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B.E. DEGREE EXAMINATIONS: NOVEMBER 2009

Third Semester

CIVIL ENGINEERING

U07CE304: Mechanics of Fluids

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

Answer ALL the Questions:-

PART A (10 x 1 = 10 Marks)

1. ---------- possesses no definite volume and is compressible

   a) Solid b) liquid c) Gas d) vapour

2. Surface tension expressed in

   a) N/m b) N/m^2 c) N^2/m d) N/m^3

3. The manometers are suitable for comparatively ----------Pressures

   a) low b) high c) very high d) high as well as low

4. The point of application of the force of buoyancy on the body is known as

   a) centre of gravity b) centre of buoyancy c) metacentre d) buoyant force

5. If the Reynolds number is less than 2000, the flow in a pipe is

   a) lanunar flow b) turbulent flow

   c) Transition flow d) uniform flow

6. The type of flow in which the velocity at any given time does not change with respect to space is called

   a) Steady flow b) compressible flow

   c) Uniform flow d) rotational flow

7. The flow in town water supply pipes is generally

   a) laminar b) turbulent c) transition d) Uniform

8. In case of laminar flow, the loss of pressure head is proportional to

   a) Velocity b) $velocity^2$ c) $velocity^3$ d) $velocity^4$

9. ---------- is the ratio of inertia force to the viscous force

   a) Frovde's number b) Weber's number c) Reynolds number d) Mach's number

10. Dynamic similarity between the model and prototype is the

    a) similarity of motion c) Similarity of lengths

    b) Similarity of forces d) Similarity of shapes

PART B (10 x 2 = 20 Marks)

11. Define Specific weight.
12. What do you mean by surface tension?
13. Define absolute pressure.
14. Define total pressure.
15. Define Discharge.
16. What do you mean by local acceleration?
17. Write down the Euler's equation of motion.
18. What is the use of pitot tube?
19. What do you mean by dimensional analysis and what are the fundamental dimensions?
20. What are the difference hydraulic models?

PART C (5 x 14 = 70 Marks)

21 a) The space between two square flat parallel plates is filled with oil. Each side of the plate is 720mm; the thickness of the oil film is 15 mm. The upper plate, which moves at 3 m/s requires a force of 120N to maintain the speed. Determine:

(i) The dynamic viscosity of the oil;

(ii) The kinematic viscosity of oil if the specific gravity of oil is 0.95.

(OR)

b) Drive an expression for the capillary rise at of a liquid having surface tension σ and contact angle θ between two vertical parallel plates a distance w apart. If the plates are of glass, m what will be the capillary rise of water having

$\sigma = 0.073$N/m, $\theta=0^{o}$? [Take W= 1mm.]

22 a) An isosceles triangular plate of base 3 m and altitude 3 m is immersed vertically in an oil of specific gravity 0.8. The base of the plate coincides with the free surface of oil. Determine:

(i) Total pressure on the plate (ii) Centre of pressure.

(OR)

b) A wooden block of specific gravity 0.75 floats in water. If the size of the block is 1m x 0.5m x 0.4m, find its metacentric height.

23 a) Derive the continuity equation for three dimensional flow.

(OR)

b) Given that u = xy, v = 2yz. Examine whether these velocity components represent two or three –dimensional incompressible flow; if three dimensional, determine the third component.

24 a) State and prove Bernoulli's equation.

(OR)

b) A pipe line of 600 mm diameter is 1.5 km long. To increase the discharge another line of the same diameter is introduce parallel to the first in the second half of the length. If f = 0.01 and head at inlet is 300 mm calculate the increase in discharge.

Neglect minor losses.

25 a) The efficiency η of a fan depends on the density ρ, the dynamic viscosity μ of the fluid, the angular ω, diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters.

(OR)

b) A spillway model is to be built to a geometrically similar scale of $\frac{1}{50}$ across a flume of 600mm width. The prototype is 15 meters high and the maximum head on it is expected to be 1.5 meters.

i) What height of model and what head on model should be used?

ii) If flow over the model f9or a partichlar5 head is 12 liters /second. What flow per metre length of prototype is expected?

iii) If the negative pressure in the model is 200 mm, what is the negative pressure in prototype? Is it practicable?

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