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17CIV13/23

## First/Second Semester B.E. Degree Examination, Feb./Mar.2022 Elements of Civil Engineering and Mechanics

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Figures to be drawn wherever necessary.  
3. Assume any missing data suitably.

### Module-1

- Briefly explain the scope of following fields of civil engineering :  
(i) Environmental engineering (ii) Geotechnical engineering. (08 Marks)
  - Write short notes on:  
(i) Principle of transmissibility (ii) Principle of super position. (06 Marks)
  - Define couple and enumerate the characteristics of a couple. (06 Marks)

OR

- Write briefly the classification of roads by Nagpur road plan. (05 Marks)
  - Explain the role of civil engineers in the infrastructure development of a country. (05 Marks)
  - Find the moment of the force about A and B for the 30 KN force shown in Fig. Q2 (c).

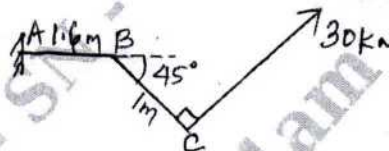


Fig. Q2 (c)

(10 Marks)

### Module-2

- Prove that angle of repose is equal to angle of friction for a block kept on an inclined plane. (10 Marks)
  - Determine the force F and its inclination  $\theta$  so as to lift a block of weight 500 N as shown in Fig. Q3 (b).

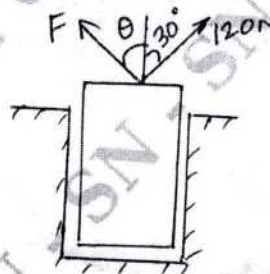


Fig. Q3 (b)

(10 Marks)

OR

- Prove that the coefficient of friction is equal to tangent of angle of friction. (08 Marks)
  - Determine the resultant force acting on a hydraulic structure at point 'O' both in magnitude and direction. (Fig. Q4 (b)).

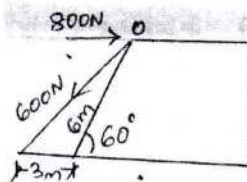


Fig. Q4 (b)

(12 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

**Module-3**

- 5 a. State and prove "Principle of Moments". (08 Marks)  
 b. Determine support reactions at A and B for the beam shown in Fig. Q5 (b).

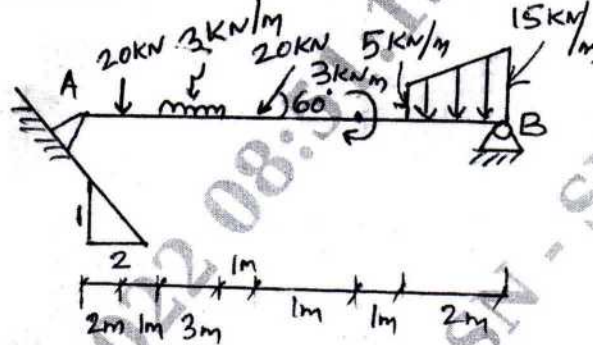


Fig. Q5 (b)

(12 Marks)

**OR**

- 6 a. Determine the distance 'X' of the load 'P' from the support A, if the reaction  $R_A$  is twice as great as reaction  $R_B$ . Take  $P = 2$  kN,  $Q = 1$  kN. Refer Fig. Q6 (a).

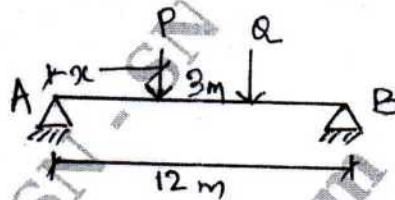


Fig. Q6 (a)

(08 Marks)

- b. Find the magnitude, direction and position of the resultant with respect to point 'A' for the force system shown in Fig. Q6 (b).

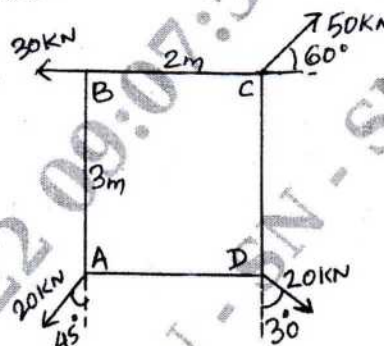


Fig. Q6 (b)

(12 Marks)

**Module-4**

- 7 a. State and prove parallel axis theorem. (10 Marks)  
 b. Find the value of "b" in Fig. Q7 (b) for which the centroid lies at a distance of 50 mm from x-axis.

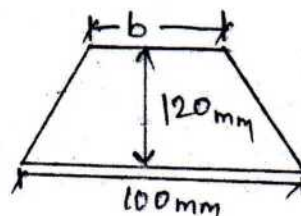


Fig. Q7 (b)

(10 Marks)

OR

- 8 a. Derive an expression for distance of centroid of a triangle above its base. (08 Marks)  
 b. Calculate the second moment of area for the shaded portion of the given section (Fig. Q8 (b)) about its horizontal centroidal axis. Also find the radius of gyration.

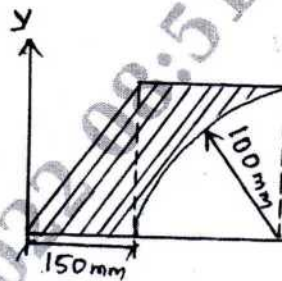


Fig. Q8 (b)

(12 Marks)

Module-5

- 9 a. State Newton's laws of motion. (08 Marks)  
 b. A pilot flying his bomber at a height of 2000 m with a uniform horizontal velocity of 600 kmph wants to strike a target (Fig. Q9 (b)). At what distance from the target, he should release the bomb.

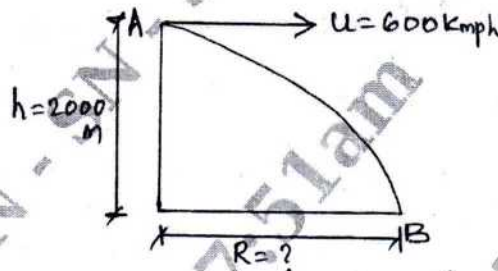


Fig. Q9 (b)

(12 Marks)

OR

- 10 a. Define the following terms:  
 (i) Velocity of projection  
 (ii) Angle of projection.  
 (iii) Trajectory  
 (iv) Horizontal range  
 (v) Time of flight. (10 Marks)  
 b. A car starts with a velocity of 4 m/s and moves in a straight line with constant acceleration. If its velocity at the end of 5 seconds is 6.5 m/s, determine (i) The uniform acceleration (10 Marks)  
 (ii) Distance travelled in 15 seconds.

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