Total No. of Questions : 12]

SEAT No. : ____

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T.E. (Civil)

FLUID MECHANICS - II

(2008 Course) (Semester - I) (Theory) (301004)

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

Instructions to the candidates:

1) ***Answer any 3 questions from each section.***
2) ***Answers to the two sections must be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What are the Civil Engineering application of flow around submerged bodies? Explain with required sketch, the effect of flow around circular cylinder giving rise to Karman Vortex trail. **[8]**

b) Explain development of tip vortices on an air foil of finite span resulting in development of induced drag? **[4]**

c) A circular cylinder has a diameter of 20mm & length of 75cm. air flows with a velocity of 10cm/s. Find total drag and shear drag. Take density of air = 1.23 kg/m^3, shear drag coeff= 0.20 and total drag coefficient = 1.2. **[6]**

OR

Q2) a) What is unsteady flow? With required example explain four types of unsteady flow. **[6]**

b) What is water hammer phenomenon and why does it occur? What are the effect of water hammer phenomenon and explain pressure variation in pipes due to sudden closure of valve. **[8]**

c) Explain the effect of free surface on drag. **[4]**

P.T.O.

Q3) a) What is Impulse Momentum equation and its application? Derive the condition for work done and efficiency for a wheel with radial curved vane. **[8]**

b) A jet of water having velocity 40 m/s strikes without shock a series of vane moving with 12m/s. The direction of motion of vane is inclined to that of jet at 20^{o}. The relative velocity at outlet is 0.9 times that at inlet. The direction of absolute velocity at outlet is normal to direction of motion of vane. Find, **[8]**

i) Vane angle at inlet and outlet,

ii) Work done,

iii) Efficiency.

OR

Q4) a) With neat sketch explain the various head on impulse and reaction turbine. What are the various efficiency for turbine and derive the condition for each. **[8]**

b) An inward flow reaction turbine has external and internal wheel diameter of 1.2m and 0.6m respectively. The water enters the wheel at 20m/s at an angle of 10^{o}. The width of wheel at inlet and outlet 150mm and 300mm. If the vane angle at inlet and outlet are 70^{o} & 20^{o}, determine, **[8]**

i) Tangential velocity at runner inlet,

ii) Absolute velocity of water at outlet.

Q5) a) What is draft tube and show that the pressure at the runner exit is below atmospheric. **[6]**

b) What are unit and specific quantities? Derive the expression for specific speed of hydraulic turbine and classify the turbine based on specific speed. **[6]**

c) What is the necessity of model testing of turbine? Give the various conditions for complete similarity between model and prototype. **[4]**

OR

Q6) a) Distinguish between Reciprocating and centrifugal pump. What are the different heads required to be developed by centrifugal pump with neat sketch? **[8]**

b) A centrifugal pump has to deliver $0.25m^3/s$ of water when running at a speed of 1500 rpm at a head of 20m. If the manometric efficiency is 75% and absolute velocity of water at outlet of impeller is 150m/s. At exit the width of pump is 30% of the diameter. calculate the impeller diameter and vane angle at outlet. **[8]**

SECTION - II

Q7) a) What is an open channel and necessity of construction of open channel? What is conveyance of a channel & give the requisite equation? **[6]**

b) What is the criterion for a channel to be efficient or economical? Derive the condition for most economical triangular channel. **[8]**

c) What are the various uniform flow formula used for design of channels? Derive the Chezy equation for velocity of flow in an open channel. **[4]**

OR

Q8) a) Explain the establishment of uniform flow in an open channel. What are the various factors affecting the Manning coefficient? **[6]**

b) What is critical depth? What are the different conditions for a flow in channel to be critical? Show that for critical flow in a channel. **[6]**

$$Q^2/T = A^3/T$$

c) A rectangular channel 4.0m wide carries a discharge of $3.2m^3/s$ with a depth of flow of 0.8m. If Manning coefficient is 0.016, determine **[6]**

i) Specific Energy,

ii) Specific force,

iii) Critical depth.

Q9) a) What are the different types of flow that occur in an open channel, give example of each. **[4]**

b) Derive the condition for head loss in a hydraulic jump in the form. **[6]**

$$\Delta E = (V1 - V2)^3 / 2g\,(V1 + V2)$$

c) Explain the location of hydraulic jump when hydraulic jump forms below a regulating sluice in a Mild slope channel. **[6]**

OR

Q10)a) A sluice gate in a 2.5m wide rectangular horizontal channel releases a discharge of $170 m^3/s$. The gate opening is 0.67m. Assuming C_c=0.6, state type of jump when tail water is **[6]**

i) 3.5m, ii) 5m, iii) 4.65m.

b) Explain the utility of hydraulic jump as energy dissipator. Explain the use of specific energy and specific force diagram to find energy loss in hydraulic jump. **[6]**

c) Explain the classification of hydraulic jump based on Froude number and what is the amount of energy lost in each case. **[4]**

Q11)a) What are the assumptions made in derivation of dynamic equation of gradually varying flow. Derive the dynamic equation of gradually varying flow. **[8]**

b) Explain the criteria for classifying channel slope and explain the development of M1, S1, & H2 using the governing equation for developing flow profile. **[8]**

OR

Q12)a) A rectangular channel is 7.5m wide and carries a discharge of $15 m^3/s$. The depth at certain section is 1.8m, determine how far from this section the depth will be 2.5m. Take the bed slope as 1 in 7500 and Manning n=0.016. **[8]**

b) What are the different methods for finding the length of flow profile and explain Ven Tee Chow method in detail. **[6]**

c) What are the different flow measuring devices? **[2]**

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