Reg. No. : | | | | | | | | | | | |

V 4594

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Third Semester

(Regulation 2004)

Mechanical Engineering

ME 1206 — APPLIED ENGINEERING MECHANICS

(Common to Aeronautical Engineering/Automobile Engineering/Mechatronics Engineering/Marine Engineering/Metallurgical Engineering and Production Engineering for candidates admitted in 2006 only)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State parallelogram law of forces.

2. State the dimensions of angular velocity and power in MLT system.

3. What is the principle of transmissibility?

4. State the conditions for equilibrium of rigid body in three dimensions.

5. What is moment of inertia of triangular lamina ($b \times h$) about its horizontal centroidal axis?

6. State the parallel axis theorem.

7. State any two important laws of friction.

8. A particle moves along x-axis and its position is expressed as $x = 3.5t^3 - 7t^2$ where x is in mts and t is in seconds. Determine the displacement during three seconds.

9. Define coefficient of restitution.

10. For a pully of diameter 2 m, $a_n = 4m/s^2$ and $\alpha_t = 9.17\ rad/s^2$. Find the total acceleration.

PART B — (5 × 16 = 80 marks)

11. (a) (i) State and prove Varignon's theorem. (6)

(ii) The resultant of two forces F_1 and F_2 acting at a point is 'R'. If F_2 is doubled R is also doubled and if the direction of F_2 is changed R is again doubled. Prove that $F_1 : F_2 : R = \sqrt{2} : \sqrt{3} : \sqrt{2}$. (10)

Or

(b) (i) Forces 32 kN, 24 kN, 24 kN and 120 kN are concurrent at origin and are respectively directed through the points whose co-ordinates are $A(2, 1, 6)$, $B(4, -2, -5)$, $C(-3, -2, 1)$ and $D(5, 1, -2)$. Determine the resultant. (12)

(ii) Find the resultant of the force system shown in Fig. 1 and its position from A. (Force in 'kN' and distance in 'm') (4)

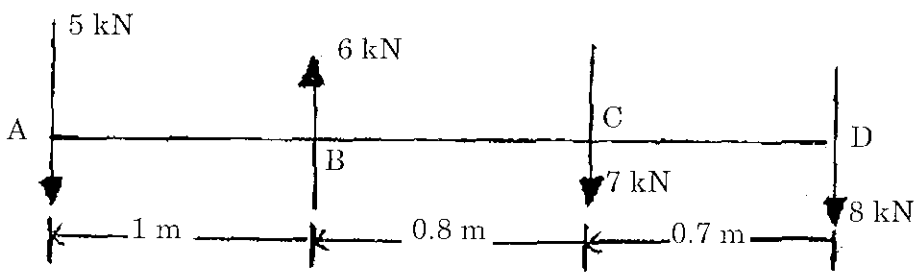

Fig. 1

12. (a) (i) For the force system shown in Fig. 2 determine the direction and magnitude of the resultant from '0'. (8)

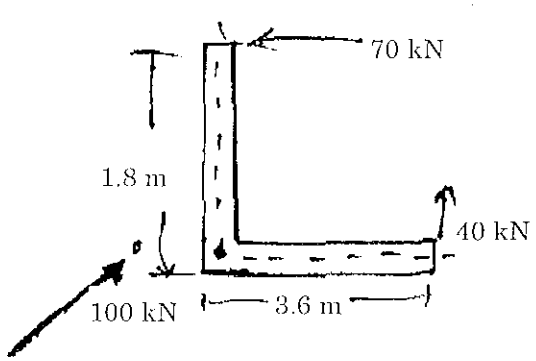

Fig. 2

(ii) Find the reaction at supports for the beam shown in Fig. 3 (8)

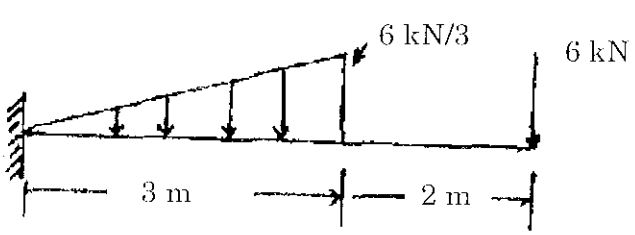

Fig. 3

Or

(b) (i) The weight of the plate is 350 N and is supported by three wires as shown in Fig. 4. Determine the tension in the wires. (12)

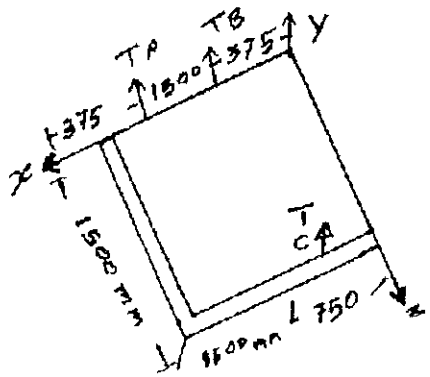

Fig. 4

(ii) Reduce the force system shown in Fig. 5 into a force couple system at 0'. (4)

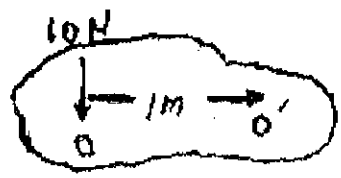

Fig. 5

13. (a) Calculate the moment of inertia of the section shown in Fig. 6 about its centroidal xx and yy axis. (16)

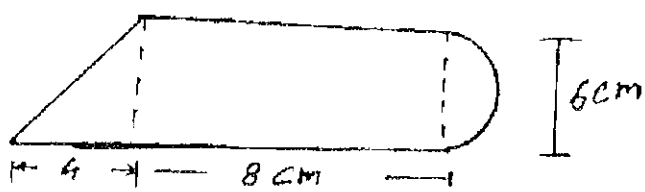

Fig. 6

Or

(b) (i) State and prove perpendicular axis theorem. (4)

(ii) Find the mass moment of inertial of a thin circular disc (I_{xx}, I_{yy} and I_{zz}). (12)

14. (a) A block of wt 1290 N rests on a horizontal surface and supports another block of weight 570 N on top of it as shown in Fig. 7. Find the force P applied to the lower block that will be necessary to cause slipping to impend.

Coefficient of friction between block (1) and (2) is 0.25

Coefficient of friction between block (1) and surface is 0.40. (16)

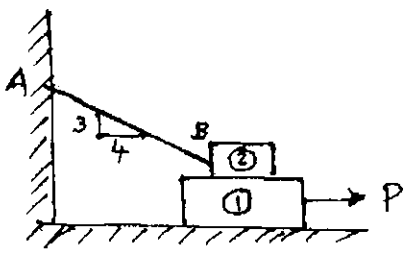

Fig. 7

Or

(b) A mass 12 kg travelling to the right with a speed of 8 m/s collides with another mass 20 kg to the left travelling with a speed of 25 m/s. If the coefficient of restitution is 0.60 find the velocities of the particles after collision and loss of kinetic energy. What is the impulse acting on either particle during impact? (16)

15. (a) A truck moving with a velocity of 10 m/s experiences a suddenly applied brake. It was observed that the truck shown in Fig. 8 skidded to rest in 7.5 m. If the mass of the truck is 3000 kg, determine the magnitude of normal reaction and frictional force on each wheel when the truck skidded to rest. (16)

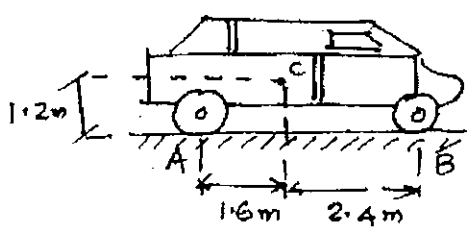

Fig. 8

Or

(b) The link BC shown in Fig. 9 is rotating clockwise with an angular velocity of 0.25 rad/s. Determine the velocity of the block 'C' and the angular velocity of the link AB at that instant. (16)

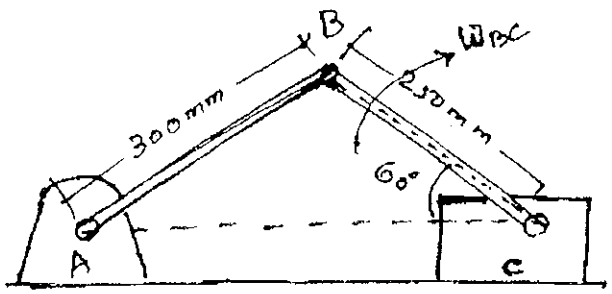

Fig. 9