

[65811]-1907
F.E. (Programme)
ENGINEERING MECHANICS
(2019 Pattern) (Semester - I/II) (101011)

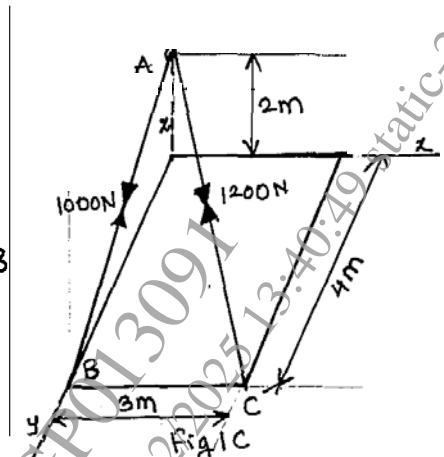
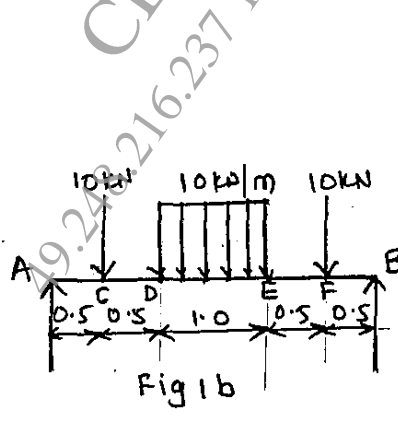
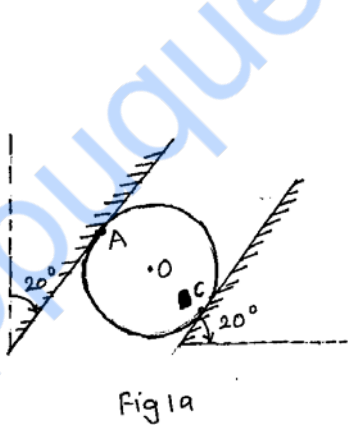
Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat Sketches must be drawn wherever 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.

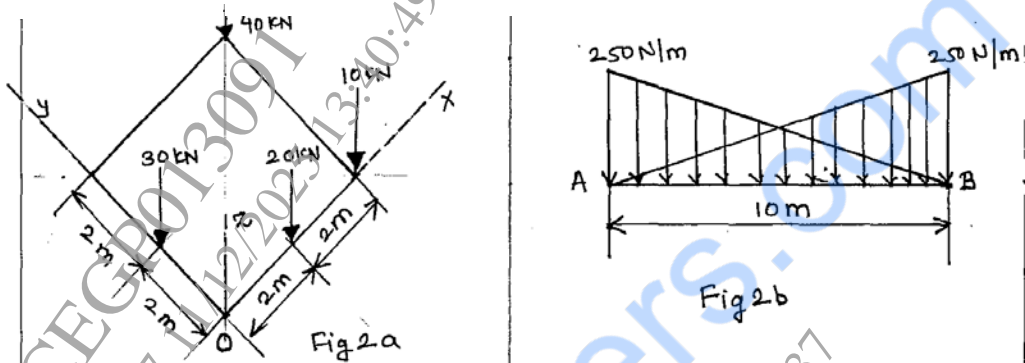
- Q1) a) A sphere weighing 500N is placed in a wrench as Shown in Fig. 1 a Find the reactions at the point of contacts A and C. [6]
- b) Determine Support Reactions for simply supported beam loaded and supported as shown in the Fig. 1 b. [6]
- c) Determine the magnitude of the resultant force ring at A , if the cable exerts the force $F_{AB} = 1000\text{ N}$ $F_{AC} = 1200\text{ N}$ as shown in Fig. 1c. [6]



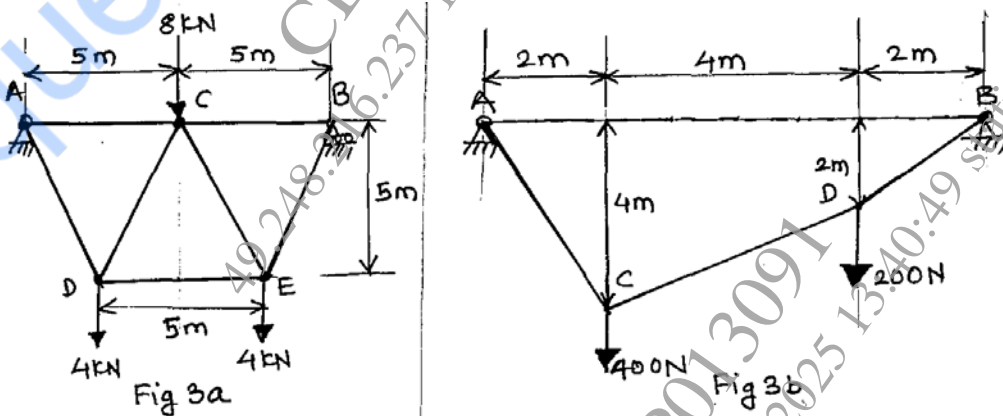
OR

- Q2) a) A square mat foundation supports four columns as shown in Fig. 2 a Determine magnitude and direction of Resultant with respect to origin 'O' [7]

- b) Determine Support Reactions for Cantilever beam loaded and supported as shown in the Fig. 2 b. [7]
- c) Explain the term Free Body Diagram in detail. [4]



- Q3) a) Analyze the truss and determine the magnitude and nature of forces in the members of the truss loaded and Supported as shown in Fig. 3 a [7]
- b) Loads are suspended as shown in Fig. 3 b for the cable Determine the component of reaction at supports and maximum tension in the cable. [7]
- c) Explain in detail degree of static indeterminacy for the truss with neat sketches [4]



OR

- Q4) a) Determine forces in all members of a truss, also find support reaction as shown in Fig. 4 a. [7]
- b) Loads are suspended as shown in Fig. 4 b from cable, Determine the component of reaction at A and maximum tension in the cable. [7]

- c) Explain in detail methods of analysis of the truss with neat sketches.[4]

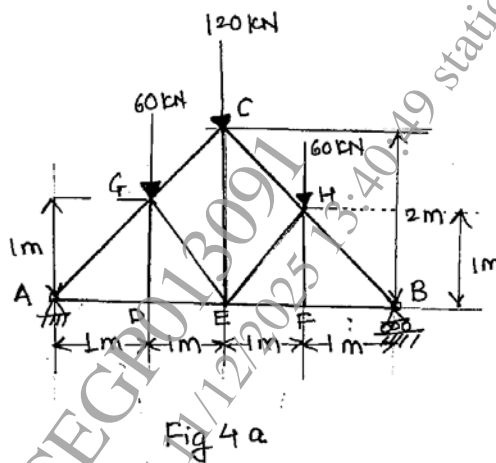


Fig 4a

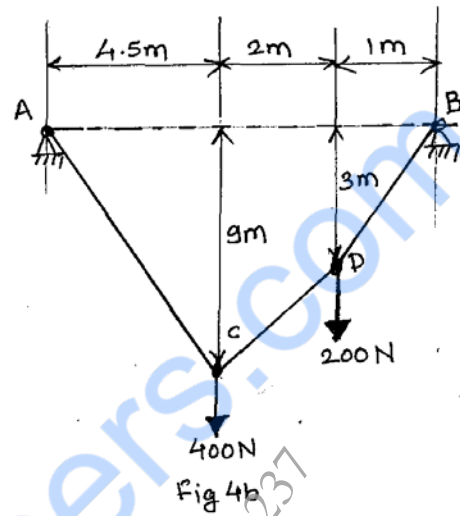


Fig 4b

- Q5) a) The motion of the particle is defined by, $X = t^3 - 9t^2 + 12t + 5$ where 'X' expressed in meters and t is in second Determine time at which velocity becomes zero, Also determine velocity and acceleration at $t = 5$ sec. [6]
- b) A Stone is thrown by a person from the ground clears 15 m high tree placed 50 m ahead of person if the angle of projection of stone is 60° determine velocity of projection of stone. Refer Fig 5 b [6]
- c) A train crosses a tunnel in 45 sec time, the speeds of the train at entry and at exit from the tunnel are 36 km/hr and 54 km / hr respectively, If acceleration remains constant then what will be length of the tunnel.[6]

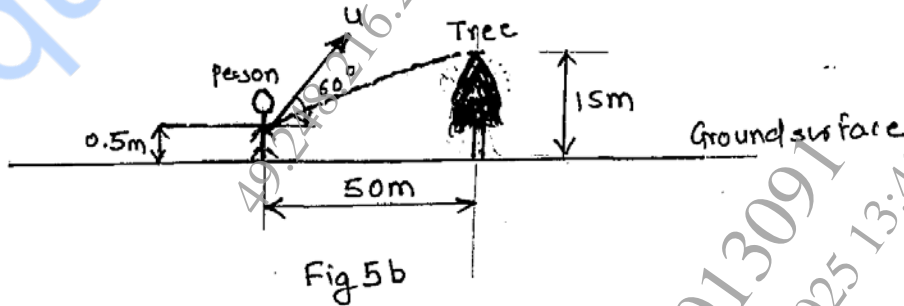
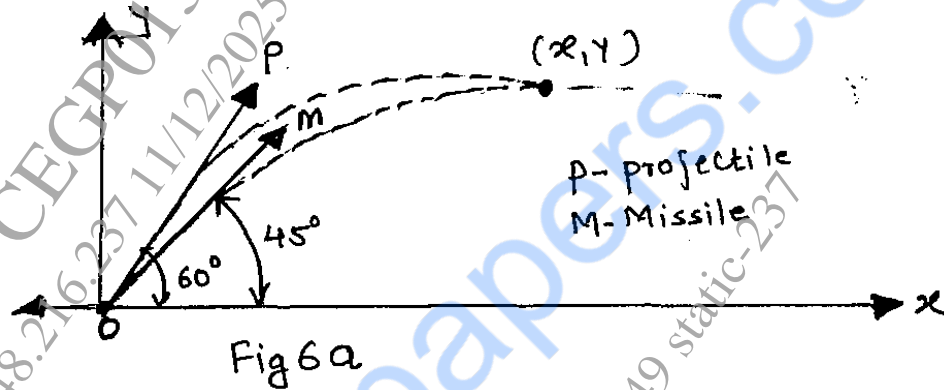


Fig 5b

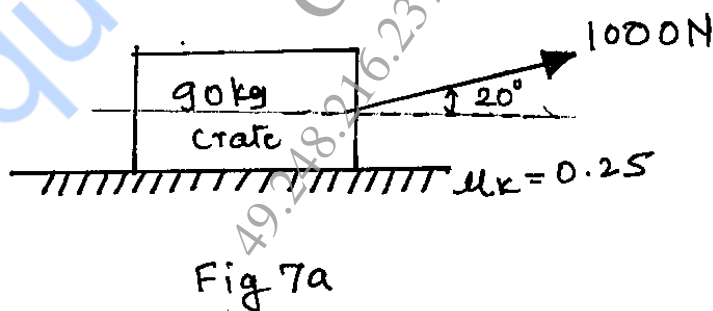
OR

- Q6) a) A projectile P is fired with a velocity of 200 m/sec at an angle of 60° with the horizontal. After some time a missile M is shot from the same point to destroy the projectile as shown in Fig. 6 a, The angle of projection and velocity of missile are 45° and 1000 m/sec respectively. Calculate the height, horizontal distance and time with respect to, firing of P at which destruction takes place. [6]

- b) A metal ball is thrown vertically Downwards with 100 m/s from top of the tower 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]
- c) A car acceleration is defined by relation $a = -1.2 v$ where, 'a' is expressed in mm/s² and 'v' in mm/sec. If $v = 50$ mm/sec at $t = 0$ determine the distance the car will travel before coming to rest. [6]



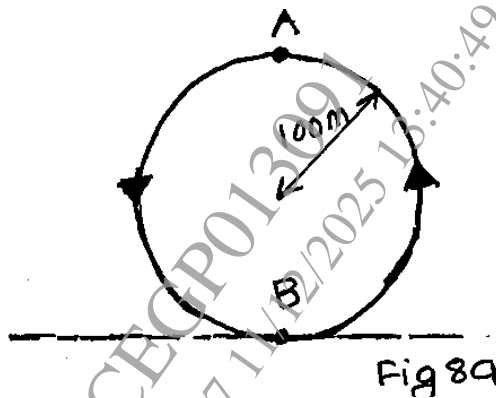
- Q7) a) The 90 kg crate as shown in the Fig 7 a rests on a horizontal plane for which coefficient of kinetic friction is 0.25. if the crate does not tip over when it is subjected to a 1000 N force determine velocity of the crate in 10 sec starting from rest. [6]



- b) A glass marble whose weight is 10 kg fall from height of 15 m and rebounds to a height of 10 m the marble and the floor remains in contact for 0.5 sec. Determine the impulse and the average force between the marble and floor. [6]
- c) Explain in detail conservative and non Conservative Forces with examples. [4]

OR

- Q8) A 76 kg pilot flies in a plane moves in a vertical loop of 100 m radius as shown in Fig 8 a, knowing that the pilot has apparent weight of 2885 N find the speed of plane at B. [6]



Apparent-weight
at B = 2885 N

- b) Two Steel Balls A and B having same mass 0.6 kg having velocities 4m/sec rightward and 2 m/sec leftward, before impact. After impact velocity of ball A is 2.5 m/sec to the left determine coefficient of restitution of the steel balls. [6]
- c) Explain in detail Impulse momentum principle and Work Energy principle. [4]