## FLUID MECHANICS (CIVL 2113)

#### **Time Allotted : 3 hrs**

Full Marks: 70

#### Figures out of the right margin indicate full marks.

# Candidates are required to answer Group A and <u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

#### Group – A (Multiple Choice Type Questions)

1.	Choose the correct alternative for the following:			$10 \times 1 = 10$
	(i)	The dimension of kinematic viscosity is (a) L <sup>2</sup> T <sup>-2</sup> (b) ML <sup>2</sup> T <sup>-1</sup>	(c) L <sup>2</sup> T <sup>-1</sup>	(d) M <sup>2</sup> L <sup>2</sup> T <sup>-2</sup>
	(ii)	Manometer is used to measureparan (a) Speed (b) Density	meter of the fluid. (c) Pressure	(d) Quality.
	(iii)	If temperature increases then viscosity of (a) Increase (c) No change	liquid (b) Decrease (d) First increas	e then decrease.
	(iv)	Buckets and blades used in a turbine are u (a) Alter the direction of water (c) To regulate the wind speed	sed to (b) Switch off th (d) To regenerat	e turbine the power.
	(v)	If Froude number is greater than 1 then th (a) Hypercritical (c) Hypocritical	e flow is considered as (b) Supercritical (d) Sub critical.	
	(vi)	<ul> <li>A floating body is in stable equilibrium when</li> <li>(a) The metacentric height is zero</li> <li>(b) It's centre of gravity is below the centre of buoyancy</li> <li>(c) The metacentre is above its centre of gravity</li> <li>(d) The metacentre is below its centre of gravity.</li> </ul>		
	(vii)	Hydraulic energy is converted into an machines. What form of energy is that? (a) Mechanical Energy (c) Nuclear Energy	other form of energ (b) Electrical En (d) Elastic Energ	y by hydraulic ergy gy.

#### B.TECH/CE/3<sup>RD</sup> SEM/CIVL 2113/2020

- (viii) Which of the following is not a way of classifying notches or weirs?
  - (a) Based on the shape of opening
  - (b) Based on the effect of the sides on the nappe
  - (c) Based on the shape of the crest
  - (d) Based on the effect of the sides on the crest.
- (ix) Weirs are normally used to calculate
  (a) Volume
  (b) Head loss
  (c) Discharge
  (d) Velocity.
- (x) Which property of the fluid accounts for the major losses in pipes?
   (a) Density (b) Specific gravity
   (c) Viscosity (d) Compressibility.

### Group – B

- (a) Define centre of buoyancy.
   A pipe through which water is flowing having diameter 30cm and 15cm at cross section 1 and 2 respectively. The velocity at section 1 is 5m/s, Find velocity head and discharge at section 2.
  - (b) An open tank contains water upto a depth of 2 m and above it an oil of specific gravity 0.9 upto a depth of 1m. Find the pressure intensity (a) at the interface of two liquids and (b) at the bottom of the tank.

(1+5)+6=12

- 3. (a) A trapezoidal channel has side slopes of 3 horizontal to 4 vertical. It has bed slope of 1 in 2000. Determine the optimum dimension of channel if it is most economical with water flow  $0.5 \text{ m}^3/\text{s}$ . Take C=80.
  - (b) Write down the condition of equilibrium of a floating body by considering C.G. and metacentre of that solid floating body.

8 + 4 = 12

### Group – C

- 4. (a) Determine the height of a rectangular weir of length 6m to be built across a rectangular channel. The maximum depth of water on the upstream side of the weir is 1.8 m and discharge is 2000litres/sec. Take  $C_d$ =0.6 and neglect end contractions.
  - (b) Water flows through a triangular right-angled weir first and then over a rectangular weir of 1m width. The discharge co-efficient of the triangular and rectangular weirs are 0.6 and 0.7 respectively. If the depth of water over the triangular weir is 360 mm, find the depth of water over the rectangular weir.

6 + 6 = 12

5. (a) An oil of specific gravity 0.7 is flowing through a pipe of diameter 300 mm at the rate of 500 litres/sec. Find the head lost due to friction and power required to maintain the flow for a length of 1000 m. Take v = 0.29 stokes.

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(b) Determine the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300 mm and length 400 m. The rate of flow of water through the pipe is 300 litres/ second. Consider all loses and take the value of f= 0.008.

6 + 6 = 12

#### Group – D

- 6. (a) State Buckingham pi theorem. Write down the advantage of Buckingham pi theorem over Rayleigh's method.
  - (b) The pressure difference P of pipe diameter d, length l depends on turbulent flow velocity v, viscosity μ, density p. Obtain an expression for P using any theorem of the dimensional analysis.

(2+2)+8=12

- 7. (a) Find an equation for the power developed by a pump if it depends upon head (H), discharge (Q) and specific weight (w) of the fluid using Rayleigh's method.
  - (b) Define specific energy curve along with its diagram. Derive the expression for critical depth of flow.

6 + 6 = 12

## Group – E

- 8. (a) Define the terms: (i) Gross Head, (ii) Hydraulic efficiency and (iii) Volumetric efficiency.
  - (b) Write a short note on Pelton turbine and briefly describe the different parts of Pelton turbine.

(2+2+2)+6=12

- 9. (a) Describe in details the main parts of a centrifugal pump.
  - (b) A centrifugal pump is to discharge 0.118m<sup>3</sup>/sec at a speed of 1450r.p.m against a head of 25 m. The impeller diameter is 250 m, it's width at outlet is 50 mm and manometric head 75%. Determine the vane angle at the outer periphery of the impeller.

6 + 6 = 12

Department & Section	Submission Link
CE A	https://classroom.google.com/c/MTE5MTM4Nzk0OTkz/a/Mjc0NTUwMzA1MDEx/details
CE B	https://classroom.google.com/c/MTQyMzI4MzQ4ODg4/a/Mjc0NTUxMjgzNTQ4/details