

Total No. of Questions :12]

SEAT No. :

**P3562**

**[5560]-505**

[Total No. of Pages :3

**T.E. Civil**

**FLUID MECHANICS-II**

**(2015 course) (Semester-I) (301005)**

*Time : 2½Hours]*

*[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 logarithmic tables, slide rule mollier charts electronic pocket calculator and steam tables is allowed.*
- 4) *Assume suitable data if necessary.*
- 5) *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, Q11 or Q12.*

**Q1) a)** Explain in brief “ practical problems involving fluid flow around submerged objects” [2]

b) Derive the following expression for emptying a tank through an orifice at its bottom.

$$T = \frac{2A \left[ \sqrt{H_1} - \sqrt{H_2} \right]}{Cd.a.\sqrt{2g}}$$

[6]

OR

**Q2) a)** Describe in brief the phenomenon of “Water Hammer”. [2]

b) A jet plane which weighs 29.50 kN and having a wing area of 20m<sup>2</sup> flies at a velocity of 960 km/hr, when the engine delivers 7358 kW power. 65% of the power is used to overcome the drag resistance of the wing . Calculate the coefficient of lift and drag for the wing. The density of atmospheric air is 1.215 Kg/m<sup>3</sup> [6]

**Q3) a)** A trapezoidal channel has a bottom width of 10.5 m and a side slope of 1.5 horizontal: 1 vertical. The Manning’s n can be taken as 0.016. What bottom slope is necessary to pass 110m<sup>3</sup>/s of discharge in this channel at depth of 3.1m? [6]

OR

**P.T.O.**

**Q4)** Explain in brief with neat sketches “Channel transitions”. [6]

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

OR

**Q6)** A stationary hydraulic jump occurs in a rectangular channel with the initial and sequent depths being equal to 0.25 m and 1.25 m respectively. Estimate

- i) The discharge per unit width and
- ii) energy loss [6]

**Q7) a)** Derive expression for the “work done by the jet” in case of flat plate inclined and moving in the direction of jet. [6]

b) Explain with neat sketch the working of a centrifugal pump. [6]

c) A centrifugal pump delivers water against a net head of 15 meter and design speed of 1050 rpm the vanes are curved back to an angle of  $30^\circ$  with the periphery. The impeller diameter is 40cm and width at outlet is 6 cm. Determine the discharge of pump if the manometric efficiency is 96%. [6]

OR

**Q8) a)** Derive the expression for minimum speed for starting a centrifugal pump. [6]

b) What do you meant by priming? Explain its significance with respect to working of centrifugal pump. [4]

c) A jet of water of diameter 8cm strikes a curved plate at its centre with a velocity of 22 m/s. The curved plate is moving with a velocity of 10m/s in the direction of jet. The jet is deflected through an angle of  $165^\circ$ . Assume the plate is smooth. Find

- i) Force exerted on the plate in the direction of jet
- ii) Power of the jet and
- iii) Efficiency of jet. [8]

**Q9) a)** Explain in brief the classification of turbines with respect to the following. [8]

- i) Type of energy at inlet
- ii) Direction of flow
- iii) Head at inlet of turbine
- iv) Specific speed of turbine

- b) A hydraulic turbine is to operate at 181 rpm under a head of 31m. The discharge is 26 m<sup>3</sup>/s and the overall efficiency is 85%. Determine the performance of the turbine under head of 21 m. [8]

OR

- Q10)a)** i) Define specific speed. Explain the significance of specific speed.  
 ii) A turbine develops 7356 kW under a head of 24.5 m at 215 rpm. What is its specific speed? Indicate the type of turbine suitable for the purpose. [8]

- b) A 140 mm diameter jet of water issuing from a nozzle impinges on buckets of pelton wheel and the jet is deflected through an angle of 165° by the buckets. The head available at the nozzle is 410m. Assuming the coefficient of velocity as 0.97, speed ratio as 0.46 and reduction in relative velocity while passing through buckets as 16%. Find  
 i) The force exerted by the jet on the bucket in tangential direction and  
 ii) Power developed. [8]

- Q11)a)** Derive the following equation of GVF with usual notations. [8]

$$\frac{dy}{dx} = \frac{S_o - S_f}{1 - \left( \frac{V^2}{g \cdot y} \right)}$$

- b) Explain the Graphical method of Integration of GVF Computation. [8]

OR

- Q12)a)** Find the slope of the free water surface in a rectangular channel of width 20m having depth of flow 6m. The discharge through the channel is 55m<sup>3</sup>/s. The bed of the channel having a slope of 1 in 4500. Assume the value of Chezy's constant C=65. [6]

- b) A wide rectangular channel carries a flow of 11m<sup>3</sup>/s/m width of the channel with bed slope of 1 in 3500 and Manning's n=0.015. If the depth at a section is 4.5m, 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. [10]

