Total No. of Questions : 12]

SEAT No. :

P2487

[Total No. of Pages : 3

[5253]-505

T.E. (Civil) (Theory)

FLUID MECHANICS - II

(2015 Pattern) (Semester - I)

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) Explain in brief with neat sketch "Karman Vortex Trail". **[2]**

b) The following data is related to the flat plate moving in stationary air of a fluid mechanics laboratory :

i) Speed of the plate = 55 km/hour

ii) Size of the plate = (1 .65 × 1.65) m

iii) Density of Air = 1.16 Kg/m^3

iv) Coefficient of lift = 0.78

v) Coefficient of drag = 0.15

Find out : I) Lift force. II) Drag force. III) Resultant force, and IV) Power required to keep the plate in motion. **[6]**

OR

Q2) a) Define unsteady flow. Give any two practical examples of it. **[2]**

b) Explain the following terms with neat sketches : **[3 + 3 = 6]**

i) Surge Tank and its Function

ii) Water hammer

Q3) Derive the energy equation with usual notations for open channel flow. **[6]**

OR

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

i) Specific Force Diagram

ii) Specific Energy Curve

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Q5) The following data is given for the irrigation channel of trapezoidal section:

a) Side slopes = 3H to 2V.

b) Q = 10.50 m^3/s,

c) Longitudinal slope = 1 in 5000 and

d) The channel is to be lined for which the value of friction coefficient in Manning's formula is n = 0.012.

Find the most economic section of the channel. **[6]**

OR

Q6) Derive the following expression for conjugate depths of hydraulic jump in rectangular channel. Also state the assumption made for it. **[6]**

$$\frac{y_1}{y_2} = \frac{1}{2}\left[-1+\sqrt{1+8Fr_2^2}\right]$$

Q7) a) A jet of water 80 mm diameter having a velocity of 20m/s, strikes normally a flat smooth plate.

Determine the thrust on the plate (i) if the plate at rest. (ii) if the plate is moving in the same direction as jet with a velocity of 6 m/s.

Also find the work done per second in each case and efficiency of the jet when the plate is moving. **[6]**

b) Derive the expression for minimum starting speed of centrifugal pump. **[6]**

c) A centrifugal pump with 1.25m diameter runs at 210 rpm and pumps 1 890 lit/sec. the average lift being 6.1 m. The angle which the vane makes at exit with the tangent to the impeller is 27° and the radial velocity of flow is 2.6 m/s. Determine the manometric efficiency and the least speed to start the pumping against the head of 6.1m, the inner diameter of the impeller being 0.6m. **[6]**

OR

Q8) a) Explain the following terms : **[6]**

i) Reciprocating pump

ii) Submersible pump

b) Explain in brief : i) Cavitation in centrifugal pump ii) Various Efficiencies of 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) Explain in brief various elements of hydroelectric power plant with the neat sketch. **[8]**

b) A Pelton wheel is revolving at a speed of 191 r.p.m. and develops 5150.50 kW when working under a head of 221 m with an overall efficiency of 80%. Determine unit speed, unit discharge and unit power. The speed ratio for the turbine is given as 0.47. Also find the speed. discharge and power when this turbine is working under a head of 141m. **[8]**

OR

Q10)a) Derive the following expression for the specific speed of hydraulic turbine. **[8]**

$$N_S = \frac{N\sqrt{P}}{H^{5/4}}$$

b) A Pelton wheel is to be designed for the following specifications :

Shaft Power = 11,772kW; Head = 380 meters;

Speed = 750 r.p.m; Overall efficiency = 86%:

and jet diameter is not to exceed one-sixth of the wheel diameter.

Determine: i) The wheel diameter. ii) The number of jet required. and iii) Diameter of the jet. Take coefficient of velocity = 0.985 and Speed ratio = 0.45 **[8]**

Q11)a) Derive the following form of GVF equation. **[6]**

$$\frac{dy}{dx} = \frac{S_o - S_f}{1 - \frac{Q^2 T}{gA^3}}.$$

b) Describe the procedure of GVF computation by "Standard Step Method". **[10]**

OR

Q12)a) Explain in brief the various types of water surface profiles. **[4]**

b) A Rectangular channel 8 m wide carries discharge of 11 m^3/s (Manning's n = 0.025. bed slope of 0.0016). Compute the length of back water profile created by a dam which backs up a depth 2 m immediately behind the dam by direct step method. Take at least 3 steps to compute the profile. **[12]**