Total No. of Questions—**8**] [Total No. of Printed Pages—**5**

Seat No.	

[5558]-109

FE EXAMINATION, 2019

ENGINEERING MECHANICS

(2015 PATTERN)

Time : 2 Hours **Maximum Marks : 50**

Instructions to the candidates:

1. ***Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q.7 or Q.8***
2. ***Figures to the right indicate full marks.***
3. ***Assume suitable data, if necessary.***
4. ***Use of electronic pocket calculator is allowed in the examination.***
5. ***Use of cell phone is prohibited in the examination hall.***

Q.1 (a) Determine the magnitude and direction of the resultant of three forces acting on the hook as shown in the **Fig. 1a.** **(06)**

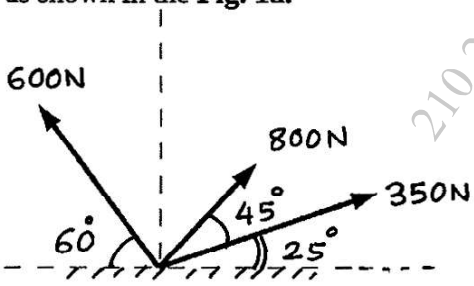

Fig. 1a

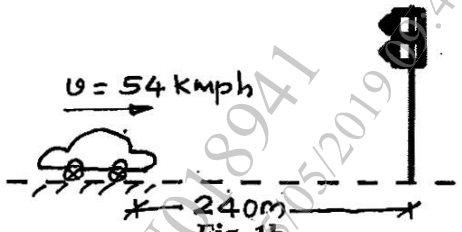

Fig. 1b

Q.1 (b) A motorist travelling with 54 kmph when he observes that a traffic light, 240m ahead of him, turns red. The traffic light is timed to stay red for 24 sec. If the motorist wishes to pass the light without stopping just as it turns green again, determine the required uniform deceleration of the car and also the speed with which he crosses the light signal. (Refer **Fig. 1b**) **(06)**

P.T.O.

OR

Q.2 (a) Locate the centroid of the plane lamina as shown in **Fig. 2a.** **(06)**

Q.2 (b) An 80 kg block rests on a rough horizontal plane as shown in the **Fig. 2b.** Find the magnitude of the force 'P' required to give an acceleration of 2 m/s^2 to the right. Take coefficient of kinetic friction as 0.20. **(06)**

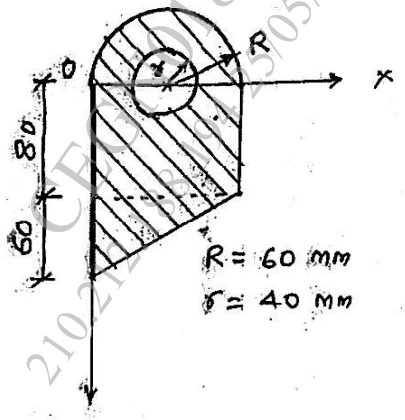

Fig. 2a

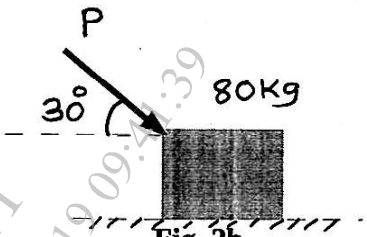

Fig. 2b

Q. 3 (a) A handball player throws a ball from A horizontally with a velocity 'u' m/s. Knowing that d = 15m, determine the range of the values of velocity for which the ball will strike the corner region BCD as shown in the **Fig. 3a.** **(06)**

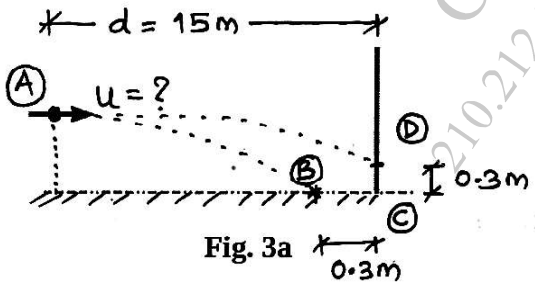

Fig. 3a

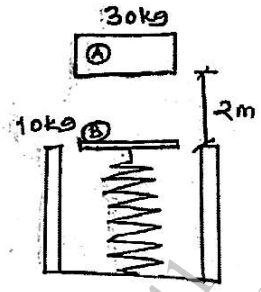

Fig. 3b

Q.3 (b) A 30 kg block dropped from a height of 2 m onto the 10 kg pan of spring scale as shown in the **Fig. 3b.** Assuming the collision to be perfectly plastic. Determine the maximum deflection (Compression) of the pan. The spring constant is k = 20 kN / m. **(06)**

OR

Q. 4 (a) The polar coordinates of a particle moving along a plane curve are, $r = t^3 - 3t + 10$ and $\Theta = 0.5\ r$, where 'r' is in meters, 'Θ' is in radians and 't' is in seconds. Determine the acceleration of the particle at t= 2 sec. **(06)**

Q.4 (b) A 20 Mg railroad car moving with 0.5 m/s speed to the right collides with a 35 Mg car which is at rest. If the coefficient of restitution between the two cars is e = 0.65 determine the speed of the cars after the collision. **(06)**

Q.5 (a) The beam AB with pin at 'B' and roller at 'A' is loaded as shown in the **Fig. 5a**. Determine the reaction at the supports A & B. **(06)**

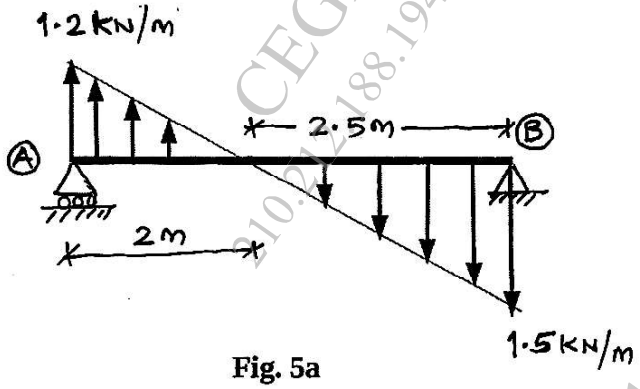

Fig. 5a

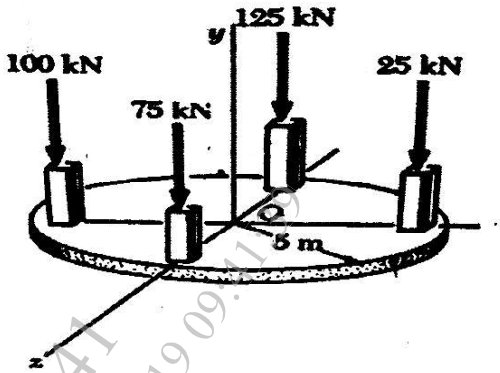

Fig. 5b

Q.5 (b) A circular mat foundation of radius 5m is supporting four columns at a distance of 4m from the centre 'O' as shown in the **Fig. 5a**. Determine the magnitude and position of the resultant force with respect to origin 'O'. **(07)**

OR

Q. 6 (a) Boom AB is supported by a pin at A and cable BC as shown in the **Fig. 6a**. Determine the reactions at pin A and the tension in the cable BC. **(06)**

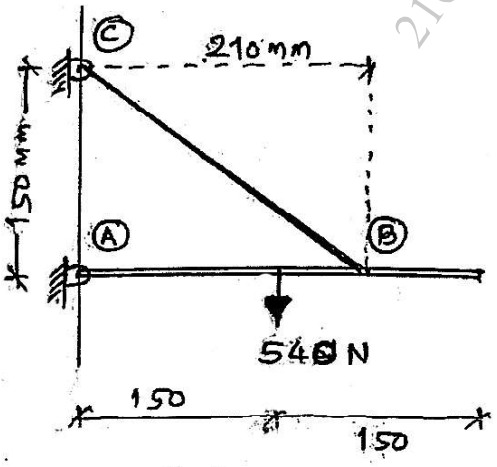

Fig. 6a

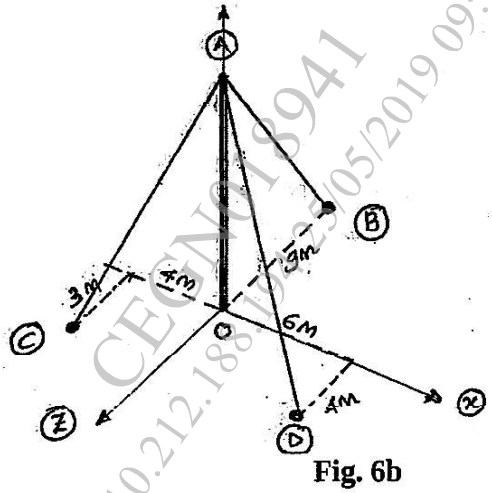

Fig. 6b

Q.6 b) The vertical boom OA is supported by three cables AC, AB and AD as shown in **Fig. 6b**. If the tension in the cable AD is 252 N, determine the tensions in the cables AB and AC. **(07)**

Q.7 (a) The truss supports vertical loads as shown in **Fig. 7a**. Determine the forces in all the members of the truss and state the nature of the forces in tabular form. **(06)**

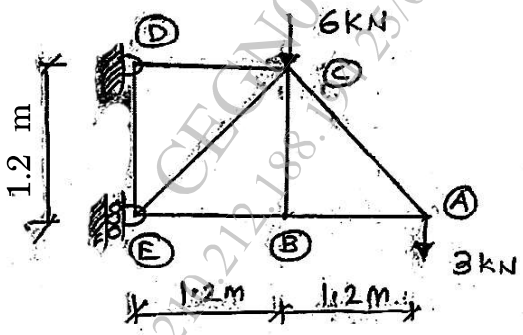

Fig. 7a

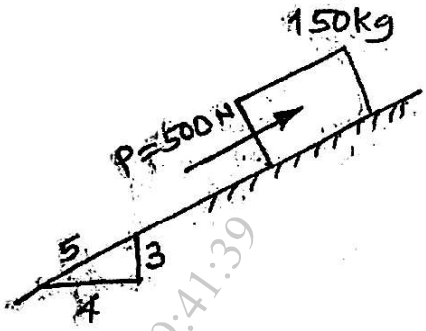

Fig. 7b

Q.7 (b) A 500 N force acting on the 150 kg block resting on the inclination as shown in the **Fig. 7b**. If the coefficient of static and kinetic friction are 0.25 and 0.20 respectively, state whether the block is in equilibrium or not. Also find the value of the frictional force. **(07)**

OR

Q. 8 (a) The truss supported and loaded as shown in the **Fig. 7a**, determine the forces in the members BC, CE and CD using section method. Also state the nature of the forces. **(07)**

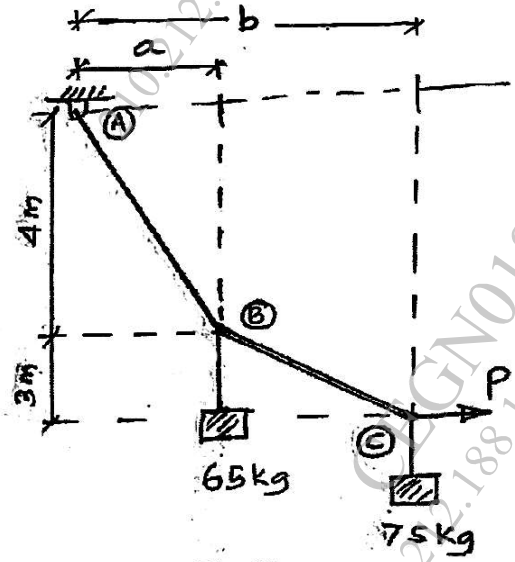

Fig. 8b

Q.8 (b) Cable ABC supports 65 kg and 75 kg loads at 'B' and 'C' points as shown in the **Fig.8b.** Determine the magnitude of the distances 'a' & 'b' (b = horizontal distance AC) to maintain equilibrium if P = 800 N. **(06)**