Register Number.....

**B.E. DEGREE EXAMINATIONS: APRIL / MAY 2009**

Third Semester

**CIVIL ENGINEERING**

**U07CE304 Mechanics of Fluids**

**Time: Three Hours** **Maximum Marks: 100**

**Answer ALL the Questions:-**

**PART A (20 x 1 = 20 Marks)**

1) The relationship between poise and $NS/m^2$ is .....

A) $1\ P = 10\ NS/m^2$ B) $10\ P = 1\ NS/m^2$ C) $1\ P = 1\ NS/m^2$ D) $1\ P = 9.81\ NS/m^2$

2) The specific gravity of a fluid is 0.85, its specific weight in SI units is .....

A) $850\ kg/m^3$ B) $8.3385\ kN/m^3$ C) $850\ kgf/m^3$ D) $850\ N/m^3$

3) The unit of surface tension is

A) Kg/m B) dyne $Sec/cm^2$ C) Pa.S D) N/m

4) The capillary rise or fall of a liquid is given by

A) $h = \frac{4\sigma \sin\theta}{\gamma d}$ B) $h = \frac{2\sigma \cos\theta}{\gamma\theta}$ C) $h = \frac{4\sigma \cos\theta}{\gamma d}$ D) $h = \frac{2\sigma \sin\theta}{\gamma\theta}$

Where, $\sigma$ is surface tension, $\gamma$ is specific weight and $\theta$ is contact angle

5) For a submerged curved surface, the vertical component of hydro static force is .....

A) Weight of the liquid supported by the curved surface

B) Mass of the liquid supported by the curved surface

C) The force on the projected area of the curved surface on the vertical plane.

D) $\gamma A \bar{y}$ where $\gamma$ is specific weight. A is the area of the curved surface and $\bar{y}$ is the centre of pressure.

6) Hydro static law of pressure is given by

A) $\frac{\partial p}{\partial z} = 0$ B) $\frac{\partial p}{\partial z} = \gamma$ C) $\frac{\partial p}{\partial z} = p$ D) $\frac{\partial p}{\partial z} = z$

7) Meta centric height is

A) The distance between centre of gravity and meta centre
B) The distance between centre of buoyancy and meta centre
C) The distance between centre of gravity and centre of buoyancy
D) The distance between centre of pressure and free surface

8) Differential manometers are used to find

A) Absolute pressure of fluids in an open channel B) Gauge pressure of fluids in an open channel
C) Gauge pressure of fluids in pipe D) The pressure difference between two points in pipes.

9) Continuity equation deals with

A) The law of conservation of momentum B) The law of conservation of Energy
C) The law of conservation of mass D) Uniform flow only

10) If φ is the velocity potential, then the velocity component in x direction is

A) $u = \frac{\partial \varphi}{\partial y}$ B) $u = -\frac{\partial \varphi}{\partial y}$ C) $u = \frac{\partial \varphi}{\partial x}$ D) $u = \frac{\partial \varphi}{\partial x}$ 21. a)

11) Flow is said to be uniform when

A) Velocity is constant with respect to time

B) When acceleration is constant with respect to time

C) When velocity, area of flow, acceleration etc. are constant with respect to distance. 21. b)

D) When velocity, area of flow, acceleration etc. are constant with respect to time.

12) Identify the wrong statement

A) ϕ exists only for ideal fluid flow

B) χ exists for real fluid flow

C) In a flownet, φ lines and χ lines meet each other orthogonally.

D) χ exists only for ideal fluid flow. ii

13) Flow in a pipe will be laminar if

A) Reynolds number is less than 2000 B) Reynolds number is more than 4000

C) Reynolds number is less than 1000 D) Froude's number is less than 1 22) a)

14) The loss of head due to sudden enlargement is

A) $\frac{0.7 v_2^2}{2g}$ B) $\frac{(v_1 - v_2)^2}{2g}$ C) $\frac{v_1^2 - v_2^2}{2g}$ D) k. $(\frac{v_1^2 - v_2^2}{2g})$

Where $v_1$ is the velocity in the smaller pipe and $v_2$ is the velocity in the larger pipe

15) The velocity distribution in a laminar flow through a circular pipe follows the

A) linear law B) parabolic law C) logarithmic law D) exponential law

16) The major loss in a pipe line is proportional to

A) Square of velocity B) Velocity C) Square root of velocity D) (Velocity)$^{1.5}$

17) Kinematic similarity between model and proto type means

A) Similarity of forces B) Similarity of shape C) Similarity of motion D) Similarity of pres

18) Identify the equation which is not dimensionally homogeneous

A) $v = \sqrt{2gH}$ B) $\frac{\rho_1}{\gamma} + \frac{v_1^2}{2g} + z_1 = \frac{\rho_2}{\gamma} + \frac{v_2^2}{2g} + z_2$ C) $\tau = \mu . \frac{du}{dy}$ D) $v = 6.26\ H^{0.5}$

19) Renold's number is defined as the ratio between 22) b)

A) Inertia force and viscous force B) Viscous and inertia force

C) Inertia force and gravity force D) Gravity force and inertia force

20) Reyleigh's method is suitable when i

A) The number of variables is large

B) The number of variables is less

C) When the number of repeated variables is less 23. a)

D) When the number of variables is equal to number of repeated variables.

PART B (5 x 16 = 80 Marks)

21. a) i) An oil of viscosity 5 poise is used for the lubrication between a shaft and sleeve. The diameter of the shaft is 0.5 m and it rotates at 200 rpm. Calculate the power lost in the oil for a sleeve length of 100 mm. The thickness of the oil film is 1.0 mm. (10)

ii) One litre of oil weighs 9 N. Calculate its specific weight, density and specific gravity (6)

(OR)

21. b) i) Calculate the capillary rise in a glass tube of 3.0 mm diameter when immersed vertically in water and mercury. The surface tensions for mercury and water may be taken as 0.51 N/m and 0.0725 N/m respectively. The contact angles for mercury and water are 130° and 0° respectively. (6)

ii) Find the kinematic viscosity of an oil having density 980 kg/m$^3$ when at a point in oil, the shear stress is 0.25 N/m$^2$ and velocity gradient is 0.3 / s (6)

iii) The pressure of a liquid is increased from 600 N/cm$^2$ to 1000 N/cm$^2$. The volume decreases by 0.2%. What is the bulk modulus of elasticity (4)

22) a) Find the horizontal and vertical components of the total force acting on a curved surface AB, which is in the form of a quadrant of a circle of radius 2m as shown in Fig.1. Assume the width of the surface as 2m. Also find the point of application of the horizontal component.

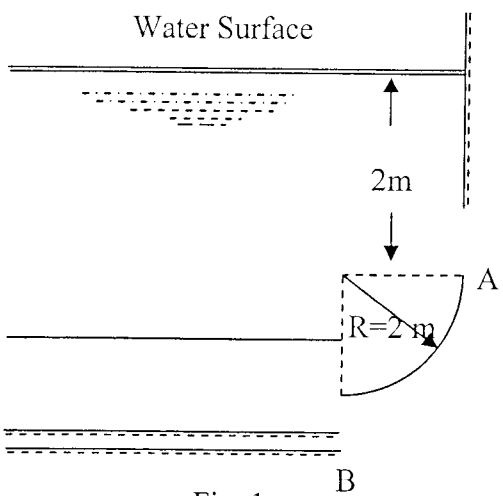


Fig. 1

(OR)

22) b) i) A pipe contains oil of specific gravity 0.8. A differential manometer connected at two points A and B of the pipe shows a difference in mercury level of 20 cm. Find the difference of pressure head between the two points. (6)

ii) A block of size 4m x 2m x 1m floats in water. What is the weight of the block if the depth of immersion is 0.6 m. Determine the meta-centric height also. (10)

23. a) i) Derive the continuity equation in three dimensions from first principle.

(OR)

23) b) i) Define velocity potential and stream function

ii) The velocity potential function $\varphi$ is given by $\varphi = x^2 - y^2$. Find the velocity components in and y direction. Also show that $\varphi$ represents a possible case of fluid flow.Find the resultar velocity at (1, 1)

24. a) A 30 cm x 15 cm venturimeter is inserted in a vertical pipe carrying an oil of specific gra 0.8, flowing in the upward direction. A differential mercury manometer connected to the i and throat gives a reading of 30 cm. The difference in elevation of the throat section and i section is 50 cm. Find the rate of flow of oil. Cd = 0.98

(OR)

24. b) i) A horizontal pipe of diameter 40 cm is suddenly contracted to a diameter of 20 cm.The press intensities in the large and smaller pipes are 14.715 N/cm$^2$ and 12.753 N/cm$^2$ respectively. Cc is 0.62, find the loss of head due to contraction. Also find the discharge

ii) Three pipes of length 750 m, 500 m and 300 m and of diameters 50 cm, 40 cm and 30 respectively are connected in series. These pipes are to be replaced by a single pipe of unifo diameter. Find the length and diameter of the equivalent pipe

25) a) Using Buckingham's $\pi$ theorem, prove that the Torque T of a disc of diameter D rotating a speed of N is a fluid of viscosity $\mu$ and density $\rho$ in a turbulent flow is given by

$$T = D^5 N^2 \rho \varphi \left[ \frac{\mu}{D^2 N \rho} \right]$$

(OR)

25) b) i) Write a short note on distorted models and list the advantages of distorted models.

ii) For a distorted model, the scale ratio in the x direction is $\mathbf{r_x}$, the scale ratio in the y direction i $\mathbf{r_y}$. Determine the scale ratio for discharge

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Time:

1. Blo

2. The

3. Gu

4. Ex

5. A pu

6. Sh

7. Hc

8. Tl

9. Tl st