbine is to operate under head of 26 m at 210 r.p.m. The discharge is $9.5 m^3/s$. If the efficiency is 90%, determine : **[8]**

i) Specific speed of the machine

ii) Power generated and

iii) Type of turbine.

Q11)a) Derive the following form of GVF equation with usual notations. Also state the assumptions made for it. **[8]**

$$\frac{dy}{dx} = \frac{S_o - S_f}{1 - F_r^2}$$

b) Describe with neat sketches "Classification of Channel Bed Slopes". **[8]**

OR

Q12)a) What do you mean by Non-uniform flow? Explain its types with neat sketch along with suitable example. **[4]**

b) A rectangular channel carries a discharge of 3 $m^3/s/m$. It is laid at a slope of 0.0001. If at section in this channel the depth is 1.6 m. how far (upstream of downstream) from the section will the depth be 1.9 m? Take Manning's n as 0.015 and width of rectangular channel as 10 m. Use the Step method (Consider the depth of flow y' with interval of 0.1m) **[12]**