

D 4504

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Annual Pattern — First Year

Civil Engineering

CE 1X 11 — SOLID AND FLUID MECHANICS

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

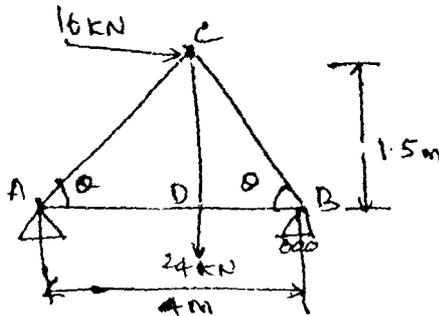
Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Poisson's ratio.
2. State the relationship between Young's Modulus and Modulus of Rigidity.
3. Define the term point of contraflexure.
4. A beam AB of span 6 m is subjected to a UDL of 10 kN/m over the entire span. What is the maximum B.M.?
5. Enlist the properties of liquid.
6. What should be the internal diameter of a glass tube if capillary rise in it is not to exceed 2.0 mm?
7. Distinguish between pathlines and streamlines.
8. Write a suitable formula for determining the loss of head in pipes due to friction.
9. Draw a neat sketch illustrating the parts of a centrifugal pump.
10. What is a penstock, where it is used?

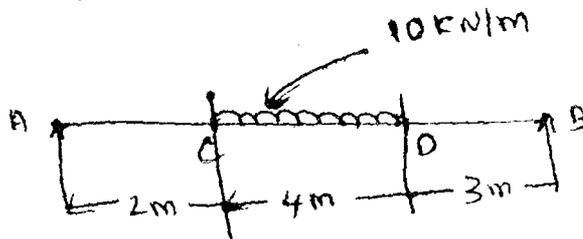
PART B — (5 × 16 = 80 marks)

11. (a) Determine the forces in the truss shown in the Fig. It carries a horizontal load of 16 kN and vertical load of 24 kN.



Or

- (b) For a given material, Young's modulus is $1 \times 10^5 \text{ N/mm}^2$ and modulus of rigidity is $4 \times 10^4 \text{ N/mm}^2$. Find the bulk modulus and lateral contraction of a round bar of 50 mm dia and 2.5 m long, when length is increased 2.5 mm.
12. (a) Draw the S.F. and B.M. diagrams for the beam shown in the Fig.



Or

- (b) A helical spring in which the mean diameter of the coil is 8 times the wire diameter is to be designed to absorb 0.2 kNm of energy with an extension of 100 mm. The maximum shear stress is not to exceed 125 N/mm^2 . Determine the mean diameter of the spring diameter of the wire and the number of turns. Also find the load with which an extension of 40 mm could be produced in the spring. Assume $G = 84 \text{ kN/mm}^2$.
13. (a) A 400 mm diameter shaft is rotating at 200 r.p.m. in a bearing of length 120 mm. If the thickness of oil film is 1.5 mm and the dynamic viscosity of the oil is 0.7 N.s/m^2 determine :
- Torque required to overcome friction in bearing
 - Power utilised in overcoming viscous resistance.
- Assume a linear velocity profile.

Or

(b) A 300 mm × 150 mm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, flow being upward. The difference in elevation of the throat section and entrance section of the venturimeter is 300 mm. The differential U-tube mercury manometer shows a gauge deflection of 250 mm. Calculate

- (i) The discharge of oil and
- (ii) The pressure difference between the entrance section and the throat section

Take the co-efficient of meter as 0.98 and specific gravity of mercury as 13.6.

14. (a) A horizontal pipe carries water at the rate of 0.04 m³/s. Its diameter which is 300 mm reduces abruptly to 150 mm. Calculate the pressure loss across the contraction. Take the co-efficient of contraction = 0.62.

Or

(b) Three pipes of diameters 300 mm, 200 mm and 400 mm and lengths 450 m, 255 m and 315 m respectively are connected in series. The difference in water surface levels in two tanks is 18 m. Determine the rate of flow of water if coefficients of friction are 0.0075, 0.0078 and 0.0072 respectively considering :

- (i) Minor losses also and
- (ii) Neglecting minor losses.

15. (a) A single acting reciprocating pump has the following details :

Stroke length $L = 400$ mm

$N = 30$ r.p.m.

Piston diameter $D = 200$ mm

Suction head $H_s = 3.0$ m

Delivery head $H_D = 20$ m

Suction pipe length $l_s = 5.0$ m

Delivery pipe length $l_d = 20$ m

Diameter of the suction pipe $D_s = 100$ mm

Diameter of the delivery pipe $D_d = 100$ mm

Friction for both pipes $f = 0.015$

$H_{atm} = 10.0$ m.

Determine the pressure heads at the beginning middle and end of delivery stroke, work done during the suction and the delivery strokes, and the power.

Or

(b) Test carried out on a pelton wheel gave the following results :

Head at the base of nozzle = 27.0 m

Discharge in the nozzle = 270 l/s

Diameter of jet = 123 mm

Power developed = 60.00 kW

Power absorbed in mechanical resistances etc. = 3.5 kW

Determine the power lost in the nozzle and due to hydraulic resistance.
