

DiplETE – ET (OLD SCHEME)

Code: DE02
Time: 3 Hours

Subject: APPLIED MECHANICS
Max. Marks: 100

DECEMBER 2010

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 half an hour 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.

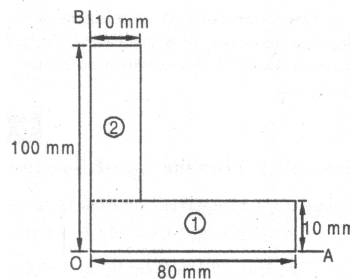
Q.1 Choose the correct or the best alternative in the following: (2×10)

- a. The subject of Applied Mechanics deals mainly with
- (A) Deformable Solids (B) Semi Solids
(C) Rigid Bodies (D) Fluids
- b. The velocity of a moving body is
- (A) a vector quantity (B) a scalar quantity.
(C) a constant quantity. (D) none of these
- c. Two forces of equal magnitude P act at an angle θ to each other. Their resultant is equal to
- (A) $2P\sin\theta/2$ (B) $2P\cos\theta/2$
(C) $2P\cos\theta$ (D) $P\cos 2\theta$
- d. The free body diagram of a body shows the body
- (A) with its surroundings and external forces acting on it
(B) isolated from all external effects
(C) isolated from its surroundings and all external actions upon it
(D) isolated from its surroundings
- e. Rain is falling vertically downwards. To a person running eastwards, the rain will appear to be coming from
- (A) East (B) West
(C) North east (D) South east

- f. Two balls of same size, one of mass 10kg and other of mass 20kg, are dropped simultaneously from a tower. When the balls are 2m above the ground, they will have the same
- (A) acceleration (B) momentum
(C) kinetic energy (D) potential energy
- g. When a bullet is fired from a gun, it is recoiled in the backward direction, it is due to
- (A) impulse (B) inertia
(C) Conservation of momentum (D) conservation of energy
- h. When a body executes SHM, there is always a constant ratio between the displacement of mass and its
- (A) frequency (B) velocity
(C) time period (D) acceleration
- i. A body moving around a fixed axis constitutes
- (A) rotational motion (B) circular motion
(C) plane motion (D) simultaneous translation & rotation
- j. The CG 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

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

- Q.2** a. Define Mechanics and Applied Mechanics ? What are the different branches of applied mechanics? (6)
- b. When two forces P and Q act at right angles, their resultant is $\sqrt{10}$ N. However, when they act at 60° , their resultant increases to $\sqrt{13}$ N. Find these forces. (10)
- Q.3** a. What do you understand by equilibrium of forces? Define laws of equilibrium (6)
- b. Determine the position of the centroid of the section shown in fig. (10)



- Q.4** a. Friction is a necessary evil. Justify. What are the harmful effects of friction in engineering? (6)
- b. A body weighing 120 N is lying on a horizontal plane for which $\mu = 0.8$. Determine: (10)
- Normal friction
 - Limiting force of friction
 - Horizontal force required to move it
 - Angle of friction
- Q.5** a. Define Newton's second law of motion and derive force equation $f = ma$ (6)
- b. A body of mass 20 kg is moving with a velocity of 2 m/s. Find the magnitude of a force required to stop it in 20 seconds. How much distance will it move through before coming to rest? (10)
- Q.6** a. Define (i) Mechanical Advantage (ii) Velocity ratio (iii) Efficiency. Derive the relation between them (6)
- b. In a lifting machine, an effort of 500 N is to be moved by a distance of 20 m to raise a load of 10,000 N by a distance of 0.8 m. Determine : (5)
- Velocity ratio;
 - Mechanical advantage, and
 - Efficiency.
- c. A particle undergoes a simple harmonic motion. The acceleration of the particle at a distance of 1.5 metres from the centre of motion being 6 metre/sec^2 . Find the time of an oscillation. (5)
- Q.7** a. Define (6)
- Proof stress
 - Ultimate stress
 - Working stress
 - Factor of safety
- b. A steel rod 20 mm diameter and 4 m long is subjected to an axial pull of 40 kN. It is extended by 2.55 mm. If the loading has been within elastic limits of the material. Find (10)
- Stress,
 - Strain, and
 - Young's modulus of elasticity
- Q.8** a. Define a shaft. What is the difference between 'Torque' and 'Torsion'? (6)
- b. A circular bar made of cast iron is to resist an occasional torque of 2.2 kNm acting in transverse plane. If the allowable stresses in compression, tension and shear are 100 MN/m^2 , 35 MN/m^2 and 50 MN/m^2 respectively, find: (10)
- Diameter of the bar;
 - Angle of twist under the applied torque per metre length of bar.
- Take: C (for cast iron) = 40 GN/m^2

- Q.9**
- What is a beam? What are the different types of beams (with fig) depending upon the end conditions? (6)
 - A simply supported beam 5m long is subjected to two point loads of 2kN each at distances of 1m and 3m respectively from the left hand support(as shown in fig.). Draw the S.F.D. and B.M.D. for the beam. (10)

