# KUMARAGURU
## college of technology
### character is life

## GENERAL INSTRUCTIONS TO THE CANDIDATES

1. Candidates are instructed to answer the questions as per Bloom's Taxonomy knowledge level ($K_1$ to $K_6$)

2. Candidates are strictly instructed not to write anything in the question paper other than their roll number.

3. Candidates should search their pockets, desks and benches and handover to the Hall Superintendent/ Invigilator if any paper, book or note which they may find therein as soon as they enter the examination hall.

4. Candidates are not permitted to bring electronic watches with memory, laptop computers, personal systems, walkie-talkie sets, paging devices, mobile phones, cameras, recording systems or any other gadget / device /object that would be of unfair assistance to him / her.

5. Corrective measures as per KCT examination policies will be imposed for malpractice in the hall like copying from any papers, books or notes and attempting to elicit the answer from neighbours.

## B.E DEGREE EXAMINATIONS: DEC 2015

(Regulation 2014)

Third Semester

### AUTOMOBILE ENGINEERING

U14AU*T*305**:** Strength of Materials

**Time: Three Hours**                                                                          **Maximum Marks: 100**

**Answer all the Questions:-**
**PART A (10 x 1 = 10 Marks)**

1. Matching the following in the lists given below                                      CO1  [$K_2$]

| **List I** | **List II** |
|---|---|
| A. Young's modulus | i. Shear Strain |
| B. Modulus of rigidity | ii. Normal Strain |
| C. Bulk modulus | iii. Transverse Strain |
| D. Poission's ratio | iv. Volumetric Strain |

Codes:

|    | A | B | C | D |
|----|---|---|---|---|
| a) | 1 | 2 | 3 | 4 |
| b) | 2 | 1 | 4 | 3 |
| c) | 2 | 1 | 3 | 4 |
| d) | 1 | 2 | 4 | 3 |

2. The maximum bending moment for the beam shown in the below figure, lies at a distance of _____ from the end *B*. CO2 [K₂]



a) $\dfrac{l}{2}$

b) $\dfrac{3l}{2}$

c) $\dfrac{l}{3}$

d) $\dfrac{2l}{3}$

3. The bending moment in the centre of a simply supported beam carrying a uniformly distributed load of *w* per unit length is CO2 [K₂]

a) zero

b) $wl^2/2$

c) $wl^2/4$

d) $wl^2/8$

4. In the torsion equation $\dfrac{\tau}{R} = \dfrac{T}{J} = \dfrac{C\theta}{L}$ the term $J/R$ is called CO3 [K₂]

a) shear modulus

b) section modulus

c) polar modulus

d) modulus of rigidity

5. Which of the following statements are incorrect? CO1 [K₂]

1. Stress is directly proportional to strain within elastic limit

2. Hooke's law holds good up to the breaking point

3. The stress is force per unit area

4. The ratio of linear stress to linear strain is called Shear Modulus

a) 1,2

b) 2,3

c) 1,4

d) 2,4

6. Matching the following CO3 [K₂]

| List I | List II |
|---|---|
| A. Polar Moment of a section | i) Thin Cylindrical Shell |
| B. Buckling | ii) Torsion of Shaft |
| C. Neutral axis | iii) Columns |
| D. Hoop Stress | iv) Bending of beams |

Codes:

|  | A | B | C | D |
|---|---|---|---|---|
| a) | 3 | 2 | 1 | 4 |
| b) | 2 | 3 | 4 | 1 |
| c) | 3 | 2 | 4 | 1 |
| d) | 2 | 3 | 1 | 4 |

7. Assertion (A): Angle of twist per unit length of a uniform diameter shaft depends upon its torsional rigidity CO2 [K₃]

Reason (R): The shaft are subjected to torque only

a) both A and R are individually true and R is the correct explanation of A

b) both A and R are individually true but R is not the correct explanation of A

c) A is true but R is false

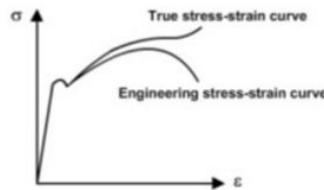d) A is false but R is true

8. Euler's formula holds good only for                        CO3 [$K_2$]

a) short columns

b) long columns

c) both short and long columns

d) weak columns

9. Select proper Sequence                                             CO1 [$K_2$]

1. Proportional Limit  2. Elastic Limit  3. Yielding and  4. Failure



a) 2,3,1,4

b) 1,4,2,3

c) 2,1,3,4

d) 1,2,3,4

10. A thin spherical shell of diameter (*d*) and thickness (*t*) is subjected to an internal pressure (*p*). The stress in the shell material is     CO3 [$K_2$]

a) $pd/t$

b) $pd/2t$

c) $pd/4t$

d) $pd/8t$

## PART B (10 x 2 = 20 Marks)
### (Answer not more than 40 words)

11. State the principle of superposition.                                     CO1 [$K_2$]

12. What is the use of Mohr's circle?                                        CO1 [$K_2$]

13. Write the assumptions in the theory of simple bending                 CO2 [$K_2$]

14. What is the maximum bending moment in a simply supported beam of span 'L' subjected to UDL of 'w' over entire span?     CO2 [$K_3$]

15. Mention any two methods of finding the slope and deflection of beams.     CO2 [$K_2$]

16. Calculate the maximum deflection of a simply supported beam carrying a point load of 100 kN at mid span. Span = 6 m, E= 20000 $kN/m^2$.     CO2 [$K_3$]

17. Write an expression for the angle of twist for a hollow circular shaft with external diameter D, internal diameter d, length L and rigidity modulus G.     CO3 [$K_3$]

18. Define torsional rigidity of the solid circular shaft.     CO3 [$K_2$]

19. The actual length of a column is 10 m. Determine its effective length, if both the ends of the column are rigidly fixed.     CO3 [$K_3$]

20. Mention the types of stresses produced in thin cylindrical shells.     CO3 [$K_2$]

**Answer any FIVE Questions:-**
**PART C (5 x 14 = 70 Marks)**
**(Answer not more than 300 words)**
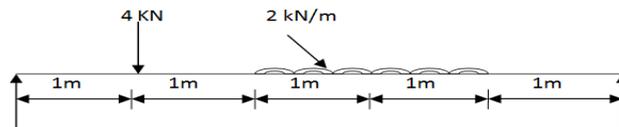
**Q.No. 21 is Compulsory**

21. A point in a strained material is subjected to stresses as shown in figure. Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane. Evaluate the answer analytically.     CO1    [K₄]
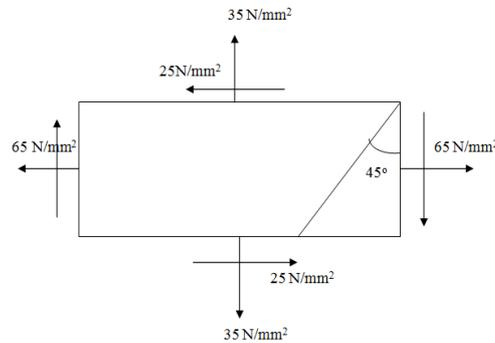


22. Draw the S.F.D and B.M.D of a Simply Supported Beam as shown in figure.     CO2    [K₃]



23. A hollow shaft, having an internal diameter 40% of its external diameter, transmits 562.5 kW power at 100 r.p.m Determine the external diameter of the shaft if the shear stress is not to exceed 60 N/mm$^2$ and the twist in a length of 2.5 m should not exceed 1.3 degrees. Assume maximum torque =1.25 mean torque and modulus of rigidity = 9 x 10$^4$ N /mm$^2$.     CO2    [K₃]

24. A steel girder of uniform section, 14 metres long is simply supported at its ends. It carries concentrated loads 90kN and 60 kN at two points 3 meters and 4.5 meters from the two ends respectively. Calculate: (i) The deflection of the girder at the points under the two loads. (ii) The maximum deflection Take: I=64x10$^{-4}$ m$^4$ and E=210x10$^6$ kN/m$^2$     CO2    [K₃]

25. A 1.2 m long column has a circular cross section of 45 mm diameter. One of the ends of the column is fixed in direction and position and other end is free. Taking factor of safety as 3, Calculate the safe load using
(i) Rankine's formula, take yield stress = 560 N/mm$^2$ and a = 1/1600 for pinned ends.
(ii) Euler's formula, Young's modulus for Cast Iron = 1.2 x 10$^5$ N/mm$^2$ .     CO3    [K₃]

26. A thin cylindrical shell 3 m long has 1m internal diameter and 15 mm metal thickness. Calculate the circumferential and longitudinal stresses induced and also the change in the dimensions of the shell, if it is subjected to an internal pressure of 1.5 N/mm$^2$ Take E = 2x10$^5$ N/mm$^2$ and poison's ratio =0.3. Also calculate change in Volume.     CO3    [K₃]

***********