

Total No. of Questions : 6]

SEAT No. :

PE-12178

[Total No. of Pages : 6

[6581]-2409

F.E.

ESC-104-CVL : ENGINEERING MECHANICS
(2024 Pattern) (Semester - I/II)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) All questions are compulsory.
- 2) Neat sketches must be drawn whenever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary and mention it clearly.
- 5) Use of electronic pocket calculator is allowed.
- 6) Use of cell phone is prohibited in the examination hall.

Q1) Write the correct option for the following multiple choice questions :

[10]

- i) Complete determination of resultant force in non concurrent forces is [2]
 - a) Determination of Magnitude
 - b) Determination of Direction
 - c) Determination of point on its line of action
 - d) All of these
- ii) Simply supported beam of span 'L' m. is loaded with Uniformly distributed load of 'W' KN/m, what is the reaction at left support? [2]
 - a) $W/2$
 - b) $WL/2$
 - c) $W^2/2$
 - d) $W^2L/2$
- iii) If m = number of members of the truss, j = number of joints of truss & if $m = (2j - 3)$ then truss is known as [2]
 - a) Statically Determinate Truss
 - b) Statically In-Determinate Truss
 - c) Unstable Truss
 - d) None of these

P.T.O.

iv) A stone is thrown down from 10 m height with initial velocity of 10 m/sec. Determine velocity with which it hits the ground. [2]

- a) 17.21 m/sec b) 9.81 m/sec
c) 14.35 m/sec d) None of these

v) A force is applied to a spring, it gets stretched by 250 mm if spring constant is 100 N, the work done is [2]

- a) 31.2 J b) 3.12 J
c) 1.25 J d) 12.5 J

Q2) Solve any Two of the following :

a) Find magnitude and direction of the resultant force with respect to origin 'O' for the concurrent force system shown in Fig. 2 a. [6]

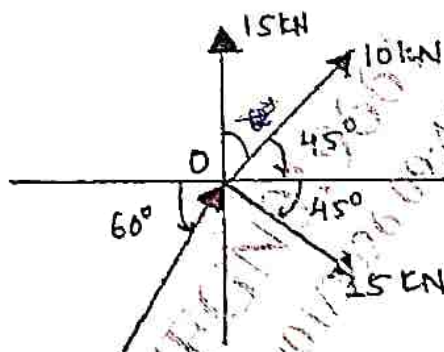


Fig 2 a

b) Determine magnitude, direction and point of application of the resultant with respect to Point P for the force system shown in the Fig. 2 b. [6]

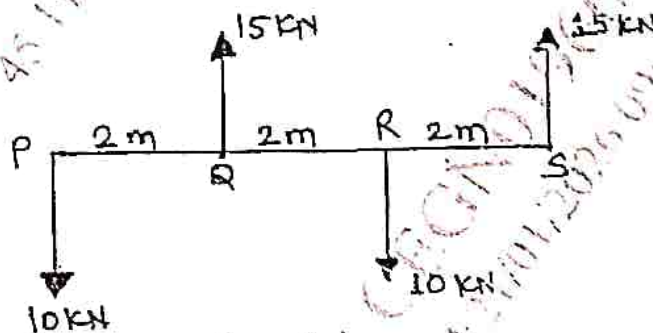
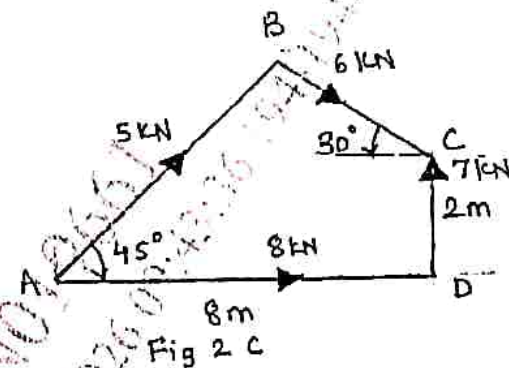
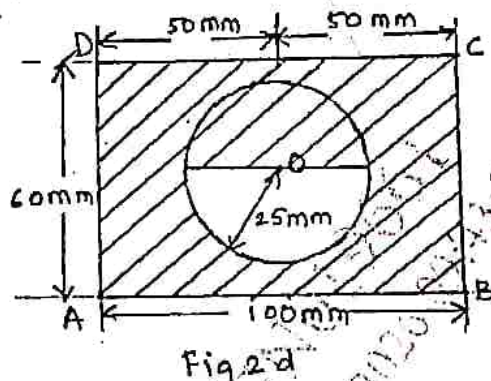


Fig 2 b

- c) Determine magnitude, direction and point of application of the resultant with respect to Point A for the force system shown in the Fig. 2 c. [6]

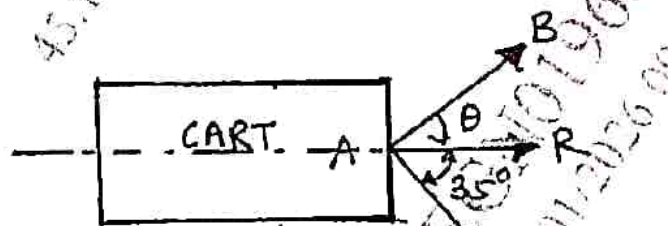


- d) Determine the X and Y coordinate of centroid of the shaded area as shown in Fig. 2 d with respect to point A. [6]



Q3) Solve any Two of the following:

- a) The resultant of two Ropes pulling a cart as shown in the Fig. 3 a acts along horizontal axis of the cart and has magnitude of 6 kN what would be tension in the ropes when $\theta = 30^\circ$, what will be θ if tension in rope AB is minimum also find minimum tension. [6]



- b) A sphere weighing 2000N is placed in a wrench as Shown in Fig. 3 b Find the reactions at the point of contacts. [6]

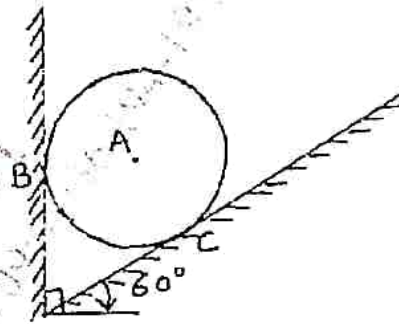


Fig 3 b

- c) Determine Support Reactions for simply supported beam loaded and supported as shown in the Fig. 3 c. [6]

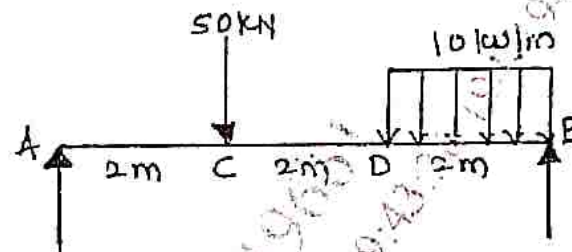


Fig 3 c

- d) A rod having length 2 m and weight 2 kg of uniform cross section is held in equilibrium as shown in Fig. 3 d, one end of the rod is touching the frictionless wall and other end is attached to the rope. Determine length of rope required and also calculate Tension in the Rope. [6]

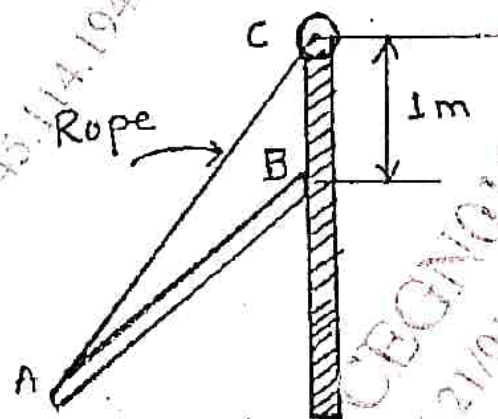


Fig 3 d

Q4) Solve any Two of the following :

- Define angle of repose, angle of friction, coefficient of friction and cone of friction with sketches. [6]
- Determine the Horizontal force P required to just start moving 1000 N Block Shown in Fig. 4 b Take coefficient of friction as 0.35. [6]

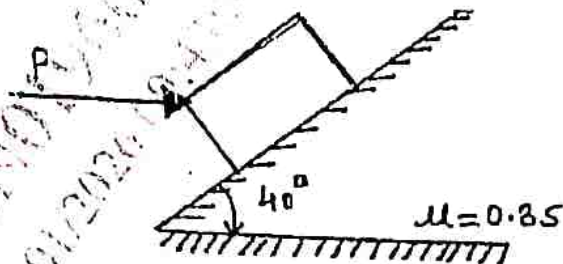


Fig 4b

- Determine distance ' x ' from A to which the 80 kg man can climb without causing the 4 m ladder to slip at its lower end A as shown in Fig. 4 c. The top of the 10kg ladder has a small roller and at the ground the coefficient of static friction is 0.2. The mass center of the man is directly above his feet. [6]

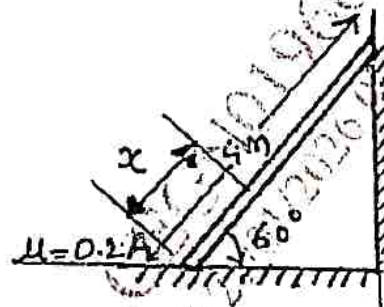


Fig 4c

- Analyze the Truss shown in Fig. 4 d by method of joints. [6]

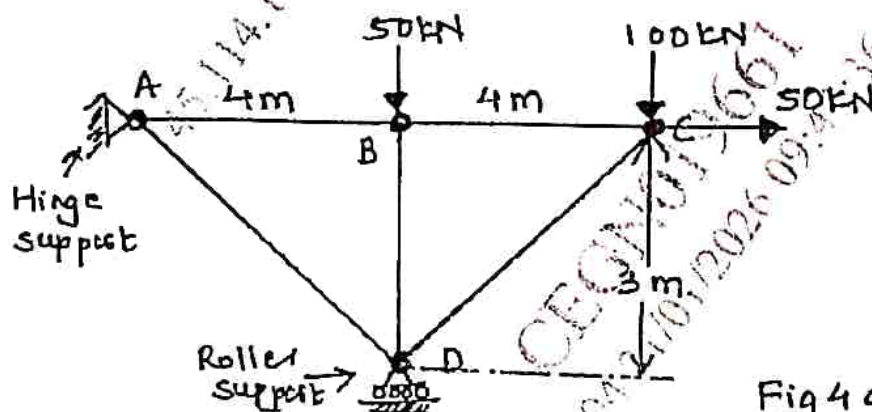


Fig 4d

Q5) Solve Any Two of the following :

- A vehicle is travelling 100 m in 10 seconds and break is applied when vehicle deaccelerates constantly at rate of 1 m/s^2 . Determine initial velocity of the vehicle, also find final velocity and distance travelled by vehicle in first 1 second. [6]
- A metal ball is thrown vertically upwards with 100 m/s from top of the building having 100m high. Determine velocity with which it hits the ground at the base of the building and also calculate time required to reach the ground level. [6]
- A cricket ball shot by a Batsman from height of 2m from ground at an angle of 45° with the horizontal with velocity of 30 m/s is caught by fielder at a height of 0.5 m above the ground. Determine distance between the batsman and fielder. [6]
- A vehicle is being driven along circular track with diameter 300 m, if the normal component of acceleration is 5 m/s^2 what will be speed of the vehicle. [6]

Q6) Solve Any Two of the following :

- In ice hockey, player hits a puck so that it comes to rest after 10 sec. after sliding over distance of 50 m horizontal plane on ice. What will be initial velocity of the puck and also calculate the coefficient of friction between puck and ice. [6]
- The 100 kg box is subjected to Force as shown in Fig 6 b determine its velocity when $t = 4$ seconds, if $v = 0$ when $t = 0$. [6]

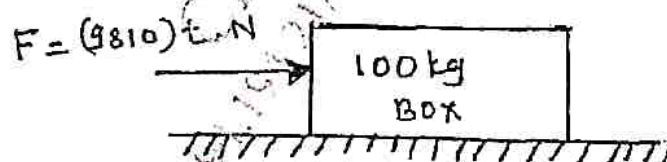


Fig 6 b

- Explain in detail principle of conservation of Energy. Define Conservative and Non-Conservative Force. [6]
- Two Cars A and B having same mass ' m '. Car A is moving towards right with as speed of 80 kmph, when it collides with car B which was at rest. Determine how far Car B will slide before coming to rest after impact. Assume coefficient of kinetic friction as 0.4 and $e = 0.5$, Neglect sizes of the car. [6]

