*(Please write your Exam Roll No.)* *Exam Roll No. ..*

# END TERM EXAMINATION

**THIRD SEMESTER [B.TECH] NOVEMBER-DECEMBER- 2018**

***Paper Code: ETCE-205*** ***Subject: Fluid Mechanics***

***Time: 3 Hours*** ***Maximum Marks: 75***

***Note: Attempt all questions as directed. Internal Choice is indicated. Assume missing data if any.***

1. Attempt any five parts: 5x5=25

a) Define poise and develop a relation between the force units and poise for dynamic viscosity? 5

b) Prove that the metacentric height of a floating body experimentally is given by a equation: $GM = wx/W.\tan\Theta$? 5

c) Differentiate between tangential and normal acceleration and find out the expression for both? 5

d) Define linear momentum and angular momentum and list out a few applications of each? 5

(e) What do you understand by Reynolds number? Mention its significance in fluid mechanics? 5

(f) What are the boundary conditions that must be satisfied by a given velocity profile in laminar boundary layer flow? 5

(g) What do you understand by fundamental units and derived units? Illustrate with examples? 5

(h) What do you understand by non dimensional factors and their use model testing? 5

Q2. a) Define surface tension and prove that $\Delta p = 4\sigma/D$? A plate of 0.02 mm distant from the fixed plate, move with a velocity of 0.5 m/sec when a force applied is 1.5 $N/m^2$. And the gap is filled with oil. Find the viscosity of the oil in poise? 8

b) What do you understand by the term anchoring of the floating body? Explain the necssecity for the same? 4.5

**OR**

Q3. a) Deduce the Chezys formula for the velocity of flow through pipes? Explain their significance in flow problems? Derive a formula developed by Darcy for loss of head due to friction for the flow through a pipe? 8

b) The velocity components in two dimensional steady state, incompressible flow are given as: 4.5

$u = x + 2y$ and $v = x^2 - 2y$, check the validity of the flow. If u expression is correct then find the expression for v so that the flow exists?

Q4 (a) A ventury meter 30 cm x 10 cm is used for measuring the discharge of oil (Sp. Gr. = 0.85) passing through vertical pipe in upward direction. The difference between entrance and throat section of the venture is 40 cm. The head recorder by mercury manometer is 20 cm. Find the discharge and the pressure difference between the entrance and throat section? Take Cd = 0.97. 8

(b) Two velocity components in a given flow field is given by 4.5

$u = 4x^2 + 3xy$

$w = z^2 - 4xy - 2yz$ and find the third component so that the flow field exists?

**OR**

Q5. (a) Define linear momentum and angular momentum and list out a few applications of each? **8.5**

(b) In a foot step (thrust) bearing, a shaft of 8 cm in diameter is rotating at 1000 rpm. An oil film is used is 1.5 mm and μ for oil = 1.5 poise. Find out the power loss in viscous resistance of the bearing? **4**

Q6. a) The velocity profile in a laminar boundary layer is given by $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$, if the water is flowing over the plate with a velocity of 10m/min. Find the thickness of the boundary, drag force on the plate and average drag coefficient. The plate is 1 m long and 1.5 m wide and flow is parallel to 1 m side. Take ρ = 1000 kg/m$^3$ and μ = 0.01 poise for water. **8**

(b) The velocity distribution in a boundary layer is given by $\frac{u}{U} = \left(\frac{y}{\delta}\right)$, find out the displacement, momentum and energy thickness? **4.5**

Q7. a) Using dimensional analysis technique proves that the power developed by the hydraulic turbine given by by $P = \rho N^3 d^5 f\left(\frac{N^2 d^2}{gH}\right)$, where d is rotor diameter, N rotor speed and H is available head and ρ density of the fluid? Define distorted models with examples? **8**

b) State and explain the Buckingham's π theorem, how is choice of repeating variable made? **4.5**

**OR**

Q8. a) Explain the characteristics of laminar and turbulent boundary layers? Which factors effect the thickness of boundary layers? Discuss the phenomenon of separation of flow over curved surface? **8**

b) Derive an expression for the drag force on smooth sphere diameter D moving with a velocity V in a fluid density ρ and dynamic viscosity μ? **4.5**

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