Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **18CE2016** | **Duration :** | **3hrs** |
| **Sub. Name :** | **SOLID MECHANICS** | **Max. Marks :** | **100** |

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| **Q. No.** | **Questions** | **Course Outcome** | **Marks** |
| **PART – A (10 x 1 = 10 MARKS)** | | | |
| 1. | How would you designate an externally redundant structures? | CO1 | 1 |
| 2. | How would you interpret strain energy in structural analysis? | CO2 | 1 |
| 3. | Give the formula for finding the section modulus of a hollow rectangular section. | CO1 | 1 |
| 4. | How would you recognize the principle of complementary shear? | CO2 | 1 |
| 5. | What is the deflection of cantilever subjected to a concentrated load at free end? | CO3 | 1 |
| 6. | State how shear force can be obtained in a conjugate beam. | CO3 | 1 |
| 7. | Specify the type of stresses and strains developed in a shaft due to torsion. | CO2 | 1 |
| 8. | Predict where closed coil springs are used. | CO4 | 1 |
| 9. | How would you comment on the failure of a short column? | CO4 | 1 |
| 10. | Define ‘Slenderness Ratio’. | CO1 | 1 |

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| **PART – B (6 x 3 = 18 MARKS)** | | | |
| 11. | Write briefly on compatibility method of structural analysis. | CO1 | 3 |
| 12. | How would you illustrate a Flitched beam with a sketch? | CO1 | 3 |
| 13. | Where would you use the Mohr’s theorems? | CO2 | 3 |
| 14. | A closely coiled helical spring is to carry a load of 500N. Its mean coil diameter is to be 10 times that of the wire diameter. Calculate these diameters if the maximum shear stress in the material of the spring is to be 80N/mm2. | CO3 | 3 |
| 15. | Bring out the assumptions made in the Euler’s column theory. | CO1 | 3 |
| 16. | A cylinder of thickness 1.5cm, has to withstand maximum internal pressure of 1.5N/mm2. If the ultimate tensile stress in the material of the cylinder is 300N/mm2, factor of safety 3.0 and joint efficiency 80%, determine the diameter of the cylinder. | CO3 | 3 |

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| **PART – C (6 x 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is a Compulsory Question)** | | | | |
| 17. | a. | Highlight the advantages of fixed beams. | CO1 | 3 |
| b. | A continuous beam ABC covers two consecutive span AB and BC of lengths 4m and 6m carrying uniformly distributed load of 6kN/m and 10kN/m respectively. If the ends A and C are simply supported, find the support moments at A, B and C. Draw also bending moment and shear force diagrams. | CO3 | 9 |
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| 18. | a. | Show that the maximum shear stress in a circular section of a beam is 4/3 times the average shear stress. | CO3 | 3 |
| b. | A timber beam of rectangular section of length 8m is simply supported. The beam carries a udl of 12kN/m run over the entire length and a point load of 10kN at 3m from the left support. If the depth is two times the width and the stress in the timber is not to exceed 8Nmm2, find the suitable dimensions of the section. | CO3 | 9 |
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| 19. | a. | How would you determine the slope and deflection at any section of a beam by Conjugate beam method? | CO1 | 3 |
| b. | A beam of length 20m is simply supported at its ends and carries two point loads of 4kN and 10kN at a distance of 8m and 12m from left end respectively. Calculate: (i) deflections under each load, (ii) Maximum deflection. Take E = 2 x 106 N/mm2 and I = 1 x 109 N/mm2. | CO3 | 9 |
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| 20. | a. | Show the Torsion Equation explaining all the terms. | CO1 | 3 |
| b. | A hollow shaft of diameter ratio 3/8 (inner diameter to outer diameter) ratio is to transmit 375kW power at 100 rpm. The maximum torque being 20% greater than the mean torque. The shear stress is not to exceed 60N/mm2 and twist in a length of 4m not to exceed 2. Calculate its external and internal diameters which would satisfy both the above conditions. Assume modulus of rigidity, C = 0.85 x 105 N/mm2. | CO3 | 9 |
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| 21. | a. | Explain how the failure of a long column and short column takes place. | CO4 | 3 |
| b. | Determine the ratio of buckling strengths of two columns one hollow and the other solid. Both are made of the same material and have the same length, cross sectional area and end conditions. The internal diameter of the hollow column is 2/3rd of its external diameter. | CO3 | 9 |
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| 22. | a. | Define a helical spring and name the two important types of helical springs. | CO1 | 3 |
| b. | A fixed beam of length 6m carries two point loads of 30kN each at a distance of 2m from both ends. Determine the fixed end moments and draw the BM diagram. | CO3 | 9 |
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| 23. | a. | How would you define the term ‘Obliquity’ and state how it is determined? | CO2 | 3 |
| b. | The principal tensile stresses at a point across two mutually perpendicular planes are 100N/mm2 and 50N/mm2. Determine the normal, tangential and resultant stresses on a plane inclined at 30º to the axis of the minor principal stress. | CO3 | 9 |
|  | **Compulsory:** | | | |
| 24. | a. | How would you show that the thin cylindrical shells subjected to internal fluid pressure, the circumferential stress is twice the longitudinal stress? | CO2 | 3 |
| b. | A thin cylinder of internal diameter 2.0m contains a fluid at an internal pressure of 3 N/mm2. Determine the maximum thickness of the cylinder if (i) the longitudinal stress is not to exceed 30N/mm2 and (ii) the circumferential stress is not to exceed 40 N/mm2. | CO3 | 9 |