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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – April/May– 2017**

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| **Code :** | **14CE2006** | **Duration :** | **3hrs** |
| **Sub. Name :** | **STRENGTH OF MATERIALS** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | A cantilever beam of length 3m carries a uniformly distributed load of 90kN/m over the entire length. If E = 2.2x108kN/m2 and I = 109mm4  find the slope and deflection at the free end using conjugate beam method. | CO1 | 15 |
| b. | Prove that the relation M = EI , where M = Bending moment,  E = Young’s Modulus, I = Moment of inertia. | CO1 | 5 |
| (OR) | | | | |
| 2. | a. | A beam of length 20m is simply supported at its ends and carries two point loads of 4kN and 10 kN at a distance of 8m and 12m from left end respectively. Calculate (i) deflection under each load (ii) maximum deflection.Take E = 2x106N/mm2 and I = 1x109 mm4. | CO1 | 12 |
| b. | Find an expression for the slope and deflection of a simply supported beam, carrying a point load W at a distance ‘a’ from left support and at a distance ‘b’ from right support where a > b. | CO1 | 8 |
| 3. | a. | A fixed beam of length 6m carries point loads of 20kN and 15kN at a distances 2m and 4m from the left end A. Find the fixed end moments and the reactions at the supports. Draw the B.M. and S.F. diagrams. | CO2 | 10 |
|  | b. | A cantilever of length 4m carries a uniflormly distributed load of 2kN/m run over the whole length. The cantilever is propped rigidly at the free end. If E = 1x105 N/mm2 and I = 108mm4. Then determine   1. Reaction at the rigid prop 2. The deflection at the centre of the cantilever and 3. Magnitude and position of maximum deflection. | CO2 | 10 |
| (OR) | | | | |
| 4. | a. | A continuous beam ABC of length 10m rests on three supports A, B, and C at the same level in which span AB = 6m and span BC = 4m. In span A, there is a point load of 3kN at a distance of 2m fron the end A, whereas in the span BC, there is a uniformly distributed load of 1kN/m run over the whole length. Determine the support moments and support reactions. Draw S.F.and B.M. diagrams. | CO2 | 16 |
|  | b. | What are the advantages and disadvantages of a fixed beam over a simply supported beam? | CO2 | 4 |
| 5. | a. | A solid round bar 4m long and 6cm in diameter is used as a strut with both ends hinged. Determine the crippling load for different end condition. Take E = 2 x 105 N/mm2. | CO2 | 4 |
|  | b. | A column of timber section 10cm x 15cm is 5m long both ends being fixed. If the young’s modulus for timber = 17.5 kN/mm2, determine the crippling load and safe load taking factor of safety as 3. | CO2 | 6 |
|  | c. | The external and internal diameter of a hollow cast iron are 5cm and 3cm respectively. If the length of this column is 4m and both of its end are fixed, determine the crippling load using Rankine’s formula. Take the value of = 550 N/mm2 and  in Rankine’s formula. | CO2 | 10 |
| (OR) | | | | |
| 6. | a. | Determine the Euler’s crippling load for an I-Section joist 30cm x 15cm x 2cm and 5m long which is used as a strut with both ends fixed. Take young’s modulus for the joint as 2 x 105 N/mm2. | CO2 | 10 |
|  | b. | A hollow cylindrical cast iron column is 6m long with both ends fixed. Determine the minimum diameter of the column if it has to carry a safe load of 300kN with a factor of safety of 4. Take the internal diameter as 0.7 times the external diameter. Take the value of = 550 N/mm2 and  in Rankine’s formula. | CO2 | 10 |
| 7. | a. | A thin cylindrical shell of 120cm diameter, 1.5cm thick and 6m long is subjected to internal fluid pressure of 2.5N/mm2. If the value of  E = 2 x 105 N/mm2 and poisson’s ratio = 0.3, calculate the change in diameter, change in length and change in volume. | CO2 | 8 |
|  | b. | Determine the maximum and minimum hoop stress across the section of a pipe of 200 mm internal diameter and 50 mm thick, when the pipe contains a fluid at a pressure of 6 N/mm2 . Also sketch the radial pressure distribution and hoop stress distribution across the section. | CO2 | 12 |
| (OR) | | | | |
| 8. | a. | Determine the position of shear centre of a channel having dimensions: flanges 120mm x 20mm and web 160mm x 10mm. | CO2 | 5 |
|  | b. | A cantilever of I section 2.4m long is subjected to a load of 200kN at the free end. Determine the resulting bending stress at corners of the top flange on the fixed end of the cantilever. The load is inclined at 20o to the vertical and passing through the centroid of the section. Thickness of web=2mm. thickness of flange = 2.5 mm.  50 mm  30 mm  A  C  D  B  2.5 mm  2.5 mm  20°  P = 200 N  X′  XU  X′  XU  Y′  Y′  YU  YU | CO2 | 15 |
|  | | **Compulsory**: |  |  |
| 9. | a. | What do you understand by the term “theories of failure”? Name the important theories of failure. | CO1 | 5 |
|  | b. | Define and explain the following theories of failure:   1. Maximum Shear stress theory 2. Maximum strain energy theory 3. Maximum shear strain energy theory | CO1 | 15 |

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