

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), April-May 2016
B. Tech. in Civil Engineering, Semester IV



Roll No.....

CE405 : Structure Analysis II

Time: 3 hours

Max. Marks: 100

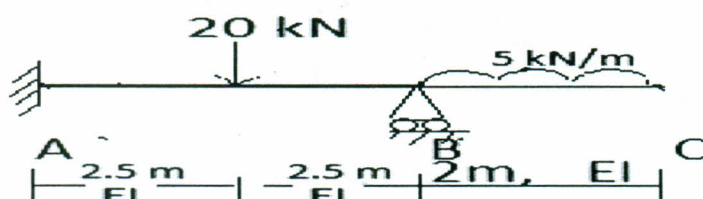
Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Objective type multiple choice questions (5 questions @ 1 mark)	10
i.	The number of independent equations to be satisfied for static equilibrium of a plane structure is - A. 1 B. 2 C. 3 D. 6	
ii.	Two closely coiled helical spring is cut into two equal parts. The stiffness of the resulting spring will be - A. Same B. Double C. Half D. one forth	
iii.	The ratio of equivalent stiffness of springs, when two springs of equal stiffness are connected in series and parallel - A. 2 B. 4 C. 0.25 D. 0.5	
iv.	A closely coiled helical spring of diameter D, contains n turns and is subjected to an axial load W. If the diameter of the coil wire is d and modulus of rigidity of the coil material is C, the maximum stress in the coil wire is A. $\frac{8WD}{\pi d^3 C}$ B. $\frac{8WD}{\pi d^3}$ C. $\frac{8WCD}{\pi d^3}$ D. $\frac{8WD}{Cd^3}$	
v.	If p is the internal pressure in a thin sphere of diameter d and thickness t, the developed hoop stress, is A. $\frac{pd}{2t}$ B. $\frac{pd}{4t}$ C. $\frac{pd}{t}$ D. $\frac{2pd}{t}$	
vi.	A cylinder of internal diameter 2.5 m and of thickness 5 cm contains a gas. If the tensile stress in the material is not to exceed 80 N/mm ² , determine the internal pressure of the gas. A. 3.2 kN/mm ² B. 3.2 N/mm ² C. 3.2 kN/m ² D. 3.2 N/m ²	
vii.	If the length of a long column is reduced to half of the length, then what will be the strength of new column as compare to old column- A. 4 times B. 2 times C. $\frac{1}{4}$ times D. $\frac{1}{2}$ times	
viii.	A cylinder is said to be thin if the ratio of its thickness & diameter, is less than A. $\frac{1}{25}$ B. $\frac{1}{20}$ C. $\frac{1}{15}$ D. $\frac{1}{10}$	
ix.	Effective length of a long column fixed at one end and hinged at far end is A. $L/2$ B. $2L$ C. $L/\sqrt{2}$ D. $\sqrt{2}L$	
x.	The variation of stresses in curved beam is - A. Parabolic B. hyperbolic C. cubic D. linear	

Q.2	Short answer type questions (4 questions @ 2.5 marks)	
i.	Derive the expression of hoop stress in a thin cylinder.	2.5
ii.	Define stiffness of a spring.	2.5
iii.	A thin spherical shell of a wall thickness 2.5 mm and diameter of 500 mm is subjected to an internal pressure p . what is the magnitude of p if diametric strain in the shell is limited to 0.0005 only. $E = 200 \text{ GPa}$, $\nu = 0.3$.	2.5
iv.	A close coiled helical spring of mean coil radius $R=32\text{mm}$ is made of a steel wire of diameter $d=8\text{mm}$. if the axial load on the spring is 80 N, then calculate the wahl's correction. Also determine maximum shearing stress developed in spring wire.	2.5

Q.3A calculate the bending moment at support A using three moment theorem, in the beam shown below. Also draw the bending moment diagram. 05



Q.3B In a machine, three springs of stiffness K_1 , K_2 & K_3 are connected in parallel. Derive the expression of equivalent stiffness of spring. 05

Q.4A A long column of length L , hinged at both ends, is subjected to a point load P . Calculate the crippling load at which it starts buckling. Given, flexural rigidity is EI . 05

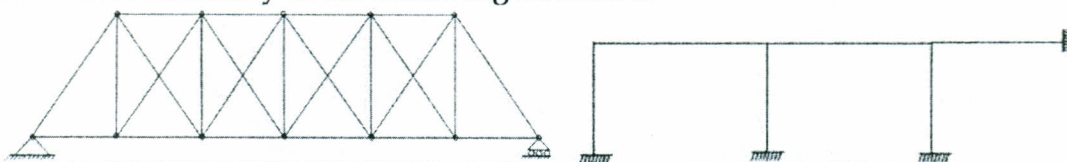
Q.4B A cylindrical vessel whose ends are closed by means of rigid plates, is made of steel plate 3 mm thick. The length and the internal diameter of the vessel are 50 mm and 25 cm respectively. Determine the longitudinal and hoop stress in the cylindrical shell due to an external fluid pressure of 3 N/mm^2 . Also calculate the increase in length, diameter and volume of the vessel. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and $\nu = 0.3$. 05

Q.5A A closed coiled helical spring is made of round steel wire is required to carry an axial load of 800 N for a maximum stress not exceeding 150 MPa in shear. Determine the wire diameter if the stiffness of the spring is 10 N/mm and diameter of the helix is 80 mm. also calculate the number of turns required in the spring. Neglect the correction due to spring index. Given $G = 84 \text{ kN/mm}^2$. 05

Q.5B Write the equations and draw the influence line diagram for shear force and bending moment in a simply supported beam having span L . 05

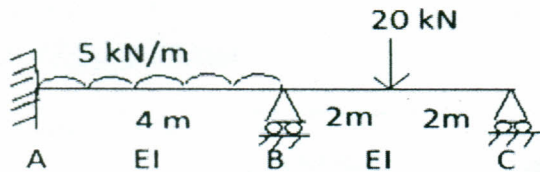
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Q.5B What do you understand by static indeterminacy of a structure? Calculate the static indeterminacy of the following structure. 05



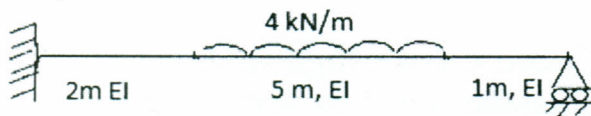
Q.6 Derive the expression of stress produced in a curved bar having large initial curvature (Winkler - Bach formula). 10

Q.7 Calculate the reaction forces and moments at supports using force method of analysis. 10

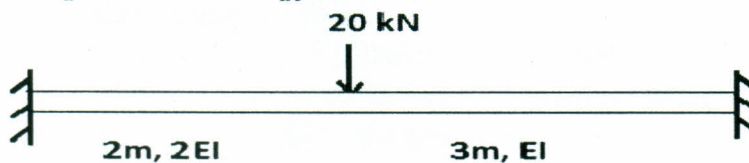


-OR-

Q.7 Calculate the reaction forces and moments at supports using force method of analysis. 10



Q.8 Calculate the bending moment at the fixed ends of the beam shown below using column analogy method. 10



Q.9A Find the Euler crippling load for a hollow cylindrical cast iron 20 cm external diameter and 25 mm thick, 6 m long and is hinged at both ends. Take $E = 1.2 \times 10^6$ N/mm². Compare the load with the crippling load as given by the Rankine's formula, taking $f_c = 550$ N/mm² and $\alpha = 1/1600$. For what length of the column would these two formulae give the same crippling load? 10

Q.9B A laminated spring of the quarter elliptic type, 60 cm long, is to provide a static deflection of 8 cm under an end load of 2500 N. if the leaf material is 6.5 cm wide and 6 mm thick, find the number of leaves required and the maximum stress. For what height can the load be dropped on the undeflected spring to cause a maximum stress of 800 MPa? $E = 200$ GPa. 10

-OR-

Q.9B A quarter elliptical cantilever leaf spring has a length of 50 cm and consists of plates each 5 cm wide and 6 mm thick, find the least number of plates which can be used if the deflection under a gradually applied load of 2000 N is not to exceed 7 cm. if, instead of being gradually applied, the load of 200 N falls a distance of 6 mm on to the undeflected spring, find the maximum deflection and stress produced. Take $E = 200$ GPa. 10

