Total No. of Questions : 12]

SEAT No. :

P1684

[Total No. of Pages : 3

[5058]-304
T.E. (Civil)
FLUID MECHANICS - II
(2012 Pattern) (Semester - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.***
2) ***Figures to right indicates full marks.***
3) ***Assume suitable data, if necessary.***

Q1) a) A kite weighing 20 N has effective area of 1.1m^2. The tension in the kite string is 36 N when the string makes an angle of 47° with the horizontal. For a wind of 35 km/hr, what are the coefficients of lift and drag if the kite assumes an angle of 10° with the horizontal? Take specific weight of air as 11.8 N/m^3. **[4]**

b) Draw approximate flow pattern and the pressure distribution around a flat plate placed perpendicularly in a stream flow. **[3]**

OR

Q2) A cylindrical tank 12m high, containing water upto top is completely emptied through a hole located in the bottom in 8.4 minutes. How long would it take for the water level to drop form the top of the tank when full to 4 m from the top? **[7]**

Q3) a) Derive continuity equation for open channel flow. **[4]**

b) Calculate critical depth for a discharge of 6 m^3/s in the following channels: **[3]**

i) Rectangle channel with base width (B) = 2.0 m

ii) Triangular channel with side slope 1:0.5.

OR

Q4) a) Classify channel flows. **[3]**

b) Draw and explain specific force diagram. **[4]**

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Q5) Derive relation between conjugate depths. **[7]**

OR

Q6) Determine the dimensions of concrete lined (Manning's roughness coefficient 'n' = 0.015) trapezoidal channel of efficient proportions to carry a discharge of 7.0 m^3/s. The bed slope of the channel is 0.0006 and side slope 1V : 1.25 H. **[7]**

Q7) a) Derive expressions for force exerted and efficiency for the case jet striking on symmetrical moving curved vane at the centre. Also derive expression for maximum efficiency. **[8]**

b) A centrifugal pump with external diameter 600 mm and internal diameter 200 mm delivers 500 *lps* of water against a head of 15 m. The speed of the pump is 600 rpm. The vanes of the impeller are curved backwards at an angle of 30º to the wheel tangent at outlet. The velocity of flow is constant at 2 m/s. If the entry to the pump is radial, determine: **[8]**

i) power required,

ii) efficiency,

iii) Minimum Starting Speed.

OR

Q8) a) Water impinges on a smooth moving curved vane under the following conditions: **[9]**

velocity of vane = 15 m/s; direction of jet at entry to vane = 30º to the direction of the vane; velocity of jet = 30 m/s. At the exit side the vane makes an angle of 170º with the direction of motion of the vane (i.e. it is curved backwards). Find:

i) the vane angle at entry so that the water strikes the vanes tangentially;

ii) the absolute velocity of the water after leaving the vane and its direction;

iii) the work done on the vanes per unit weight of water supplied.

b) Define various heads of centrifugal pump. Draw a neat sketch showing all heads. **[7]**

Q9) a) Design a Pelton wheel which is required to develop 1500 kW, when working under a head of 160 m at a speed of 420 rpm. The overall efficiency may be taken as 85%, and assume other data required. **[8]**

b) Define unit quantities and derive expressions for each of them. **[9]**

OR

Q10)a) Draw a neat sketch showing sectional arrangement of Francis turbine and explain the working of each component part. **[9]**

b) A turbine develops 7355 kW under a head of 24.7 m at 210 rpm. What is its specific speed? Indicate the type of turbine suitable for the purpose. If this turbine is tested in the laboratory where the head of water available is only 7.5 m, what power will it develop and at what speed? **[8]**

Q11)a) Starting from the basic principle, derive an expression of GVF for a wide rectangular channel in the form. **[8]**

$$\frac{dy}{dx} = S_o \frac{1 - \left(\frac{y_n}{y}\right)^{10/3}}{1 - \left(\frac{y_c}{y}\right)^3}$$

Where, dy/dx = slope of water surface profile, S_o = bed slope

y_n = normal depth, y_c = critical depth.

b) Explain the Graphical Integration Method of GVF computation. **[8]**

OR

Q12)a) Explain the profiles on mild slope. Give example of each profile. **[8]**

b) A wide rectangular channel carries a flow of 10 $m^3/s/m$ width of the channel with a bed slope of 1 in 3000 and Manning's n = 0.015. If the depth at a section is 4.0 m, determine how far upstream or downstream of the section, the depth of flow would be within 5% of the normal depth. Use direct step method with two steps. Classify and sketch the profile. **[8]**