

COMMON TO ALL BRANCHES

II SEMESTER – (REGULATIONS 2004)

GE 181 – ENGINEERING MECHANICS

Time: 3 hours

Maximum marks: 100.

PART – A

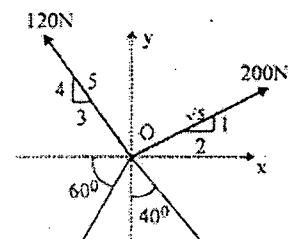
(10 x 2 = 20 Marks)

1. A force of 500 N forms angles 60° , 45° and 120° respectively with x, y and z axes. Write the force in vector form
2. A force is represented by a vector form $P = (10i - 8j + 14k)$. Determine the projection of this force on a line which originates from $(2, -5, 3)$ and passes through points $(5, 2, -4)$.
3. State Varignon's theorem
4. State the theorems of Pappus and Guldinus to find out the surface area and volume of a body
5. A belt embraces an angle of 200° over the surface of a pulley of 500mm diameter. If the tight side tension of the belt is 2.5kN. Find out the slack side tension of the belt. The coefficient of friction between the belt and the pulley can be taken as 0.3
6. The motion of a particle is defined by the relation $x = t^3 - 15t^2 - 20$, where x is expressed in metres and t in second. Determine the acceleration of the particle at $t = 3$ seconds.
7. State laws of dry friction
8. A ball is thrown vertically upwards from the top of a building 25m above the ground with an initial velocity of 18m/sec. Find the maximum height reached by the ball from the ground.
9. What is general plane motion? Give some examples.
10. A ball is rotating with an angular velocity of 8 rads/sec. After 5 sec, the angular velocity 28 rad / sec. Determine angular acceleration.

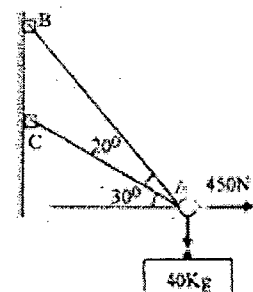
PART – B

(5 x 16 = 80 Marks)

11. (a) A system of four forces acting on a body is as shown in fig1. Determine the resultant forces and its direction. **(8 Marks)**



- 11(b) Determine the tension in the cables AB and AC required to hold the 40kg crate as show in fig2. **(8 Marks)**



12. (a) A frame supported at A and B is subjected to a force of 500 N as shown in fig 3. Compute the reactions at the support points for the cases of $\theta = 0^\circ$, $\theta = 60^\circ$, $\theta = 90^\circ$

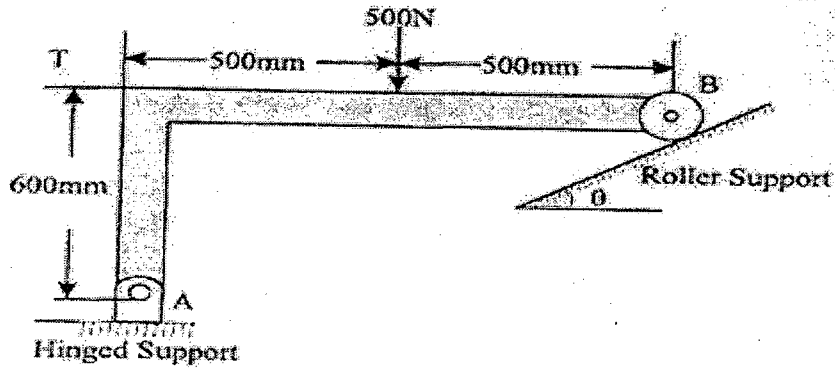


Fig 3.

(OR)

- 12 b) Three forces + 20N, -10 N and +30 N are acting perpendicular to X Z plane as shown in fig 4. The lines of action of all the forces are parallel to y-axis. The co-ordinates of the point of action of these forces along x and z directions are respectively (2,3), (4,2) and (7,4), all the distances being referred in meters. Find out.
- the magnitude of the resultant force
 - The location of the resultant

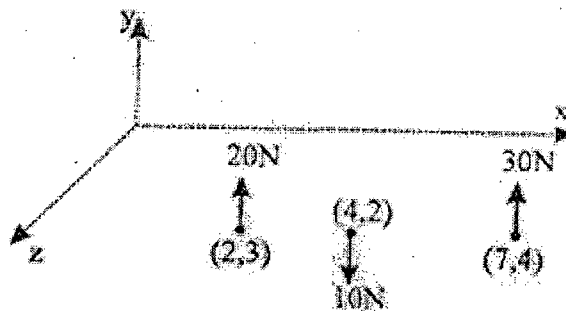


Fig 4.

- 13 (a) For the plane area shown in fig 5, locate the centroid of the area.

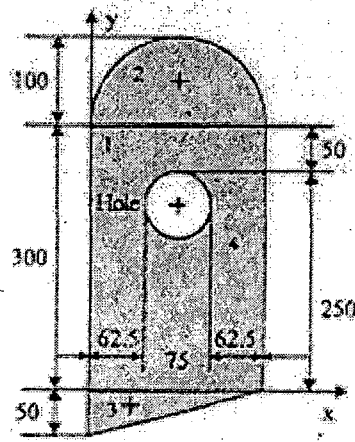


Fig 5

(OR)

13 (b) Find the Moment of Inertia of the section shown in figure 6 about horizontal and vertical axes through the centroid. Also determine the principle moment of inertia.

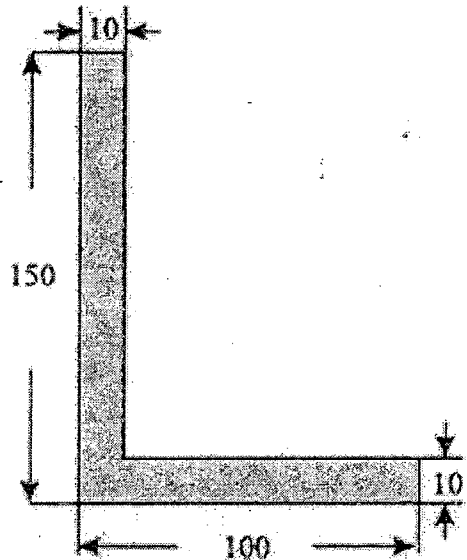


Fig 6.

14 (a) (i) Define angle of friction and angle of repose.

(4 Marks)

(ii) A ladder is 8 m long and weighs 300. The centre of gravity of the ladder is 3m along the length of ladder from the bottom end. The ladder rests against a vertical wall at B and on the horizontal floor at A as shown in fig7. Determine the safe height up to which a man weighing 900N can climb without making the ladder slip. The co-efficient of friction between ladder and floor is 0.4 and ladder top and wall is 0.3. (12 Marks)

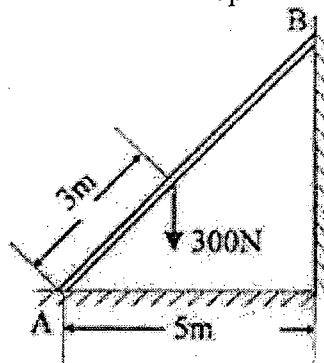


Fig 7

(OR)

14 (b) (i) A car starts from rest and accelerates uniformly to a speed of 80kmph over a distance of 500m. Find time and acceleration. Further acceleration raises the speed to 96kmph in 10 seconds. Find the acceleration and distance. Brakes are applied to bring the car to rest under uniform retardation in 5 seconds. Find the distance covered during braking. (8 Marks)

(ii) A projectile is thrown with a velocity of 5 m/s at elevation of 60° to the horizontal. Find the velocity of another projectile thrown at an elevation of 45° which will have (i) equal horizontal range (ii) equal maximum height (iii) equal time of flight with the first. (8 Marks)

15 (a) The two blocks of mass 20kg and 40kg are connected by a rope passing over a friction less pulley as shown in figure 8. Assuming co-efficient of friction as 0.3 for all contact surfaces. Find the tension in the string, acceleration of the system. Also compute the velocity of the system after 4 second starting from the rest

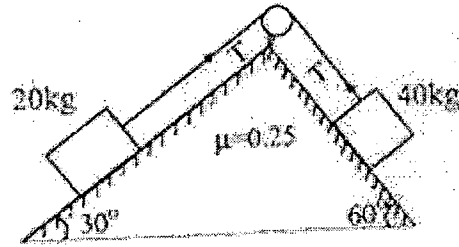


Fig 8

(OR)

15 (b) An inextensible string passing over a smooth pulley as shown in fig 9 joining two blocks. If the blocks are released simultaneously from rest, determine the velocity of block A after it has moved over 2 m and the tension in the string. Assume the co-efficient of friction at the contact surface is 0.2 . Use energy principle.

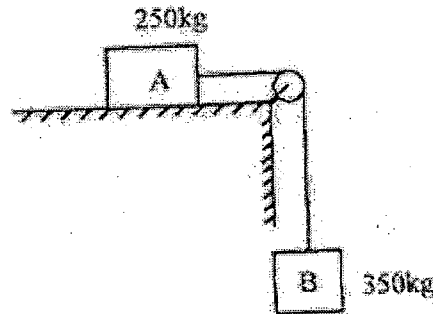


Fig 9