

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.ARCH/SEM-1/ARCH-103/2012-13**

**2012**

**ENGINEERING MECHANICS**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for the following :

10 × 1 = 10

- i) Centroid lies on
  - a) Symmetrical Axis
  - b) Symmetrical surface
  - c) Axis of surface
  - d) Axis of symmetry.
- ii) If a particle is thrown vertically up ward with a velocity of 9.81 m/s, the time taken by it to come back to original position is
  - a) 1 sec
  - b) 2 sec
  - c) 3 sec
  - d) 4 sec.
- iii) M.I. of circular area whose diameter is  $d$  about an axis perpendicular to the area passing through its centre is given by
  - a)  $\frac{\pi d^4}{64}$
  - b)  $\pi \frac{d^4}{64}$
  - c)  $\frac{\pi d^4}{6}$
  - d)  $\pi \frac{d^4}{64}$ .

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- iv) Moment of inertia is the function of
  - a) inertia force
  - b) mass of the body
  - c) cross-section area of the body
  - d) all of these.
- v) The ratio of Limiting Friction and reaction is known as
  - a) co-efficient of friction
  - b) angle of friction
  - c) angle of repose
  - d) sliding friction.
- vi) Varignon's theorem is the principle of
  - a) moment
  - b) momentum
  - c) movement
  - d) moment of inertia.
- vii) Limiting friction independent of
  - a) surface of contact
  - b) surface roughness
  - c) area of contact
  - d) nature of surface.
- viii) Centre of gravity is a
  - a) line
  - b) point
  - c) axis
  - d) none of this.
- ix) The force which meet at one point but there line of action do not lie on one plane, are called
  - a) coplanar, non-concurrent forces
  - b) non coplanar, concurrent forces
  - c) non-coplanar, non-concurrent forces
  - d) coplanar, concurrent forces.
- x) The horizontal range of a projectile is maximum when the angle of projection is
  - a)  $30^\circ$
  - b)  $45^\circ$
  - c)  $60^\circ$
  - d)  $75^\circ$ .



**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.  $3 \times 5 = 15$

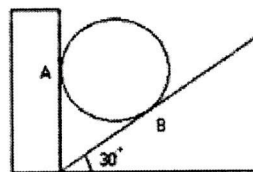
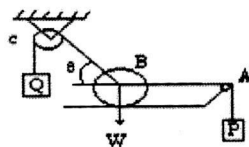
2. Write and explain the law of transmissibility of forces.
3. Write the law of equilibrium for the system of two and three forces.
4. What is the principle of moment and explain how it is used to find the unknown forces from a system of forces.
5. Define and explain on any two of the following :
  - a) Law of static friction
  - b) Moment of couple
  - c) Parallel axis theorem.

**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

6. a) A ball of weight  $w$  is resting upon a smooth plane and is attached at the centre to two string which pass over smooth pulleys and carry loads  $P$  and  $Q$  as shown in Figure (a). Find the angle  $\theta$  and the pressure between the ball and the plane.

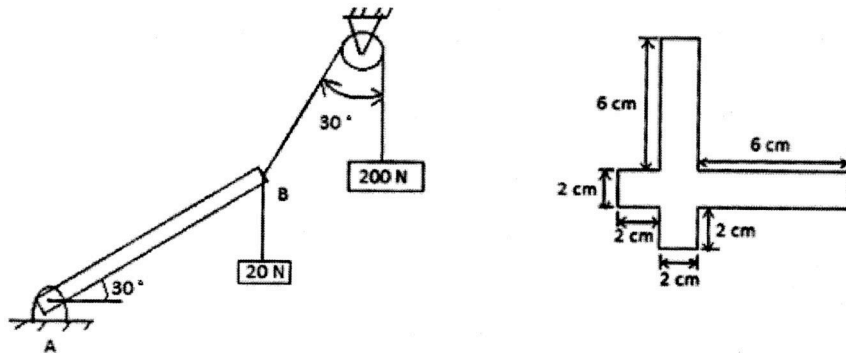


- b) A disc has a mass of 25 kg and radius 200 mm rests between the smooth inclined and vertical surfaces as shown in Figure (b). Find the reaction at the point A and B.



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7. a) State and prove Varignon's theorem.  
b) A prismatic bar of 600 mm length and 800 N weights is hinged at point A and hanged at point b by a string with 200 N weights through a smooth pulley and also a 20 N weight is hanging at the same point as shown in Figure (c). Find the reaction at point A. 6 + 9



8. a) Determine the centroid of a quarter circle area by integration method.  
b) Determine the centroid of the area shown in Fig. (d) 6 + 9
9. a) State perpendicular axis theorem. What do you mean by radius of gyration ?  
b) Find the moment of inertia about  $x$  and  $y$  axes of a z section whose top, bottom and middle flanges are  $100 \times 10 \text{ mm}^2$  so that the top of middle flange is connected at the bottom of right side of top flange and the bottom of middle flange is connected at the top of left side of bottom flange. All the dimensions are parallel with  $x$  or  $y$  axes. 2 + 2 = 11

