

Reg. No.	
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B.E. (Full Time) DEGREE END SEMESTER EXAMINATIONS, APR/MAY 2012

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Common to all branches

II Semester

**GE 181 Engineering Mechanics**

(Regulation 2004)

Time: 3 Hrs.

Maximum: 100 marks

Answer **ALL** questions

**Part A – (10 x 2 = 20 marks)**

1. Define collinear forces and concurrent forces.
2. State and explain Lamé's theorem.
3. State Varignon's theorem.
4. What are the equilibrium equations for 2-D rigid body.
5. Define polar moment of area and radius of gyration.
6. Write the expressions for second moment of area of a rectangle with respect to its centroidal axes.
7. Define principal axes.
8. State Coloumb's law of friction.
9. Explain work energy principle.
10. A particle starts from rest and moves along a straight line with constant acceleration. It reaches velocity of 3 m/s after covering a distance of 8 m. Find the acceleration.

**Part – B (5 x 16 = 80 Marks)**

11. Determine the second moment of area about the centroidal axes of the section shown in Fig.1
- 12a. Determine the forces in the supporting cables DA, DB and DC due to a bucket of weight 20 N attached at D as shown in Fig.2.

(OR)

- 12b. (i) A 300 mm wooden beam of mass 54 kg is supported by pin at A and by cable BC as shown in Fig.3. Find the reaction at A and tension in the cable. (8)
- (ii) Determine the tension in the cable ABD and reaction at the support C of the member shown in Fig.4. Assume the pulley at B is smooth. (8)
- 13a. Determine the centroidal position of the shaded area shown in Fig.5 and Fig.6. The radius of the circle  $a = 10$  mm.

(OR)

- 13b. (i) Derive the mass moment of inertia of a thin rectangular surface and thin circular disc about the centroidal axes. (8)
- (ii) Derive the mass moment of inertia of a rectangular block about its centroidal axes.
- 14a. (i) Explain work energy principle and derive the relevant expression. (6)
- (ii) A bullet of mass 53 gm is fired from a gun into a block of wood with a velocity of 326 m/s and it penetrates a depth of 11.3 cm. If the same bullet is fired from the same gun with the same velocity into a block of wood 6.5 cm at what velocity the bullet would emerge the block after penetration? (10)

(OR)

- 14b. (i) A particle of mass  $m$  is projected vertically upward with a velocity  $V_0$  in a medium whose resistance is expressed as  $kV$ . Determine the expression of time for the particle to come to rest. (8)
- (ii) Determine the expression for the time of the particle, 14b(i), to come to rest if the resistance of the medium is expressed as  $kV^2$  instead of  $kV$ . (8)
- 15a. (i) Define coefficient of friction, angle of friction and angle of repose. (6)
- (ii) A uniform ladder 8 m long weighing 200 N with one end of it is resting against a vertical wall and the other end is resting on a horizontal surface. A man of 720 N climbs the ladder. At what position of the man along the length of the ladder, it will start slipping? Assume the coefficient of friction for all contact surfaces as 0.25. (10)

(OR)

- 15b. (i) Derive the expression for the ratio of the tension forces developed in a belt drive. (6)
- (ii) A rotating drum, shown in Fig.7 is braked by flat belt attached to the lever ABC hinged at B. Determine the braking moment exerted by a vertical weight of 150 N while the coefficient of friction between the belt and drum is 0.43. (10)