K 4542

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Second Semester

(Regulation 2004)

Civil Engineering

GE — 1151 ENGINEERING MECHANICS

(Common to All branches of B.E./B.Tech.)

(Common to B.E. (Part – Time) First Semester Civil Engineering, Mechanical Engineering - Regulation 2005)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the principle of transmissibility.

2. Define equilibrant.

3. A force $\vec{F} = (10\vec{i} + 8\vec{j} - 5\vec{k})N$ acts at the point A (2,5,6) m. What is the moment of the force about the point B (3,1,4) m.

4. State the Varignon's theorem.

5. Write the mass moment of inertia about the centroidal axes of a (a) Sphere of radius 'a' (b) Cylinder of length ' L' and radius 'r'.

6. State the theorems of Pappus Guldinus.

7. A particle moves along X-axis and its position is expressed as $X = 3.5t^3 - 7t^2$, where 'X' is in m, & 't' is in seconds. Find the instantaneous acceleration at $t = 3s.$.

8. State D' Alembert's principle.

9. Define angle of friction.

10. What do you mean by general plane motion?

11. (a) If five forces act on a particle as shown in figure 1 and the algebraic sum of horizontal components of all these forces is −329.904 kN, calculate the magnitude of P and the resultant of all the forces.
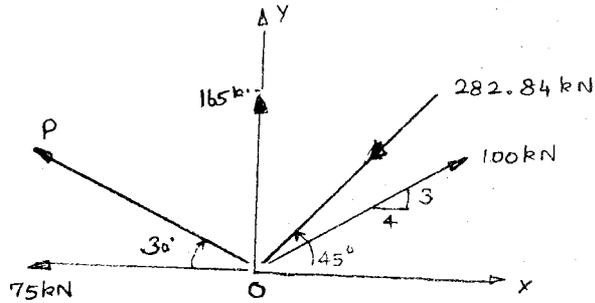

Figure 1

Or

(b) The resultant of the two concurrent forces, when they act at an angle of 60° is 14N. If the same forces are acting at right angles, their resultant is $\sqrt{136}$ N. Determine the magnitude of the two forces.

12. (a) A rigid bar AB is subjected to a system of parallel forces as shown in figure 2. Reduce the given system of forces to an equivalent (i) Single resultant force (ii) Force moment system at A (iii) Force moment system at D.
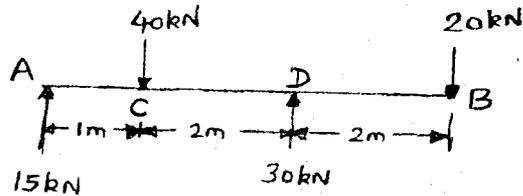

Figure 2

Or

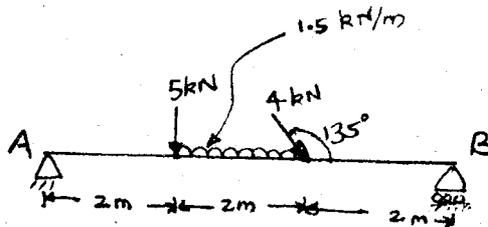(b) A beam AB 6m long is loaded as shown in figure 3. Determine the reactions at A & B.

Figure 3

2

K 4542

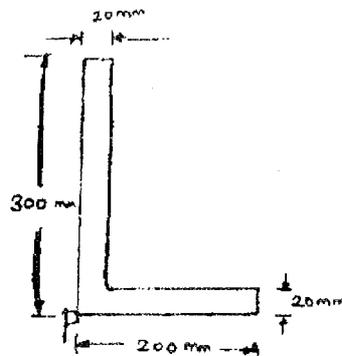13. (a) Determine the Principal Moments of Inertia of the section shown in figure 4 about P.

Figure 4

Or

(b) Find the Moment of Inertia of the given T-Section shown in figure 5, about the centroidal horizontal and vertical axes.
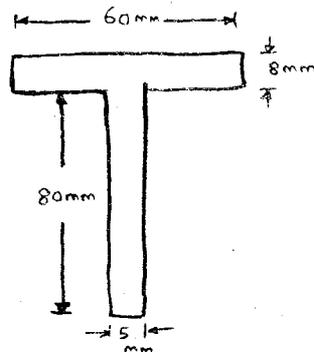

Figure 5

14. (a) A road roller of mass 1200 kg and radius 0.25m, as shown in figure 6 is pulled with a force of P =1500 N on a rough ground. If the roller starts from rest and rolls without slipping, determine the distance traveled by the centre of the roller at which roller acquires a velocity of 3 m/s.
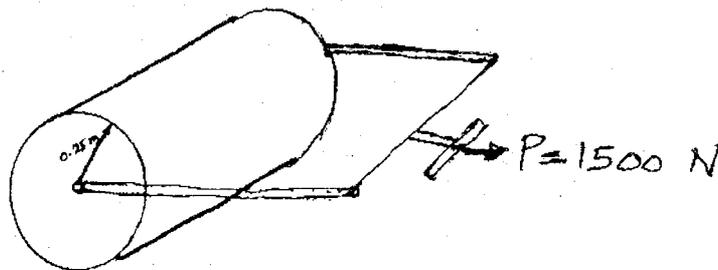

Figure 6

Or

K 4542

(b) Two rough planes shown in figure 7, are inclined at 30° and 60° to the horizontal. Masses of 12 kg and 24 kg are placed on the faces and are connected by a string passed over a frictionless pulley on the top of planes. If $\mu = 0.6$ between the blocks and planes, find the resulting acceleration of the blocks.
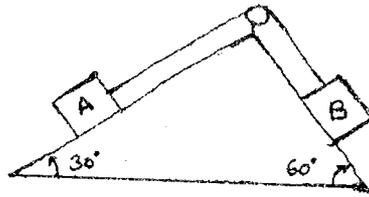

Figure 7

15. (a) A horizontal drum of a belt drive of radius 0.5 m, carries the belt over a semicircle around it. It is rotated anticlockwise to transmit a torque of 300 Nm. If the coefficient of friction between the belt and the drum is 0.3, calculate the tensions in the limbs 1 & 2 of the belt shown in figure 8 and the reaction on the bearings. The drum has a mass of 20 kg and the belt is assumed to be massless.
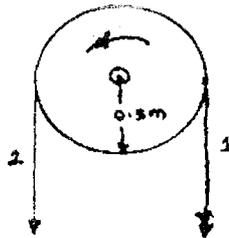

Figure 8

Or

(b) In the engine system shown in figure 9, the crank AB has a constant clockwise angular velocity of 2000 revolutions/minute. For the crank position indicated, determine the angular velocity of the connecting rod BD and velocity of piston P.
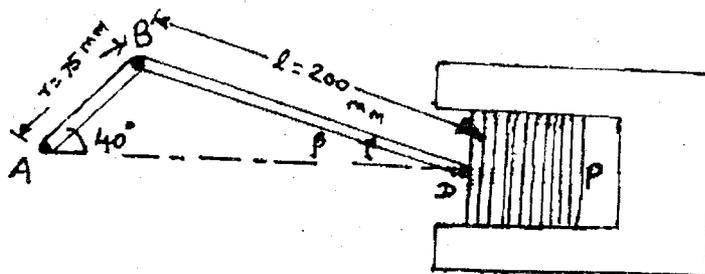

Figure 9

4