



KERALA AGRICULTURAL UNIVERSITY  
B.Tech (Agrl.Engg.) 2015 & Previous Admissions  
II Semester Re-Examination-August-2017

I den.1203

Strength of Materials (2+1)

Marks: 50  
Time: 2 hours

**I Fill up the Blanks/State True or False (10x1=10)**

- 1 A shaft revolving at  $N$  rpm transmits torque ( $T$ ) in kg.m, the power developed is -----
- 2 The maximum eccentricity of a load on a circular section to have same type of stress is ----- of the diameter.
- 3 The unit for Young's modulus for elasticity is -----
- 4 Polar moment of inertia of a solid shaft of diameter ( $D$ ) is -----
- 5 The relation between equivalent length ( $L$ ) and actual length ( $l$ ) of a column for both ends hinged is -----
- 6 The neutral axis of a section is an axis, at which the bending stress is -----
- 7 The value of Rankine's constant for mild steel is -----
- 8 The ratio of lateral strain to linear strain is called -----
- 9 When a rectangular section of a beam is subjected to a shearing force, the ratio of maximum shear stress to the average shear stress is 1.5
- 10 The stress in a body of suddenly loaded is twice the stress induced, when the same load is applied gradually.

**II Write short notes on any FIVE (5x2=10)**

- 1 What is a laminated spring? Where is it used?
- 2 Distinguish overhanging beam and continuous beam.
- 3 A solid steel shaft is to transmit a torque of 10 kN m. If the shearing stress is not to exceed 45 MPa, find the minimum diameter of the shaft.
- 4 Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion.
- 5 A mild steel column of 50 mm diameter is hinged at both of its ends. Find the crippling load for the column, if its length is 2.5m. Take  $E$  for the column material as 200 GPa.
- 6 What is meant by eccentric loading? Explain its effect on short column.
- 7 Distinguish between bending stress and shearing stress.

**III Answer any FIVE (5x4=20)**

- 1 A simply supported beam of span 4.5 m carries a uniformly distributed load of 3.6 kN/m over a length of 2 m from the left end A. Draw the shear force and bending moment diagrams for the beam.
- 2 Derive a relation for strain energy stored in a body, when the load is gradually applied.
- 3 A reinforced concrete circular column of 400 mm diameter has 4 steel bars of 20 mm diameter embedded in it. Find the maximum load which the column can carry, if the stresses on steel and concrete are not to exceed 120 MPa and 5 MPa respectively. Take modulus of elasticity of steel as 18 times that of concrete.

- 4 A circular bar rigidly fixed at its both ends uniformly tapers from 75 mm at one end to 50 mm at the other end. If its temperature is raised through 26 K, What will be the maximum stress developed in the bar. Take E as 200 GPa and  $\alpha$  as  $12 \times 10^{-6} /K$  for the bar material.
- 5 A leaf spring is to be made of seven steel plates 65 mm wide and 6.5 mm thick. Calculate the length of the spring, so that it may carry a central load of 2.75 kN, the bending stress being limited to 160 MPa. Also calculate the deflection at the centre of the spring. Take E for the spring material as 200 GPa.
- 6 Find the Euler's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3 m and hinged at its both ends. Take E as 205 GPa. Also determine crippling load by Rankine's formula using constants as 335 MPa and  $\frac{1}{7500}$ .
- 7 Derive an expression for shear stress at any point in the cross section of a beam.

IV **Write essay on any ONE**

(1x10=10)

- 1 Derive the relation  $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$
- 2 Derive a relation for the Euler's crippling load for a column when one end fixed and other free.

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