****Last Date of Submission ……..** **Section CE 21/CE 22**

Babu Banarasi Das -National Institute of Technology & Management, Lucknow

B. Tech Second Year (Third Semester) 2018-19

Department of Civil Engineering

FLUID MECHANICS-(RCE-303)

Assignment: I (Unit 1)

ATTEMPT ALL QUESTIONS:-

1. Define the following fluid properties-
   a) Density,b) weight density and c) specific gravity of fluid.
2. What is the difference between dynamic viscosity and kinematic viscosity? State their units of measurement.
3. Define surface tension. Prove the relationship between surface tension and pressure inside the droplet of liquid in excess of outside pressure is given by $p=4\sigma/d$.
4. The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4m and rotates at 190rpm. Calculate the power lost in the bearing for a sleeve length of 90mm. the thickness of the oil film is 1.5mm.
5. viscosity of a liquid having kinematic viscosity 6 stokes and specific gravity 1.9.
6. The following cases represents the two velocity components, determine the third component of velocity such that they satisfy the continuity equation;

   $u= x^2+y^2+z^2$; $v=xy^2-yz^2+xy$.

7. Determine the velocity and acceleration of a particle at position
   x=1, y=2, z=5, at t = 0.1 sec in velocity field prescribed by: $V=10x^2i-20xyj+100tk$
8. 250 litre/sec of water is flowing in a pipe having diameter of 30cm. If the pipe bend by 135^0. Find out magnitude and direction of resultant force on bend. The pressure of water flowing in the pipe is 400kPa.
9. Two horizontal plates are placed 11.5mm a part the space between them being filled with all of viscosity14 poise. Calculate the shear stress in the oil if upper plate moves with a velocity of 3.5m/s.
10. 1 litre of crude oil weighs 9.6 N. calculate its specific weight, density and specific gravity.

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Assignment: II (Unit II)

1. Derive continuity equation for steady, incompressible, irrotational 3-Dflow.
2. A solid cone of relative density 0.80 floats in water. What should be its minimum apex angle, so that it may float its apex downwards in stable equilibrium.
3. Name different types of fluid flow & explain them in brief.
4. .A 300mm dia pipe carrying water divides into two branches of dia 200 mm & 100 mm respectively. If average velocities in the 300 mm pipe & 200 mm pipe are 2.5 m/s & 1.6 m/s respectively, determine the velocity in 100 mm dia pipe.
5. With the neat sketches, explain the conditions of equilibrium of floating & submerged bodies**.**
6. Explain free & forced vortex flow with their examples.
7. Stream function in two dimensional flow field is given by $\psi=xy$. Find out corresponding the velocity potential.
8. A rectangular plane surface 2 m wide and 3 m deep lies in water in such a way that its plane makes an angle of 30^0 with the free surface of water. Determine the total pressure and position of COP,when the upper edge is 1.5m below the free water surface
9. A rectangular body 3m *1.5m *1m floats in oil of sp.gr. 0.78,the depth of immersion being 0.65m.Compute
10. Weight of the body **(b)** Metacentric height **(c)** Nature of equilibrium.

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Assignment: III (Unit III)

1. Enunciate Euler's Equation of motion &thereby derive Bernoulli's Equation. Illustrate clearly the assumptions taken.
2. Find the velocity of flow of an oil through a pipe, when the difference of mercury level in a differential U-tube manometer connected to the two tappings of the pitot-tube is 100 mm. Take co-efficient of pitot-tube = 0.98 & sp.gr. of oil =0.8.
3. Give the expression of discharge for orifice meter.
4. A 45^{o} reducing bend is connected in a pipeline, the diameters at the inlet & outlet of the bend being 600 mm & 300 mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829 N/cm^2& rate of flow of water is 600 litres/s.
5. A pipe of 300mm diameter conveying 0.30m^3/s of water has right angled bend in a horizontal plane. Find the resultant force exerted on the bend if pressure at inlet and outlet of the bend are 24.52N/cm^2 and 23.54N/cm^2.
6. Derive the expression Cd= Cv * Cc.
7. Derive Bernoulli's equation with the help of Euler's equation.
8. Find the discharge of water flowing a pipe 200 mm diameter placed in an inclined position where a venturimeter is inserted, having throat diameter of 100 mm. The difference between the main and throat is measured by a liquid of specific gravity .75 in an inverted U tube which gives a reading of 300 mm. The loss of head between the main and throat is .3 times the kinetic head of pipe.
9. Prove that the time; $T = 2AH^{1/2}/C_dA_0\sqrt{2g}$ required to empty a tank by Orificemeter.
10. What are the various methods of dimensional analysis.

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Assignment: IV (Unit IV)

1) What are the various energy losses in pipes.
2) Derive an equation showing that in laminar flow through circular pipes, velocity of flow varies parabolically.
3) What are the causes which result in separation of boundary layer ?
4) Derive the expression for velocity variation for a laminar incompressible flow in a circular pipe.
5) Derive the expression for shear stress distribution and velocity distribution for laminar flow in a circular pipe
6) Explain with a neat .sketch the phenomenon of boundary layer separation on a stationary flat plate.
7) What do you understand by hydrodynamically smooth and rough boundaries?
8) Distinguish between laminar boundary layer and turbulent boundary layer.
9) Determine the distance from the pipe, at which the local velocity is equal to the average velocity for turbulent flow in pipes.
10) An oil having viscosity of 1.42 poise and specific gravity 0.9 flows through a pipe 25 mm diameter and 300 m long at Reynolds number of 1800. Find the flow through the pipe and the power required to maintain the flow.

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Assignment: V(Unit V)

1. What do you understand by boundary layer and boundary layer theory?
2. Obtain Von Karman momentum integral equation.
3. For the velocity profile for laminar boundary layer $u/U= 3/2(y/\delta)-1/2(y/\delta)^3$. Determine the boundary layer thickness, shear stress, drag force and co-efficient of drag in terms of Reynolds number.
4. The velocity distribution in the boundary layer is given as $u/U= 3/2\eta-1/2\eta^2$. In which $\eta=y/\delta$. Compute δ^x/δ and θ/δ.
5. Define boundary layer and explain the fundamental causes of boundary layer development with suitable sketches
6. Explain the boundary layer thickness, displacement thickness, momentum thickness and energy thickness. The velocity distribution in boundary layer is given by

   $u/U= 3/2\eta-\eta^2/2$. Find (θ/δ).

7. Define the terms- a) boundary layer thickness, b) displacement thickness, c) momentum thickness, d) energy thickness.
8. What do you understand by laminar and turbulent boundary layer.
9. Define boundary conditions for the velocity profiles.
10. Define total drag on a flat plate due to laminar and turbulent boundary layer.

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