

DECEMBER 2007

Code: DE02
Time: 3 Hours

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 best alternative in the following:

(2x10)

a. Identify the pair which has same dimensions.

- (A) Force and Power. (B) Energy and Work.
(C) Momentum and Energy. (D) Impulse and Momentum.

b. Given that $P+Q=R$ and also $P=Q=R$ the angle between vectors P and Q is

- (A) 0 (B) $\frac{\pi}{3}$
(C) $\frac{2\pi}{3}$ (D) π

c. A cantilever of span 3.0 m carries a point load at the free end, if the slope is 1degree(0.01745 radian), the deflection at the free end would be approximately equal to

- (A) 35mm (B) 17.5mm
(C) 26.2mm (D) 69.5mm

d. The CG of a triangle lies at the point of intersection of

- (A) Diagonals (B) Altitudes
(C) Bisector of Angles (D) Medians

e. A zero angle of friction implies that

- (A) Frictional force is zero.

(B) Frictional force is infinite.
plane.
of motion.

(C) Frictional force acts normal to the

(D) Frictional force acts along the direction

f. For maximum horizontal range, the angle of projection should be

(A) 30°

(B) 45°

(C)

60°

(D)

75°

g. The Poisson's ratio for most of material is close to

(A) 0.5

(B) 0.2

(C) 0.25

(D) 0.33

h. The speed of a particle executing simple harmonic motion with amplitude A is half of the maximum speed. At that instant, displacement of the particle is

(A) $\frac{\sqrt{3}}{2} A$

(B) $A/2$

(C) $\frac{2A}{\sqrt{3}}$

(D) $3\sqrt{2}A$

i. Brittleness is opposite to

(A) Toughness

(B) Plasticity

(C) Malleability

(D) Creep Strength

j. A cantilever beam of effective length L carries a load W at the free end. The maximum deflection would be

(A) $\frac{5WL^3}{384EI}$

(B) $\frac{WL^3}{8EI}$

(C) $\frac{WL^3}{48EI}$

(D) $\frac{WL^3}{3EI}$

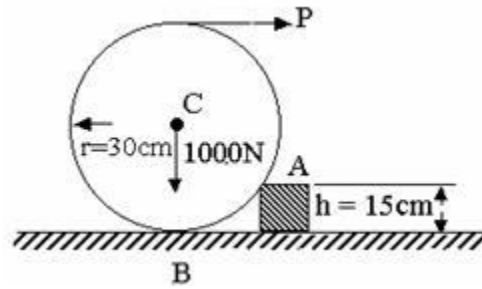
Answer any FIVE Questions out of EIGHT Questions.

Each question carries 16 marks.

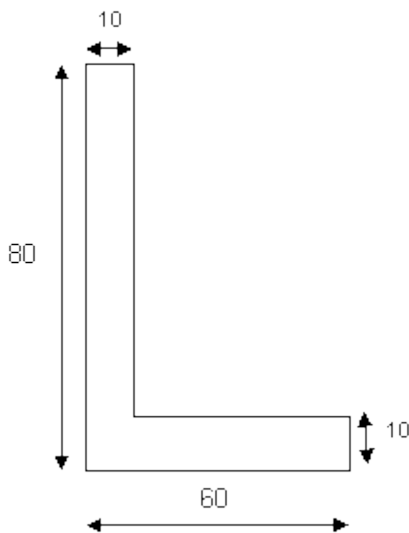
Q.2 a. State Lami's theorem. (2)

b. A uniform wheel of 60.00 cm diameter and weighing 1000 N rests against a rectangular block 15 cm high lying on a horizontal plane as shown below. It is to be pulled over this block by a horizontal force P applied to the end of a string

would round the circumference of the wheel. Find the force P when the wheel is just about to roll over the block. (14)



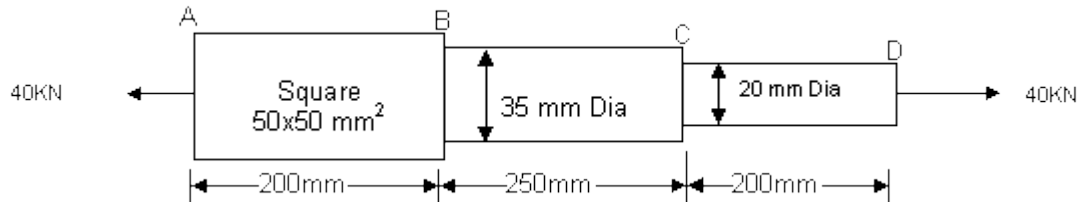
- Q.3** a. Define section modulus. (3)
 b. Find the MOI about centroidal axes XX and YY of The section shown below in figure. (13)



- Q.4** a. Define Coefficient of friction, angle of friction and angle of Repose? (6)
 b. A pull of 50 N inclined at 30° to the horizontal is necessary to just move a block placed on horizontal table. If coefficient of friction is 0.2 find out the weight of block. (10)

- Q.5** a. Define Ultimate stress, Working stress and Proof stress. (6)

- b. Figure shows a steel bar consisting of three lengths. Find the stresses in the three parts and the total elongation of the bar for an axial pull of 40 KN. Take $E=2.1 \times 10^5 \text{ N/mm}^2$ (10)



- Q.6** a. Define time period and frequency in circular motion. (4)
- b. A 2000 Kg car begins to skid when traveling at 72 Km/hr. along a level (banking angle = 0) circular curve of 200m radius. Find (i) The coefficient of friction between the tyre and the road. (ii) If the same car now moves with the same speed on a frictionless road banked at an angle of 2° , find the least radius of the circular path along which it can move. (12)
- Q.7** a. State Newton's second law of motion. Give example. (3)
- b. In a machine the effort was found to move a distance of 20m when load moved a distance of 0.5m. With this machine a load of 22400N was raised by the application of an effort of 800N. Determine :-
 (i) V.R. (ii) M.A. (iii) Efficiency (iv) Probable effort & the load raised if the machine is perfect. (13)
- Q.8** a. What is the difference between Torque & Torsion? (4)
- b. What diameter of shaft will be required to transmit 80 kW at 60 r.p.m., if the maximum torque is 30 percent greater than the mean torque and the limit of torsional stress is to be 56 MPa? If the modulus of rigidity is 84GPa, what is the maximum angle of twist in 3m length? (12)
- Q.9** a. What is point of contra flexure? (3)

- b. A simply supported beam 10m long carries a uniformly distributed load of 10kN/m. In addition, it carries a point load of 40KN at a distance of 3m from left end support. Determine shear force and bending moment and draw S.F. and B.M. diagrams. **(13)**