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**First/Second Semester B.E. Degree Examination, June/July 2016**  
**Elements of Civil Engineering and Engineering Mechanics**

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions,  
choosing ONE full question from each module.*

**Module-1**

- 1 a. Explain briefly the role of civil engineer in the infra-structural development of nation. (10 Marks)  
 b. Classify the roads and dams and draw the neat sketches. (10 Marks)

**OR**

- 2 a. State and explain principle of transmissibility of forces. (04 Marks)  
 b. Define couple and explain various characteristics of couple. (08 Marks)  
 c. A 100 N vertical force is applied to the end of lever which is attached to a shaft as shown in Fig. Q2(c), determine :  
 i) The moment of force about 'O'  
 ii) The horizontal force applied at 'A' which creates same moment about 'O'  
 iii) The smallest force applied at 'A' which creates same moment about 'O'. (08 Marks)

**Module-2**

- 3 a. Distinguish between resolution and composition of forces. (04 Marks)  
 b. State and prove parallelogram law of forces. (06 Marks)  
 c. Three forces acting on a hook are as shown in Fig. Q3(c). Determine the direction of the fourth force of magnitude 100 N such that the hook is pulled in x - direction only. Determine the resultant force in x-direction. (10 Marks)

**OR**

- 4 a. State and prove Varignon's theorem of moments. (08 Marks)  
 b. A rigid plate ABCD is subjected to forces as shown in Fig. 4(b). Compute the magnitude, direction and line of action of the resultant of the system with reference to the point A. (12 Marks)

**Module-3**

- 5 a. State and prove Lami's theorem. (04 Marks)  
 b. What is meant by equilibrium of a rigid body? State the conditions of static equilibrium for coplanar concurrent and non - concurrent force systems. (08 Marks)  
 c. Two identical rollers each weighting 200 N are pulled in a trough as shown in Fig. Q5(c). Assuming all contact surfaces are smooth, find the reactions developed at contact surfaces A, B, C and D. (08 Marks)

**OR**

- 6 a. List the Law's of friction. (06 Marks)  
 b. Define : i) Angle of repose ii) Angle of friction  
 iii) coefficient of friction iv) cone of friction. (08 Marks)  
 c. What is the value of 'P' in the system shown in Fig. Q6(c) to cause the motion to impend? Assume the pulley is smooth and the coefficient of friction between the other contact surfaces is 0.2. (06 Marks)

**Module-4**

- 7 a. Locate the Centroid of area shown in Fig. Q7(a) with respect to the Cartesian coordinate system shown. (10 Marks)  
 b. Distinguish between centroid and centre of gravity. (04 Marks)  
 c. Derive the expression for the centroid of the semi – circular lamina from the diametric axis. (06 Marks)

OR

- 8 a. State and prove parallel axis theorem. (06 Marks)  
 b. Determine the second moment of area about the horizontal centroidal axis as show in Fig. 8 (b). Also find radius of gyration. (14 Marks)

**Module-5**

- 9 a. Define the following terms : i) Projectile ii) Angle of projectile iii) Vertical height iv) Time of flight v) Horizontal range. (10 Marks)  
 b. A feather is dropped on the moon from a height of 1.40m. The acceleration of gravity on the moon is  $1.67\text{m/s}^2$ . Determine the time for the feather to fall to the surface of the moon. (10 Marks)

OR

- 10 a. Briefly explain about : i) Super elevation ii) relative motion iii) motion under gravity iv) centrifugal force. (10 Marks)  
 b. A ball is thrown vertically upward with a speed of 25 m/s :  
 i) How high does it rise?  
 ii) How long does it take to reach its highest point?  
 iii) How long does the ball take to hit the ground after it reaches its highest point?  
 iv) What is the velocity when it returns to the level from which it started? (10 Marks)

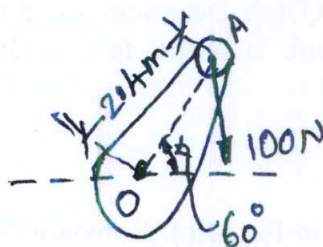


Fig. Q2(c)

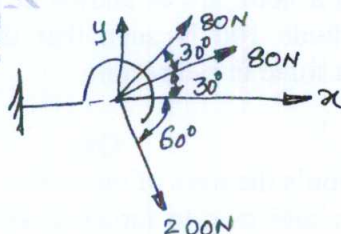


Fig. Q3(c)

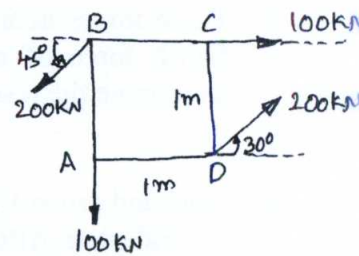


Fig. Q4(b)

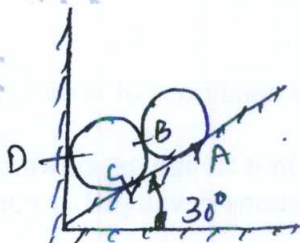


Fig. Q5(c)

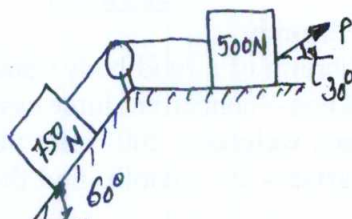


Fig. Q6(c)

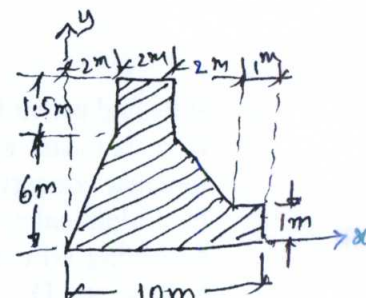


Fig. Q7(a)

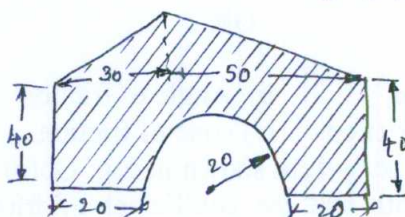


Fig. Q8(b)

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