

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010
Second Semester

U07CE204: FLUID AND SOLID MECHANICS

(Common to Electrical and Electronics Engineering & Electronic Instrumentation Engineering)

Time: Three Hours

Maximum Marks: 100

Answer ALL Questions:-
PART A (10 x 1 = 10 Marks)

1. Surface tension is expressed in

- A. N/m B. N/m^2 C. N^2/m D. N/m^3

2. The path followed by fluid particles in motion is called

- A. stream line B. path line C. streak line D. Flow net

3. Velocity head is given by

- A. V/g B. $V^2/2g$ C. $V^3/2g$ D. $V^2/2g^2$

4. Chezy's formula is given as

- A. $v = c\sqrt{m^2i}$ B. $v = c^2\sqrt{mi}$ C. $v = c\sqrt{mi}$ D. $v = c\sqrt{mi^2}$

5. A Kaplan turbine is

- A. An inward flow impulse turbine B. Low head axial flow turbine
C. High head axial flow turbine D. High head mixed flow turbine

6. The deformation per unit length is called

- A. strain B. tensile stress C. compressive stress D. shear stress

7. The ratio between the change in volume to original volume of the body is called ____ strain

- A. tensile B. compressive C. shear D. volumetric

8. In case of a hollow shaft the average torsional energy/unit volume is given by

- A. $\frac{\tau^2}{4C^2} \frac{D^4 + d^4}{D^4}$ B. $\frac{\tau^2}{C^2} \frac{D^4 + d^4}{D^4}$ C. $\frac{\tau^2}{4C^2} \frac{D + d}{D^4}$ D. $\frac{\tau^2}{C^2} \frac{D^4 + d^4}{D^4}$

9. If a close-coiled helical spring is subjected to load W and the deflection produced is δ then stiffness of the spring is given by

A. W/δ

B. $W.\delta$

C. δ/W

D. W^2/δ

10. A frame in which the members is more than $(2j - 3)$ is known as

- A. perfect frame B. deficient frame C. redundant frame D. static frame

PART B (10 x 2 = 20 Marks)

11. Define capillarity.
12. What are the types of fluid flows?
13. State Bernoulli's theorem.
14. Define the term Total energy line.
15. What is draft tube? Why is it necessary in reaction turbine?
16. Define modulus of elasticity.
17. Define Poisson's ratio.
18. Write any two basic assumptions in torsion equation.
19. What are the types of springs?
20. What is frame? How are frames classified?

PART C (5 x 14=70 Marks)

21. a) (i) The velocity distribution in a viscous flow over a plate is given by $u = 4y - y^2$ for

$y \leq 2m$ where u = velocity in m/sec at a point distant y from the plate. If the coefficient of dynamic viscosity is 15 poise. Determine the shear stress at $y = 0$ and $y = 2.0m$. (7)

(ii) Determine the maximum size of glass tubing that can be used to measure water level, if the capillary rise in the tube is not exceed 0.25 mm. Take surface tension of water in contact with air as 0.0735 N/m. (7)

(OR)

b) (i) A 90 N rectangular solid block slides down a 30° inclined plane. The plane is lubricated by a 3 mm thick film of oil of relative density 0.90 and viscosity is 8 poise. If the contact area is 0.3 m^2 , estimate the terminal velocity of the block. (7)

(ii) If the surface tension at air-water interface is 0.073 N/m, what is the pressure difference between inside and outside of air bubbles of diameter 0.01 mm. (7)

22. a)(i) Derive the Euler's equation. Show that Bernoulli's equation can be obtained by integrating Euler's equation. (8)

(ii) A compound piping system consists of 1200 m length with 0.75 m diameter, 750m length with of 0.6m diameter and 600 m length with 0.45m diameter, pipes being connected in series. Determine (6)

- (1) equivalent length of 0.45 m diameter pipe
- (2) equivalent size of pipe of 2550 m length.

(OR)

b) (i) Derive Darcy Weisbach equation for head loss due to friction in flow through pipe. (8)

(ii) Water is flowing through a pipe having diameters 600mm and 400mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 350 KN/m² and the pressure at the upper end is 100 KN/m². Determine the difference in datum head if the rate of flow through the pipe is 60 litres/sec. (6)

23. a) (i) Derive the expression for specific speed of a turbine. (8)

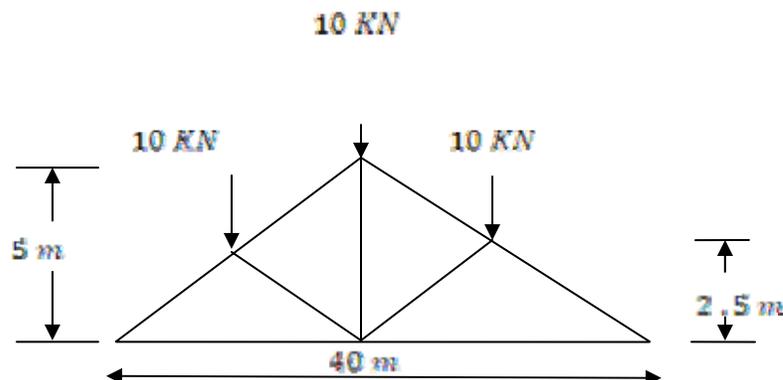
(ii) The cylinder bore diameter of a single acting reciprocating pump is 150 mm and its stroke length is 300 mm. The pump runs at 50 rpm and lifts water through a height of 35 m. The delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and theoretical power required to run the pump. If the actual discharge is 4.2 litre/sec. Find the percentage of slip. (6)

(OR)

b) (i) Define Perfect frame and redundant frame. (4)

(ii) Determine the stresses induced in the members of the truss shown in fig. Size of each member is of 200 mm external diameter and 20 mm thick. Assume that all joints are pin jointed.

(10)



24. a) (i) Define Modulus of rigidity and Bulk Modulus. (6)

(ii) A square steel rod 20mm x 20 mm in section is to carry an axial load (compressive) of

100KN. Calculate the shortening in a length of 50 mm. **Take $E = 2.14 \times 10^8 \frac{KN}{m^2}$.** (8)

(OR)

b) (i) What are major principle stress and minor principle stress. (6)

(ii) At a point in a stresses body the principal stresses are 100 MN/m² (tensile) and 60 MN/m² (Compressive). Determine the normal stress and the shear stress on a plane inclined at 50° to the axis of major principle stress. Also calculate the maximum shear stress at the point. (8)

25. a) (i) A steel shaft transmits 600 KW power at 200 rpm. Calculate the torque induce in it. (4)

(ii) What must be the length of a 5 mm diameter aluminium wire so that it can be twisted through one complete revolution without exceeding a shearing stress of 42 MN/m². Take $C = 27 \text{ GN/m}^2$. (10)

(OR)

b) (i) What are Leaf Spring? Where are they commonly used? (6)

(ii) A closely coiled helical spring is to carry a load of 500 N. Its mean diameter is to be 10 times that of the wire diameter. Calculate the diameter if the maximum shear stress in the material of the spring is to be 80 MN/m². (8)
