Code No: R21014 **R10** SET - 1

II B. Tech I Semester Supplementary Examinations, June - 2015
FLUID MECHANICS
(Civil Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1 a) Write short notes on differential manometers

b) Determine the torque of the shaft when rotates in bearings at speed of 220 rpm. Shaft diameter is 200 mm and two bearings of 20 cm width are used. The bearings are with uniform oil film of thickness 1 mm

2 a) Explain about Hydrostatic forces

b) A dam has a parabolic shape, $y=x^2/8$ .The width of dam is 3 m.If the height of water retains by dam is 8 m. Find the resultant force activity on the dam and the portion of center of pressure

3 a) Define stream function and velocity potential function

b) It for a two-dimensional potential flow the velocity potential is given by $\acute{A}=x(2y-1)$ determine the velocity at the point P(4,5). Determine also the value of stream function $\tilde{A}$ at the point P.

4 a) Write shorts notes on:
i) Bernoulli's equation ii) Euler's equation iii) Vortex Flow.

b) A closed vertical cylinder 350mm in diameter and height 400mm height is filled With oil of relative density 0.9 to a depth of 280mm, the remaining volume Containing air at atmosphere pressure. The cylinder rotates about its vertical Axis at such a speed that the oil. Just begins to uncover the base. Calculate The speed of rotation for this condition
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5 a) What are different types of drag? What is streamlining? What is its effect on the Different types of drag?

b) A cylinder 15 cm in diameter and 10 m long, is made to turn 1500 revolutions per minute with its axis perpendicular in a stream of air having uniform velocity of 25 m/sec. Assuming ideal fluid, find:
i) Circulation ii) Lift force experienced by the cylinder and
iii) The position of stagnation points Take density of air as 1.2 kg/m^3.

6 a) Sketch the Reynolds apparatus and explain how the laminar flow can be demonstrated with the help of this apparatus?

b) Oil of absolute viscosity 1.5 poise and relative density 0.85 flows through a 30cm diameter pipe. If the head losses in 3000M length of pipe is 20M. estimate the friction factor by assuming the flow to be laminar.

7 a) Derive Darcy-Weisbach equation for loss of head in apipe

b) Two tanks are connected by a 300 mm diameter 1000 m long pipe. Find the rate of flow if the difference of water level in the tank is 10 m. Take 4f = 0.04 and ignore minor losses

8 a) What is suppressed weir and a weir with end contractions?

b) Find the expression for discharge over a trapezoidal notch in terms head of liquid over the crest of the notch and included angle and bottom width

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1 a) The velocity distribution for flow over a flat plate is given by $U= 4y – 3 y^{3/2}$,Where U is velocity in m/s at a distance y m above plate.Determine the shear stress at y = 4 cm.Assume dynamic viscosity is 6 poise
b) Explain about atmospheric, gauge and vacuum pressure

2 A tank has a base 3m square from which four side slope outward at 60^0 to the horizontal for a vertical height of 3m they then turn vertically upward for another 3m. The tank is filled with water of full depth of 6m. Find the total pressure and centre pressure on one of the sloping sides of the tank.

3 a) For a two-dimensional flow, the velocity components are $u= x/(x^2+y^2)$, $v=y/(x^2+y^2)$ determine
i) the acceleration components a_x and a_y;
ii) the rotation of z.
b) How the 'circulation' is is defined?

4 a) Derive Bernoullis equation and state assumptions
b) The water is flowing through a pipe having diameters 20cm and 10cm at sections 1 and 2 respectively. The rate of flow through pipe is 35litres/s. The section 1 is 6m above datum and section 2 is 4m above datum. If the pressure at section 1 is $39{:}24 Ncm^2$ and the intensity of pressure at section 2.

5 a) Explain the Mechanics of boundary layer transition
b) Through a horizontal circular pipe of diameter 100 mm and of length 10m, an oil of dynamic 0.097 poise and relative density 0.9 is flowing. Calculate the difference of pressure at the two ends of the pipe, if 100 Kg, of the oil is collected in a tank in 30 seconds.
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Code No: R21014 **R10** SET - 2

6 A pipe line ABC 180 m long is laid on an upward slope of 1 in 60. The length of portion AB is 90 m and its diameter is 0.15 m. At B the pipe section suddenly enlarges to 0.30 m diameter and remains so for the remainder of its length BC, 90m. A flow of 50 liters per second is pumped into the pipe at its lower end A and is discharged at the upper end C into a closed tank. The pressure at the supply end A is 137.34 kN/m^2. Sketch (a) the total energy line (b) the hydraulic gradient line and also find the pressure at discharge end C. Take f = 0.02 in $hf=flV^2/2gD$

7 A pipe of diameter 0.4m and of length 2000m is connected to a reservoir at one end. The other end of the pipe is connected to a junction from which two pipes of lengths 1000m and diameter 300mm run in parallel. These parallel pipes are connected in another reservoir which is having level of water 10m below the water level of the above reservoir. Find the total discharge if f=0.015. Neglect minor losses.

8 a) Explain why ventilation of suppressed rectangular weir is necessary?

b) A rectangular weir is 2m long and has a head of 0.675m. Find the discharge taking into account two end contractions.

Code No: R21014 **R10** SET - 3

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1 a) Explain Newtons law of viscosity.

b) A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 40 cm and the height of fluid in the left from the centre of pipe is 15cm below.

2 A tank has a base 4m square from which four side slope outward at 45^0 to the horizontal for a vertical height of 3m they then turn vertically upward for another 3m. The tank is filled with water of full depth of 6m. Find the total pressure and centre pressure on one of the sloping sides of the tank

3 a) If $\phi = 3xy$, find x and y components of velocity at (1,3) and (3,3). Determine the discharge empassing between streamlines passing through these points.

b) Explain in brief about one-dimensional, two-dimensional and three-dimensional flows?

4 a) Define Bernoulli's equation and Mention the assumptions made to derive it.

b) A pipeline carrying oil of speci– c gravity 0.8, changes in diameter from 300mm at a position A to 500mm diameter to a position B which is 5m at a higher level. If the pressure? s at A and B are 19.62 N/c m^2 and 14.91 N/c m^2 respectively, and the discharge is 150 Lit/s, determine the loss of head and direction of flow

5 a) Explain the Mechanics of boundary layer transition

b) Through a horizontal circular pipe of diameter 100 mm and of length 10m, an oil of dynamic 0.097 poise and relative density 0.9 is flowing. Calculate the difference of pressure at the two ends of the pipe, if 100 Kg, of the oil is collected in a tank in 30 seconds.
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Code No: R21014 **R10** SET - 3

6 a) Sketch the Reynolds apparatus and explain how the laminar flow can be demonstrated with the help of this apparatus?
b) Derive an expression for the velocity distribution for turbulent flow in smooth pipe

7 a) How the loss of energy at the entrance to the pipe and exit from the pipe is to be determined?
b) A horizontal pipeline 50 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 30 m of its length from the tank, the pipe is 100 mm diameter and its diameter suddenly enlarged to 200 mm. The height of the water level in the tank is 10 m above the centre of the pipe. Determine the rate of flow. Take 4f = 0.04 for both sections of the pipe and consider minor losses.

8 a) Discuss the various empirical formulae for discharge over weirs?
b) Find the discharge through a triangular notch under a constant head of 3.25m if the angle of the notch is 120^0. Take Cd=0.62.

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1 a) Explain manometer in brief.
b) How thick is the layer of liquid mud of specific gravity 1.6, at the bottom of a tank with water 8.5m deep above it, if there is a pressure of 490.5kN/m^2 against the bottom of the tank?

2 a) Explain about Center of pressure
b) A rectangular plane surface is 2m wide and 3m deep. It lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when its upper edge is horizontal and coincides with water surface.

3 a) Explain in brief about streamline, streak line and path line.
b) Show stream function and velocity potential intersect orthogonally

4 a) Mention the different forces in a fluid flow. For the Euler's s equation of motion, which force are taken into consideration.
b) A conical tube of length 2m is fixed vertically with its smaller end upwards. The velocity of flow at the smaller end is 5m/s, while at the lower end it is 2m/s. The pressure head at the smaller end is 2.5m of liquid. The loss of head in the tube is 0.35 ($V1 - V2)^2$ / 2g, where $V1$ is the velocity at the smaller end and $V2$ at the lower end respectively. Determine the pressure head at the lower end. Flow takes place in downward direction.

5 a) What are the boundary conditions that must be satisfied by a given velocity profile in laminar boundary layer flows.
b) A smooth flat plate of length 5m and width 2m is moving with a velocity of 4m/sec in stationary air of density as 1.25KG/m^3 and kinematic viscosity $1.5*10^{-5}m^2$/sec Determine thickness of the boundary layer at the trailing edge of the smooth plate. Find the total drag on one side of the plate assuming that the boundary layer is turbulent from the very beginning.
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Code No: R21014 **R10** SET - 4

6 a) What do you understand by turbulent flow? What factors decides the type of flow in pipes?

b) Water is flowing through a rough pipe of diameter 40cm and length 3000m at the rate of 0.4 m^3/s. Find the power required to maintain this flow. Take the Average height of roughness of K = 0.3mm.

7 a) Derive and expression for head lost due to sudden contraction of a pipe

b) A pipe increases in diameter suddenly from 10 cm to 20 cm. if the discharge of water through the pipe is 100 lit/sec., determine the loss of head due to sudden enlargement of cross sectional area. Also determine the difference of pressure between two sections of the pipe line.

8 a) What is Notch? How are the notches classified?

b) Find the discharge through a triangular notch under a constant head of 0.25m if the angle of the notch is 120^0. Take Cd=0.62.