

Code: DE02
Time: 3 Hours

JUNE 2011

Subject: APPLIED MECHANICS
Max. Marks: 100

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2 × 10)

- a. Impulse gives a measure of the product of
- (A) Force & Acceleration (B) Mass & Acceleration
(C) Force & Time (D) Force & Velocity
- b. The dimensional formula ML^2T^{-3} represents
- (A) Work (B) Power
(C) Force (D) Momentum
- c. _____ is a method of designating a force by writing two capital letters one on either side of force
- (A) Newton's notation (B) Lami's notation
(C) Bow's notation (D) Varignon's notation
- d. The algebraic sum of moments of all the forces about a point is zero. This is
- (A) Varignon's theorem (B) Principle of moment
(C) Lami's theorem (D) none of these
- e. For a perfectly elastic bodies, the value of coefficient of restitution is
- (A) 1 (B) 0.5 to 1
(C) 0 to 0.5 (D) zero.
- f. The Centre of gravity of a plane lamina will not be at its geometrical centre if it is a
- (A) Circle (B) Square
(C) Rectangle (D) Right angled triangle

- g. The value of Poisson's ratio depends upon
- (A) nature of load, tensile or compressive
 - (B) magnitude of load
 - (C) material of test specimen
 - (D) dimensions of test specimen
- h. In a composite body, consisting of two different materials _____ will be same in both materials
- (A) stress
 - (B) strain
 - (C) both stress, strain
 - (D) none of these
- i. The MOI of a body is always minimum w.r.t. its
- (A) base
 - (B) centroidal axis
 - (C) vertical axis
 - (D) horizontal axis
- j. The criteria for the design of a shaft is the stress at
- (A) the external surface
 - (B) the axis
 - (C) any inside layer
 - (D) any of these

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

- Q.2** a. Define free body diagram and state the condition of equilibrium for coplanar and concurrent forces. (6)
- b. The following forces act at a point
- (i) 30 N inclined at 45° towards North of East
 - (ii) 25 N towards North
 - (iii) 40 N inclined at 50° towards South of West
 - (iv) 60 N towards North West
 - (v) 35 N towards East
 - (vi) 15N towards west.
- Find the magnitude and direction of the resultant force. (10)
- Q.3** a. Define coefficient of friction. Name three harmful effects of friction in engineering? (6)
- b. A block of wood weighs 25 N. It can be just drawn along a table by a horizontal force of 15 N. Find.
- i) Co-efficient of friction,
 - ii) If the block is then loaded with another 10 N load, what will be the least force would be able to move the block? (10)
- Q.4** a. State the three laws of Newton. (6)

- b. A flywheel is rotating at 600 rpm. After ten seconds it is rotating at 100 rpm. If retardation is uniform determine the number of revolution made by the flywheel and time taken before it comes to rest from the speed of 600 rpm. (10)

Q.5 a. Define a shaft. What is 'Torque'? (6)

- b. A circular bar made of cast iron is to resist a torque of 2.2 kNm acting in transverse plane. If the allowable stresses in shear is 35 MN/m^2 , find:
 (i) Diameter of the bar;
 (ii) Angle of twist under the applied torque per meter length of bar.
 Take: C (for cast iron) = 40 GN/m^2 (10)

Q.6 a. Define the terms 'Centroid', 'Centre of gravity' and 'Moment of inertia'. (6)

- b. Determine the position of the centroid of T-section as shown in Fig.1. (10)

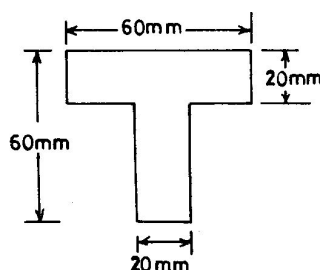


Fig.1

Q.7 a. Define D'Alembert's principle. (6)

- b. A hammer weighing 20 N is moving with a speed of 5 m/s, strikes the head of a nail and drives it 20 mm into the wall. Neglecting the mass of nail, calculate:
 (i) Acceleration during impact; (ii) Time interval during impact;
 (iii) Impulse; (iv) Impulsive force. (10)

Q.8 a. Define (i) Proof stress (ii) Ultimate stress (iii) Working stress. (6)

- b. A steel bar 900 mm long; its two ends are 40 mm and 30 mm in diameter and the length of each rod is 200 mm. The middle portion of the bar is 15 mm in diameter and 500 mm long. If the bar is subjected to an axial tensile load of 15 kN, find its total extension. (Take $E = 2 \times 10^8 \text{ kN/m}^2$) (10)

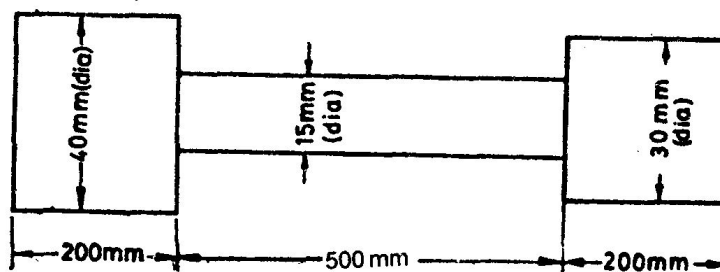


Fig.2

- Q.9** a. What are shear force and bending moment diagrams?
- b. Draw the B.M. and S.F. diagrams for the beam loaded as shown in Fig.3. (10)

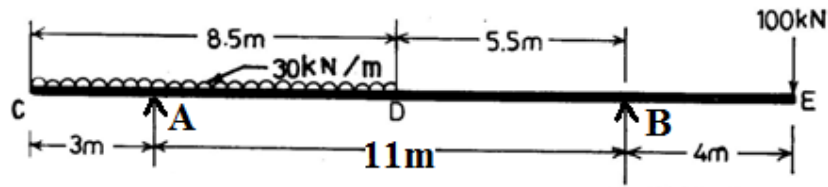


Fig.3