

DiplETE – ET (OLD SCHEME)

Code: DE02
Time: 3 Hours

JUNE 2010

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.
- 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.

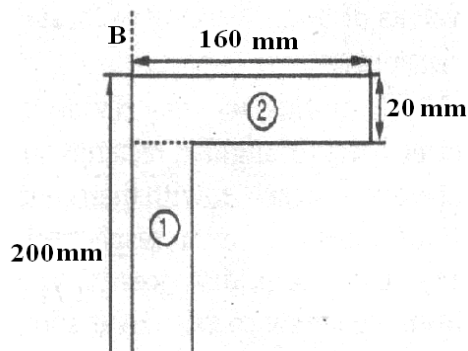
Q.1 Choose the correct or the best alternative in the following: (2 × 10)

- a. Which of the following is not considered as the basic quantity?
- (A) Length (B) Mass
(C) Time (D) Density
- b. The vectors are said to be equal if they have _____.
- (A) same magnitude
(B) same magnitude, same direction
(C) same magnitude, different direction
(D) different magnitude, same direction
- c. Newton's first law of motion gives the concept of _____.
- (A) Work (B) Force
(C) Inertia (D) Energy
- d. A force which combines with two or more forces to produce equilibrium is called?
- (A) resultant (B) equilibrium
(C) couple (D) moment
- e. The time-acceleration graph of a body moving with uniform acceleration is a straight line _____.
- (A) passing through the origin. (B) inclined to the time axis.
(C) parallel to time axis. (D) parallel to acceleration axis.
- f. A body has linear momentum P and translational kinetic energy E. If momentum becomes 2P, the K.E. will have the value _____.

- (A) 0.5E (B) E
(C) 2E (D) 4E
- g. The apparent weight of a man in a lift is less than the real weight when the lift is going down _____.
- (A) freely (B) under the force of gravity
(C) with some constant velocity (D) with some acceleration
- h. In SHM, the acceleration is proportional to _____.
- (A) displacement (B) linear velocity
(C) time (D) rate of change of angular velocity
- i. A zero torque acting on a system will result in conservation of _____.
- (A) linear velocity (B) angular velocity
(C) angular momentum (D) moment of momentum
- j. A solid particle covers equal distances around a circular path in equal intervals of time. Which of the following parameters connected with the motion of particle remains constant with time?
- (A) displacement (B) speed
(C) velocity (D) acceleration

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

- Q.2** a. Explain difference between fundamental & derived units. Which system of units is being followed in india these days? (6)
- b. Find the greatest and the least resultant of two forces whose magnitudes are 50 N and 30 N respectively by making the suitable assumptions in respect of their angle of inclination. (10)
- Q.3** a. Describe the method of finding centre of gravity of an irregular body. (6)
- b. Determine the position of the centroid of the section shown in Fig.1. (10)



- Q.4** a. Define: (6)
- (i) Coefficient of friction
 - (ii) Angle of friction
 - (iii) Angle of repose
- b. A block of wood weighs 25 N. It can be just drawn along a table by a horizontal force of 15 N, Find: (10)
- (i) Co-efficient of friction,
 - (ii) If the block is then loaded with another 10 N load, which least force would be able to move the block?
- Q.5** a. State and explain D'Alembert's principle. (6)
- b. A bullet weighing 2 N leaves the barrel of a gun with a velocity of 25 m/s. Find the impulse of force produced by the discharge of bullet when the force lasted for 0.2 s. Also find the average impulsive force. (10)
- Q.6** a. What do you understand by a self locking machine? State the condition for self locking. (4)
- b. The length of an inclined plane is 5 m. and its height is 2.5 m. If a force of 400 N pulls a load of 600 N up the inclined plane, find: (6)
- (i) Mechanical advantage;
 - (ii) Velocity Ratio; and
 - (iii) Efficiency of the machine.
- c. State Lami's theorem. What are the conditions of equilibrium of system of coplanar forces? (6)
- Q.7** a. Define: (6)
- (i) Hooke's law.
 - (ii) Modulus of rigidity.
 - (iii) Bulk modulus of elasticity.

- b. The following observations were made during a tensile test on a mild steel specimen 40 mm diameter and 200 mm long. Elongation with 40 kN load (within limit of proportionality), $\delta l = 0.0304$ mm, Yield load = 161 kN, maximum load = 242 kN, Length of specimen at fracture = 249 mm. (10)

Determine:

- (i) Young's modulus of elasticity.
- (ii) Yield point stress.
- (iii) Ultimate stress.
- (iv) Percentage elongation.

Q.8 a. What assumptions are made while deriving the torsion equation? (6)

- b. A solid steel shaft is subjected to a torque of 45 kNm. If the angle of twist is 0.5° per metre length of the shaft and the shear stress is not to be allowed to exceed 90 MN/m^2 find: (10)

- (i) Suitable diameter for the shaft
- (ii) Final maximum shear stress and angle of twist; and
- (iii) Maximum shear strain in the shaft. Take: $C = 80 \text{ GN/m}^2$

Q.9 a. Define Shear force and Bending moment diagrams. What are their salient features? (6)

- b. A simply supported beam is carrying a u.d.l. of 2.5 kN/m over the right half portion of the beam. The length of the beam is 6 m. draw the S.F.D. and B.M.D. for the beam. (10)

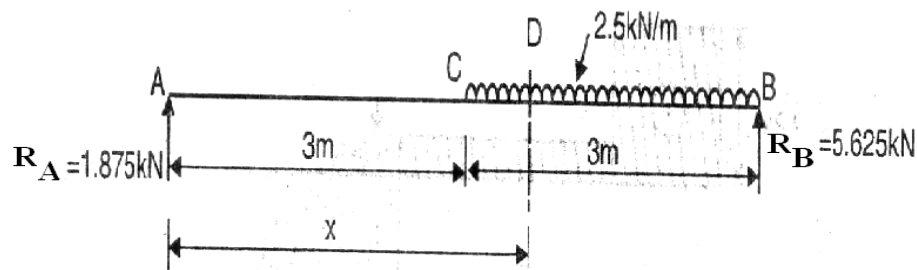


Fig.2