

Enrollment No.....



Faculty of Engineering

End Sem (Odd) Examination Dec-2017

ME2CO02 Strength of Materials

Programme: Diploma

Branch/Specialisation: ME

Duration: 3 Hrs.**Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

- Q.1 i. The ratio of linear stress to linear strain is known as **1**
 (a) Poisson's ratio (b) Bulk Modulus
 (c) Modulus of Rigidity (d) Modulus of Elasticity
- ii. The ratio of shear stress to shear strain is called **1**
 (a) Poisson's ratio (b) Bulk Modulus
 (c) Modulus of Rigidity (d) Modulus of Elasticity
- iii. The property by virtue of which a metal can be beaten into plates **1**
 is called
 (a) Ductility (b) Malleability
 (c) Resilience (d) Plasticity
- iv. The normal stress on an oblique plane at an angle θ to the cross **1**
 section of a body which is subjected to a direct tensile stress (σ)
 is equal to
 (a) $\frac{\sigma}{2} \sin 2\theta$ (b) $\sigma \cos \theta$ (c) $\sigma \cos^2 \theta$ (d) $\sigma \sin^2 \theta$
- v. A simple supported beam of span (l) carries a point load (W) at the **1**
 centre of the beam. The shear force diagram will be
 (a) Two equal and opposite triangles
 (b) A triangle
 (c) Two equal and opposite rectangles
 (d) A rectangle
- vi. A cantilever of length (l) carries a point load (W) at the free end. **1**
 The shear force diagram will be
 (a) Two equal and opposite triangles
 (b) A triangle
 (c) Two equal and opposite rectangles
 (d) A rectangle

P.T.O.

[2]

- vii. The Torsional rigidity of a shaft is define as the torque required to produce **1**
 (a) Maximum twist in the shaft
 (b) Maximum shear stress in the shaft
 (c) Minimum twist in the shaft
 (d) A twist of one radian per unit length of the shaft
- viii. Two shafts, one solid and the other hollow, are made of the same materials and are having same length and weight. The hollow shaft as compared to solid shaft is **1**
 (a) More strong (b) Less strong
 (c) Having same strength (d) None of these
- ix. The Rankine's constant for a given material of a column depends upon the **1**
 (a) Length of column (b) Diameter of the column
 (c) Length and diameter (d) None of these
- x. Strut is defined as a **1**
 (a) Member of a structure which carries a tensile load
 (b) Member of a structure which carries an axial compressive load
 (c) Vertical member of structure which carries a tensile load
 (d) None of these
- Q.2 i. Define and explain the terms: Stress, Strain and Poisson's ratio **3**
 ii. Find the Young's Modulus of a brass rod of diameter 25 mm and of length 250 mm which is subjected to a tensile load of 50 kN when the extension of the rod is equal to 0.3 mm. **7**
- OR iii. What is Bulk Modulus? Derive an expression for Young's modulus in terms of Bulk Modulus and Poisson's ratio? **7**
- Q.3 i. Define the mechanical properties: Ductility, Hardness and Endurance limit. **3**
 ii. What do you understand by non-destructive testing? Name various non-destructive testing methods and explain one of them in detail. **7**
- OR iii. The tensile stresses at a point across two mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2 . Determine the normal, tangential and resultant stresses on a plane inclined at 30° to the axis of the minor stress. **7**

[3]

- Q.4 i. What are different types of the beams? **3**
 ii. A cantilever of length 2.0 m carries a uniformly distributed load of 1 kN/m run over a length of 1.5 m from the free end. Draw the shear force and bending moment diagrams for the cantilever. **7**
- OR iii. Prove the relation, **7**

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$
 Where, M = Bending moment, I = Moment of Inertia
 σ = Bending Stress, y = Distance from neutral axis
 E = Young's modulus and R = Radius of curvature
- Q.5 i. What is a spring? Name the two important types of spring with the field of application. **3**
 ii. A hollow shaft of external diameter 120 mm transmits 300 kW power at 200 rpm. Determine the maximum internal diameter if the maximum stress in the shaft is not to exceed 60 N/mm^2 . **7**
- OR iii. A closely coiled helical spring of round steel wire 10 mm in diameter having 10 complete turns with a mean diameter of 12 cm is subjected to an axial load of 2000 N. Determine: (i) the deflection of the spring (ii) maximum shear stress in the wire, (iii) stiffness of the spring. Take $C = 8 \times 10^4$. **7**
- Q.6 i. Explain the assumptions made in Euler's column theory. **3**
 ii. What is 'equivalent length of a column'? Give the ratio of equivalent length and actual length of columns with various end conditions. **7**
- OR iii. A column of timber section $15 \text{ cm} \times 20 \text{ cm}$ is 6 metre long both ends being fixed. If the Young's modulus for timber = 17.5 kN/mm^2 , determine: (a) Crippling load, and (b) Safe load for the column if factor of safety = 3. **7**

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Marking Scheme

Q.1	i.	The ratio of linear stress to linear strain is known as (d) Modulus of Elasticity	1
	ii.	The ratio of shear stress to shear strain is called (c) Modulus of Rigidity	1
	iii.	The property by virtue of which a metal can be beaten into plates is called (b) Malleability	1
	iv.	The normal stress on an oblique plane at an angle θ to the cross section of a body which is subjected to a direct tensile stress (σ) is equal to (c) $\sigma \cos^2 \theta$	1
	v.	A simple supported beam of span (l) carries a point load (W) at the centre of the beam. The shear force diagram will be (c) Two equal and opposite rectangles	1
	vi.	A cantilever of length (l) carries a point load (W) at the free end. The shear force diagram will be (d) A rectangle	1
	vii.	The Torsional rigidity of a shaft is define as the torque required to produce (d) A twist of one radian per unit length of the shaft	1
	viii.	Two shafts, one solid and the other hallow, are made of the same materials and are having same length and weight. The hollow shaft as compared to solid shaft is (a) More strong	1
	ix.	The Rankine's constant for a given material of a column depends upon the (d) None of the above	1
	x.	Strut is define as a (b) Member of a structure which carries an axial compressive load	1
Q.2	i.	Definition of each term 01 mark * 3 = 3 marks	3
	ii.	Marking on steps Given ----- 01 mark Formula -----02 mark	7

		Solution----- 02 mark	
		Answer ----- 02 mark	
	iii.	Definition of Bulk modulus ----- 02 mark	7
		Derivation ----- 05 mark	
Q.3	i.	Definition of each term -----01 mark * 3 = 3 marks	3
	ii.	Definition of non-destructive testing--02 mark Name of various non-destructive testing methods-----02 mark Detail about any one method ----- 03 marks	7
	iii.	Marking on steps Given with diagram----- 01 mark Formula ----- 02 mark Solution----- 02 mark Answer ----- 02 mark	7
Q.4	i.	Name of beams ----- 01 mark * 3 = 3 marks	3
	ii.	Marking on steps Given with diagram----- 01 mark Formula ----- 02 mark Solution----- 02 mark SF and BM diagram----- 02 mark	7
	iii.	Diagram ----- 01 mark Assumptions----- 02 mark Solution ----- 04 mark	7
Q.5	i.	1. Definition of Spring -----01 mark 2. Name with application ----- 02 mark	3
	ii.	Marking on steps Given with diagram----- 01 mark Formula ----- 02 mark Solution----- 02 mark Answer ----- 02 mark	7

iii. Marking on steps **7**
Given with diagram-----01 mark
Formula ----- 02 mark
Solution----- 02 mark
Answer part (i) ----- 01 mark
Answer part (ii) ----- 01 mark

Q.6 i. All Assumptions ----- 03 mark **3**
ii. Definition of equivalent length of column-----02 marks **7**
Formula with diagram ----- 05 marks
iii. Marking on steps **7**
Given with diagram-----01 mark
Formula -----02 mark
Solution----- 02 mark
Answer part (i) -----01 mark
Answer part (ii) ----- 01 mark