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INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech II Semester End Examinations (Regular) - May, 2019

Regulation: IARE – R18

ENGINEERING MECHANICS

Time: 3 Hours

(AE)

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT – I

1. (a) Explain Lami's theorem with neat sketch and prove [7M]

$$\frac{P}{\sin \alpha} = \frac{Q}{\sin \beta} = \frac{R}{\sin \gamma}$$
- (b) Two forces acts at an angle of 120° . The bigger force is of 40 N and the resultant is perpendicular to the smaller one. Find the smaller force. [7M]
2. (a) What differences exist between kinetics and kinematics. State and explain Newtons law of gravitation and Newton's three laws of motion? [7M]
- (b) The following forces ac at a point: [7M]
 - (i) 20N inclined at 30° towards North of East.
 - (ii) 25N towards North
 - (iii) 30N towards North West and
 - (iv) 35N inclined at 40° towards South of west.

Find the magnitude and direction of the resultant force.

UNIT – II

3. (a) Explain the types of friction with examples? Explain the difference between coefficient of friction and angle of friction. [7M]
- (b) Using the method of joints, find the axial forces in all the members of a truss with the loading as shown in Figure 1. [7M]

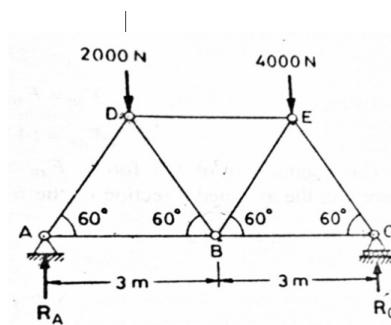


Figure 1

4. (a) Explain different types of loading with neat sketch. Explain the following terms [7M]
 i. Work done by weight force
 ii. Work done by friction force
 iii. Work done by spring force
- (b) Simply supported beam AB of span 5m is loaded as shown in Figure 2. Find the reactions at A and B. [7M]

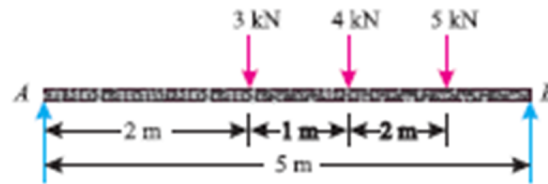


Figure 2

UNIT – III

5. (a) Distinguish between centroid and center of gravity. Describe the various methods of finding the centre of gravity of a body. [7M]
- (b) Determine the coordinates X and Y. A 100mm diameter circular hole is cut in a thin plate as shown in Figure 3. Find the centroid of the remaining shaded area (All dimensions are in mm). [7M]

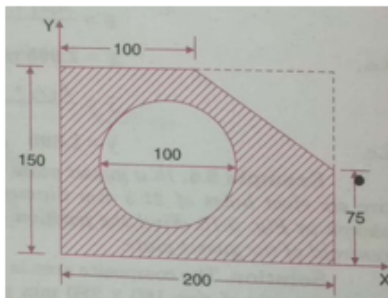


Figure 3

6. (a) Derive an expression for moment of inertia of a semicircular section with neat sketch. [7M]
- (b) Determine the moment of inertia of a semicircular section of 100 mm diameter about its center of gravity and parallel to X-X and Y-Y axes. [7M]

UNIT – IV

7. (a) Define the terms velocity and acceleration. Write governing equations of velocity and acceleration of fixed axis rotation. [7M]
- (b) A particle starts from rest and moves along a straight line with constant acceleration a . If it acquires a velocity $v=3$ mm/s, after having traveled a distance $S=7.5$ m, find the magnitude of the acceleration. [7M]
8. (a) Define the term rigid body. Explain motion of a rigid link with neat sketch. [7M]
- (b) Two bodies of masses 4 kg and 30 kg are hung to the ends of a rope, passing over a frictionless pulley. With what acceleration the heavier mass comes down? What is the tension in the string? [7M]

UNIT – V

9. (a) Explain simple pendulum with neat sketch. Write the expression for time period of a simple pendulum. [7M]
- (b) A weight P is attached to spring of stiffness C_1 and C_2 in two different cases as shown in Figure 4. Determine the period of vibrations in both the cases. [7M]

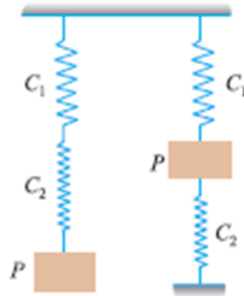


Figure 4

10. (a) Define Simple Harmonic Motion(SHM). Draw the graphical representation for displacement, velocity and acceleration equations of SHM. [7M]
- (b) A body moving with SHM has amplitude of 1 meter and the period of complete oscillation is 2 seconds. What will be the velocity and acceleration of the body after 0.4 second from the extreme position? [7M]

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