

F.E. Common (2012 Course), Examination May 2014
Engineering Mechanics [101011]
(Semester -II)

Time: 2 Hours

Max. Marks : 50

Instructions to the candidates:

1. Attempt *Q. 1* or *Q. 2*, *Q. 3* or *Q. 4*, *Q. 5* or *Q. 6*.
2. Answers should be written in single answer books.
3. Neat diagram must be drawn wherever necessary.
4. Figure to the right indicates full marks.
5. Assume suitable data, if necessary and clearly state.
6. Use of cell phone is prohibited in the examination hall.
7. Use of electronics pocket calculator is allowed.

SECTION I

- Q1) a) The angle between the two concurrent forces is 90° and their resultant is 2500 N. The resultant makes an angle of 46° with one of the force, determine the magnitude of each force. [04]
- b) A particle moves along a straight line with an acceleration $a = (4t^2 - 2)$, where a is in m/s^2 and t is in s. when $t = 0$, the particle is at 2 m to the left of origin and when $t = 2$ s the particle is at 20 m to left of origin. Determine the position of particle at $t = 4$ s. [04]
- c) A cricket ball shot by a batsman from a height of 1.8 m at an angle of 30° with the horizontal with a velocity of 18 m/s is caught by a fielder at a height of 0.6 m from the ground. Determine the distance between the batsman and fielder. [04]
- d) A block weighing 200 N is pulled up a 30° plane by a force P producing a velocity of 5 m/s in 5 s. If the coefficient of friction is 0.2, determine the magnitude of force P using impulse momentum principle. [04]

OR

- Q2) a) A thin rod is bend into a shape OABCD as shown in **Fig. 2 a**. determine the centroid of the bent rod with respect to origin O. [04]

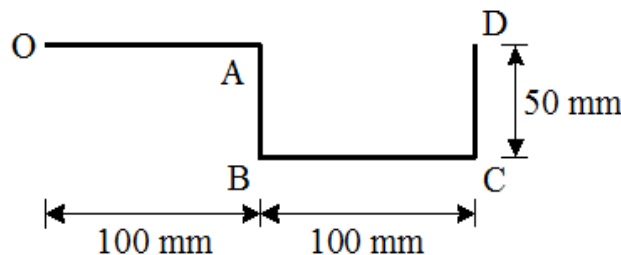


Fig. 2 a

- b) Two trains P and Q are 190 m and 160 m long moving in opposite directions on parallel tracks. The velocity of the shorter train is three times that of larger one. If the trains take 5 s to pass each other, determine the velocity of each train. [04]

- c) Two blocks shown in **Fig. 2 c** have weight 90 N and 45 N. The coefficient of friction between the block A and the horizontal plane is 0.25. If the system is released from rest and the block B moves through a vertical distance of 0.6 m, determine the velocity of the blocks neglecting the friction in the pulley. [04]
- d) Determine the work done by all forces acting on the block of 18 kg as shown in **Fig. 2 d** as it moves 12 m upwards along the plane. Take coefficient of kinetic friction as 0.2. [04]

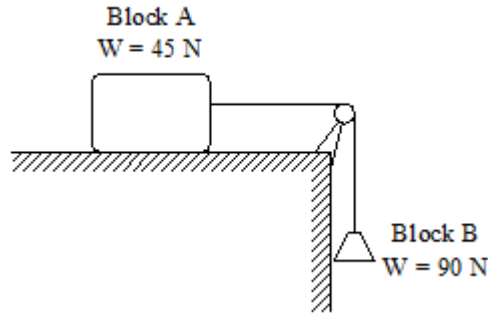


Fig. 2 c

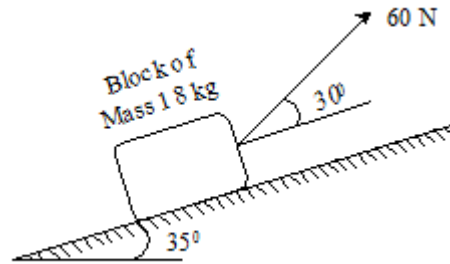


Fig. 2 d

- Q3) a) Find the angle of tilt θ with the horizontal so that the contact force at B will be one-half that at A for the smooth cylinder. Refer **Fig. 3 a**. [06]

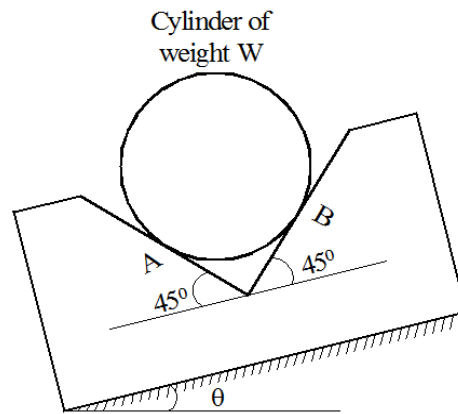


Fig. 3 a

- b) A 10 kN platform is supported vertically at A, B and C as shown in **Fig. 3 b**. If it carries a load of 6 kN, Determine the reaction at each support. [06]

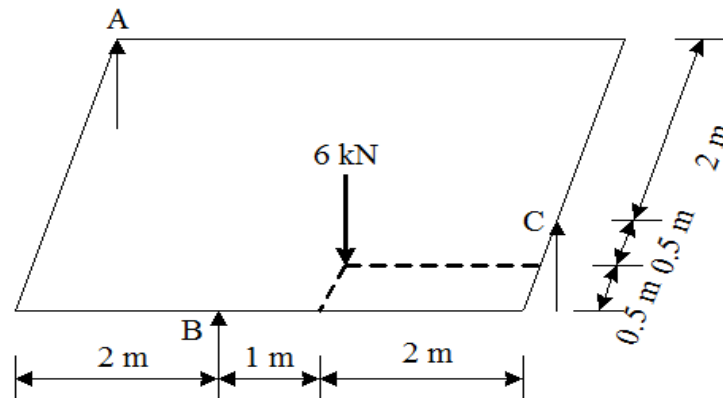


Fig. 3 b

- c) Determine the support reaction for the beam loaded and supported as shown in **Fig. 3 c**. 50 kN force is inclined at 30° to horizontal. [05]

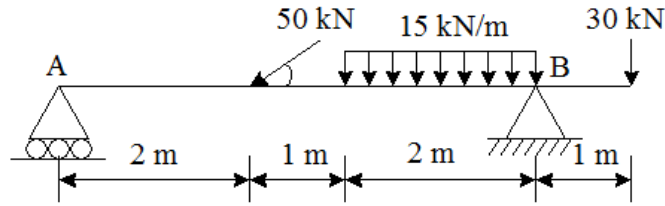


Fig. 3 c

OR

- Q4) a) Three cables are joined at the junction C as shown in Fig. 4 a. Determine the tension in cable AC and BC caused by the weight of the 30 kg cylinder. [05]

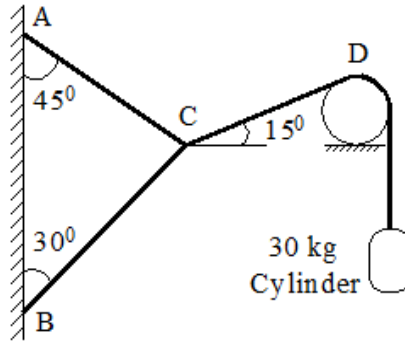


Fig. 4 a

- b) The cable exert forces $F_{AB} = 100 \text{ N}$ and $F_{AC} = 120 \text{ N}$ on the ring at A as shown in Fig. 4 b. Determine the magnitude of the resultant force acting at A. [06]

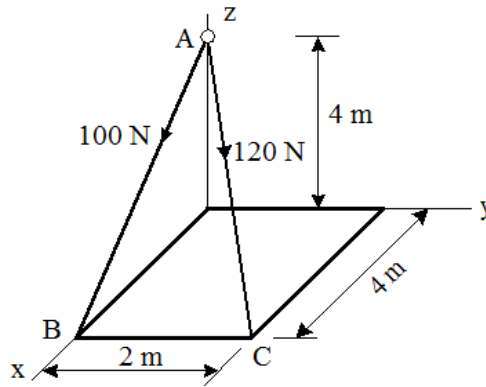


Fig. 4 b

- c) The uniform 18 kg bar OA is held in position as shown in Fig. 4 c by the smooth pin at O and the cable AB. Determine the tension in the cable and the reaction at O. [06]

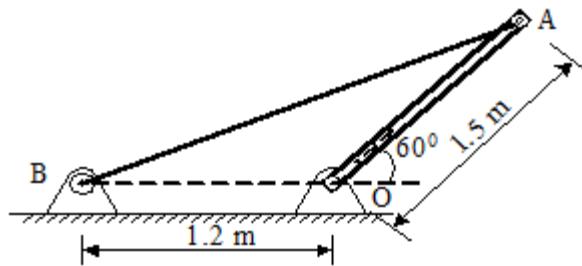


Fig. 4 c

- Q5) a) Determine the axial forces in each member of the plane truss as shown in Fig. 5 a. [06]

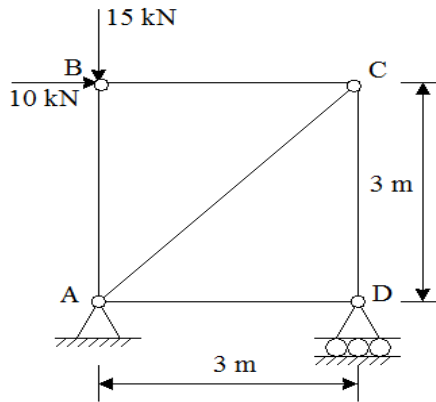


Fig. 5 a

- b) A body of weight 50 N is traveled along a rough horizontal plane by a pull of 18 N acting at an angle of 14° with the horizontal find the coefficient of static friction. [06]
- c) Explain in brief angle of friction, coefficient of friction and laws of static friction. [05]

OR

- Q6) a) A cable supported at A and D at the same level over a span of 30 m is loaded as shown in **Fig. 6 a**. Determine the maximum tension in the segment of the cable. [06]

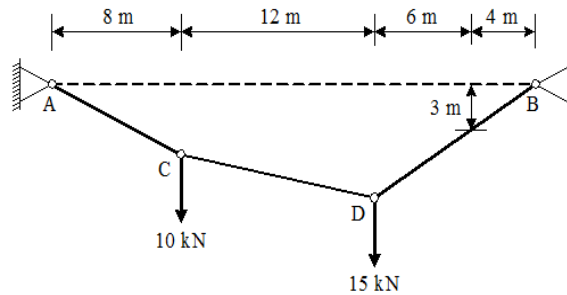


Fig. 6 a

- b) Determine the range of cylinder weight W as shown in **Fig. 6 b** for which the system is in equilibrium. The coefficient of friction between cord and cylindrical support surface is 0.3 and that between 100 N block and the incline surface is zero. [06]

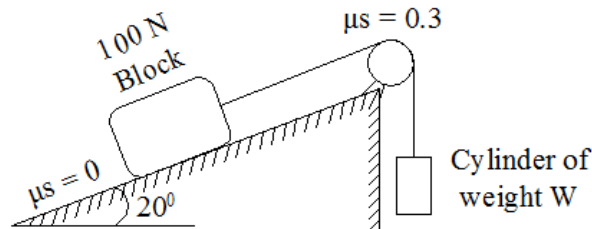


Fig. 6 b

- c) i. State the assumption for the analysis of plane truss. [05]
 ii. Define deficient, perfect and redundant truss.