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B020313(020)

B. Tech. (Third Semester) Examination, April-May 2021

(AICTE Scheme)

(Civil Engg. Branch)

INTRODUCTION to SOLID MECHANICS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *All questions are compulsory with internal choices among (b), (c) and (d) parts.* (any two from b, c and d except q no 2)

Unit-I

1. (a) Mark correct or incorrect among the following relations : 4

(i) $G = \dfrac{E}{2(1+\mu)}$

(ii) $K = \dfrac{E}{3(1+2\mu)}$

(iii) $E = \dfrac{9KG}{3K+G}$

(iv) $\mu = \dfrac{3K+2G}{6K+2G}$

(b) Draw stress-strain curve, mark the salient points and explain them. 8

(c) A prismatic bar is fastened between two rigid walls at A and B subjected to loads as shown in figure below. Determine the reactions at the supports. 8

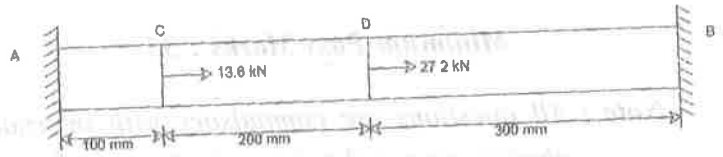

Fig. 1

(d) A stepped bar with circular cross section and supported at top, hangs vertically under its own weight. Dimensions of the bar are shown in the

figure below. Calculate the elongation of the bar under is own weigth. Take $E = 2 \times 10^5$ N/mm^2 and density $\gamma = 8 \times 10^{-5}$ N/mm^3. 8

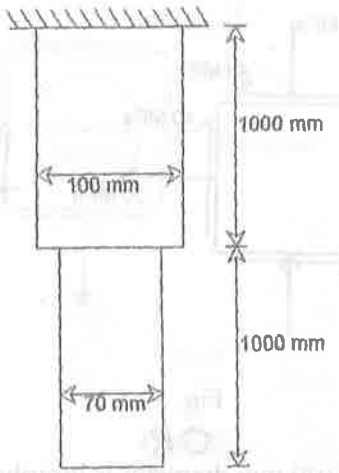

Fig. 2

Unit-II

2. (a) What is angle of obliquity? 4

(b) For the state of stress shown in figure below, determine : 16

(i) The principal planes

(ii) The principal stresses

(iii) The maximum shearing stress and its plane

(iv) Normal stress corresponding to maximum shearing stress.

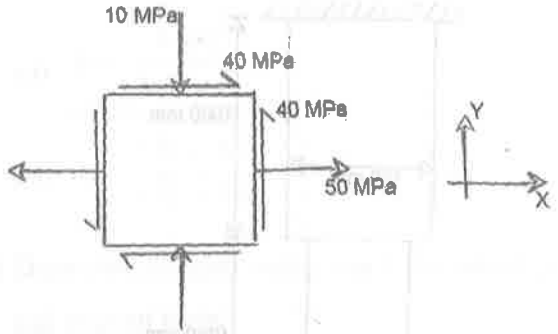

Fig. 3

OR

(c) A circle of 100 mm diameter is inscribed on a steel plate before it is stressed and then the plate is loaded as shown in figure. Then the circle is deformed into an ellipse. Determine the major and minor axes of the ellipse and their directions.

Take $E = 2{\cdot}1 \times 10^6$ kg/ cm^2 and $\frac{1}{m} = \mu = 0{\cdot}28$. 16

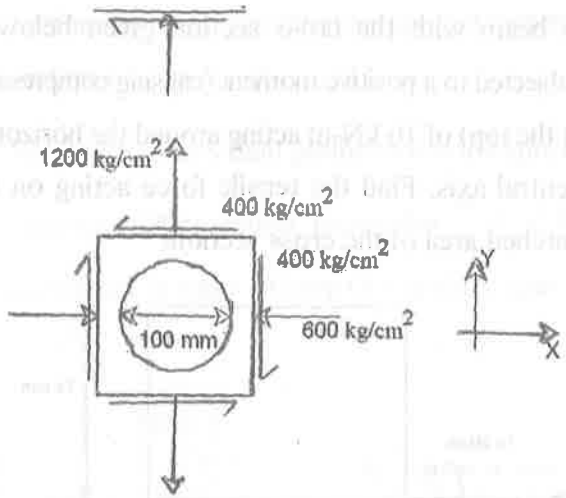

Fig. 4

Unit-III

3. (a) What is the relaion between bending moment, shear force and intensity of loading? 4

(b) Draw BMD and SFD for the beam sown below. 8

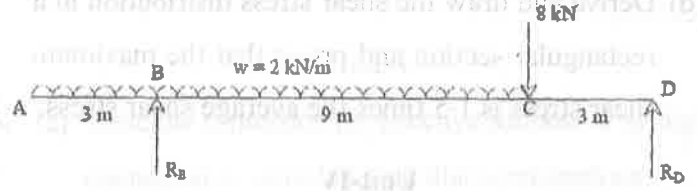

Fig. 5

(c) A beam with the cross section given below is subjected to a positive moment (causing compression at the top) of 16 kN-m acting around the horizontal neutral axis. Find the tensile force acting on the hatched area of the cross section. 8

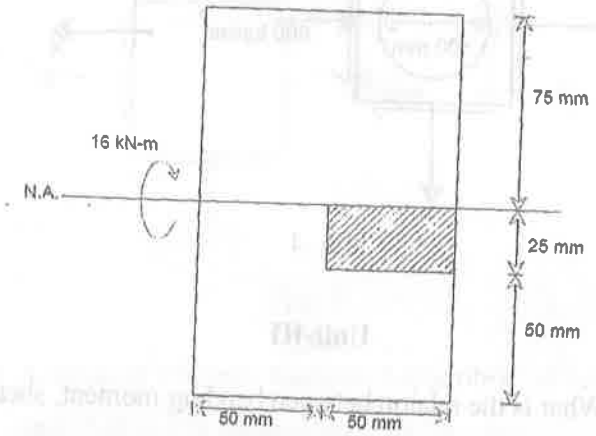

Fig. 6

(d) Derive and draw the shear stress distribution in a rectangular section and prove that the maximum shear stress is 1·5 times the average shear stress. 8

Unit-IV

4. (a) Explain in brief the three different conditions of equilibrium. 4

(b) Define Kern and find its position in a rectangular section of size $b \times d$. 8

(c) For an elementary dam profile shown in figure under reservoir full condition, prove that $\frac{h}{b} \leq \sqrt{G}$ for no tension at base. Where G = specific gravity of the dam material. 8

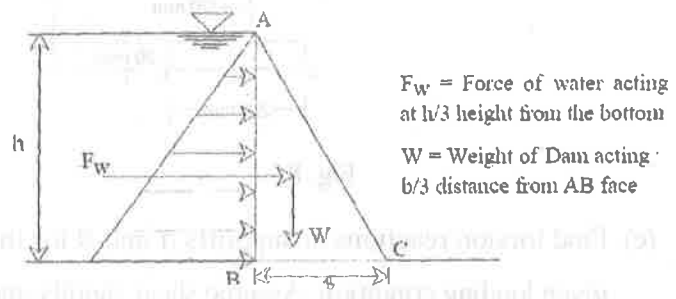

Fig. 7

(d) Explain Euler's theory and Rankine's theory for failure of column. 8

Unit-V

5. (a) Write the expression for effective stiffness of springs connected in series and parallel combinations. 4

(b) A cantilever beam of span 2 m has inclined loading at the free end. The section of the beam is shown

below. Calculate bending stress at the four corners *A*, *B*, *C* and *D* of the beam cross section at fixed end. 8

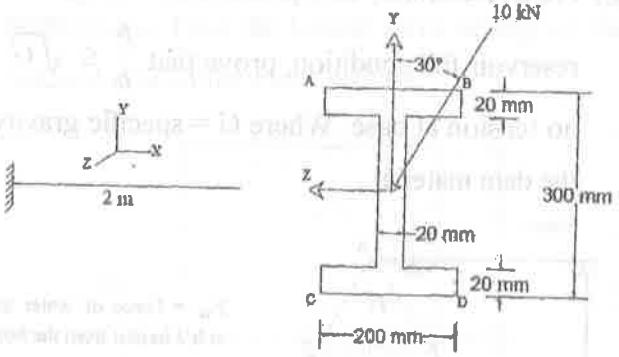

Fig. 8

(c) Find torsion reactions at supports *A* and *B* for the given loading condition. Assume shear rigidity and uniform cross section. 8

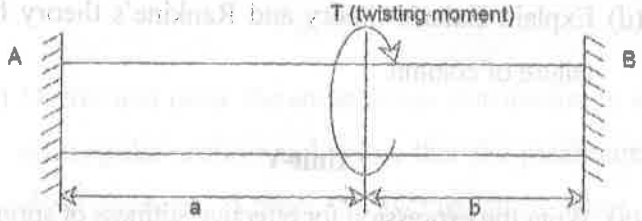

Fig. 8

(d) Write short notes on closed coil helical spring. 8