B.E. / B.TECH. DEGREE EXAMINATIONS: APRIL / MAY 2010

Second Semester

U07GE201: ENGINEERING MECHANICS

(Common to ALL Branches)

Time: Three hours   **Maximum Marks: 100**

Answer ALL the Questions:-

PART A (10 x 1 = 10 Marks)

1. The derived units of force are dimensionally described as

   a) $ML^{-2}T$ b) MLT^{-2} c) MLT d) MLT^{-1}

2. The forces with common line of action are called as

   a) Coplanar   b) Concurrent   c) Collinear   d) Parallel

3. A fixed support has

   a) Vertical reaction only

   b) Vertical, Horizontal reactions only

   c) Vertical or Horizontal reaction only

   d) Vertical, Horizontal reactions and moment only

4. The equations of equilibrium of a rigid body in two dimension are

   a) $\Sigma F_x = \Sigma F_y = 0$ b) $\Sigma F_x = \Sigma M = 0$

   c) $\Sigma F_y = \Sigma M = 0$ d) $\Sigma F_x = \Sigma F_y = \Sigma M = 0$

5. The first moment of area about the centroidal axes is

   a) Positive   b) Negative   c) Zero   d) Positive or Negative

6. The axis about which the product of inertia is zero is called

   a) Centroidal axis   b) Major Axis   c) Principal Axis   d) Minor Axis

7. Belt drive is most effective if

   a) there is no friction   b) the friction is maximum

   c) the belt is thick   d) the belt width is small

8. One of the law of kinetic friction is

   a) the frictional force is independent of the normal reaction

   b) the frictional force is always opposite to the direction of motion

   c) the frictional force is constant for moderate speed

   d) kinetic friction is always greater than static friction

9. It is required to stop a vehicle moving at 30 m/s in a distance of 90 m. The time required is

    a) 1/3 s   b) 120 s   c) 3 s   d) 2700 s

10. The product of mass and velocity is

    a) Power   b) Momentum   c) Acceleration   d) Force

PART B (10 x 2 = 20 Marks)

11. State the Lami's theorem.

12. Determine the cross product of two forces $F_1 = 2i -3j + 2k$ and $F_2 = 2i - 4k$

13. Define Rigid body.

14. State the Varignon's theorem.

15. State the parallel axis theorem.

16. What do you meant by radius of gyration?

17. Define angle of repose.

18. Differentiate between static and dynamic friction.

19. State D'Alembert's principle.

20. What is curvilinear motion? Give two examples.

PART C (5 x 14 = 70 Marks)

21. a) i) If two forces $F_1 = 20kN$ and $F_2 = 15kN$ act on a particle as shown in fig.21a i),

   find their resultant by a) Parallelogram law and b) Triangle law.   (6)
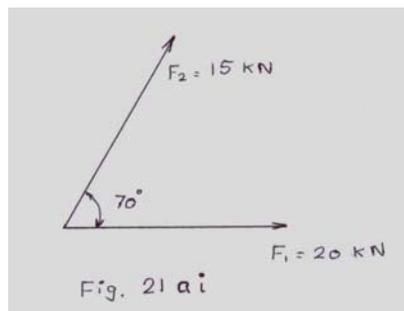
Fig. 21 a i

ii) A system of four forces acting on a body is shown in fig. 21a ii), determine the
resultant.   (8)


Fig. 21 a ii
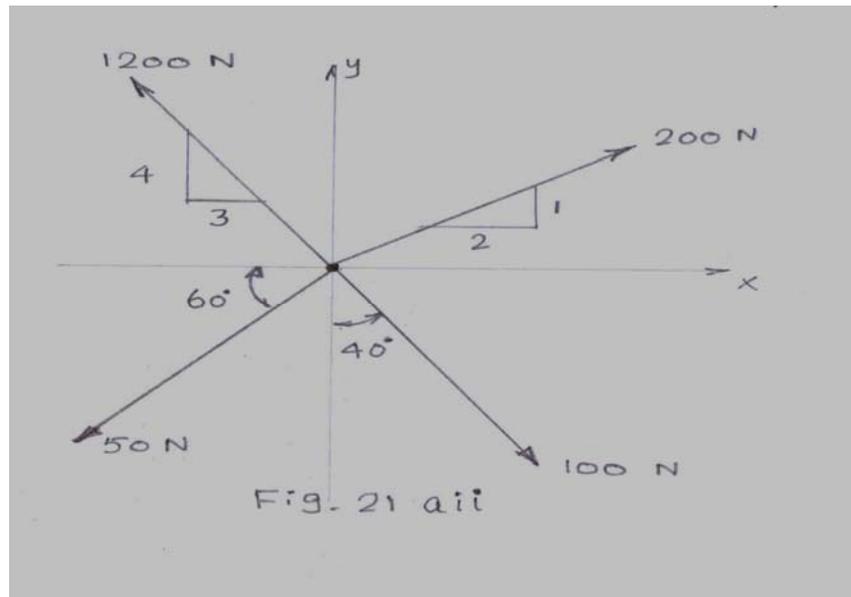
(OR)

b)   Four forces 32 kN, 24 kN, 24 kN and 120 kN are concurrent at origin and are
respectively directed through the points whose coordinates are A(2, 1, 6),   B(4, -2, 5),
C(-3, -2, 1) and D(5, 1, -2). Determine the resultant of the system.

22. a)   Two identical rollers each weighing 500 N rest on inclined plane and are supported by a
vertical wall as shown in fig. 22 a). Assuming all surfaces of contact to be smooth,
determine the wall reaction at P, floor reactions at R & S and the reaction of one roller
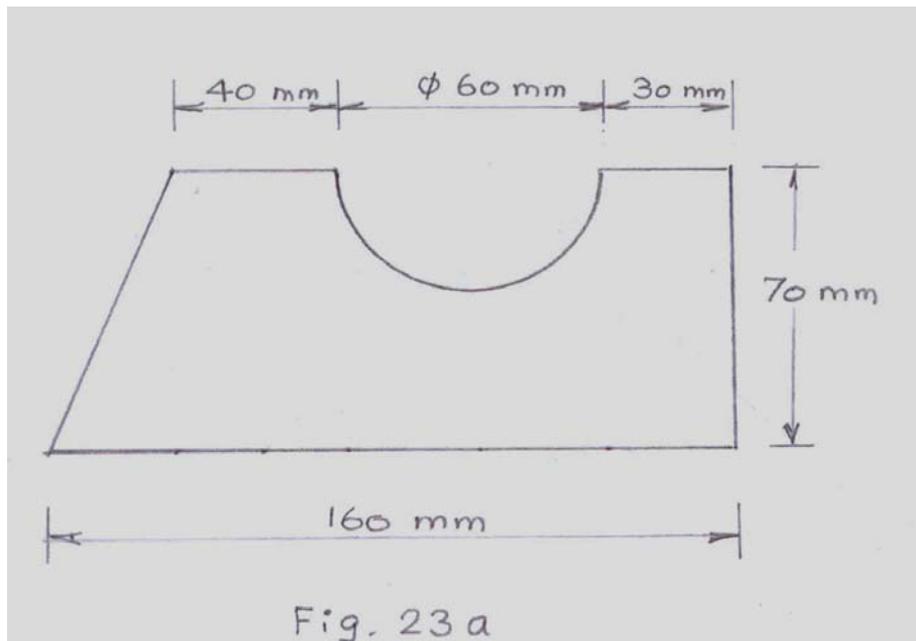against the other.
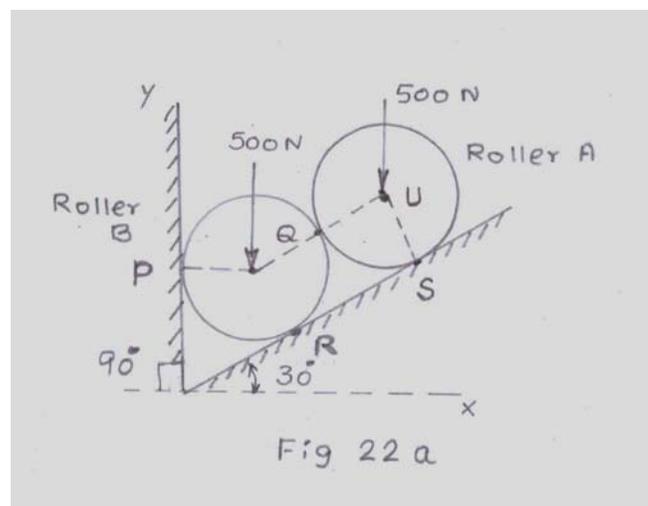
Fig 22 a

(OR)

b) Determine the reaction components at support A & B for the beam shown in fig. 22 b)
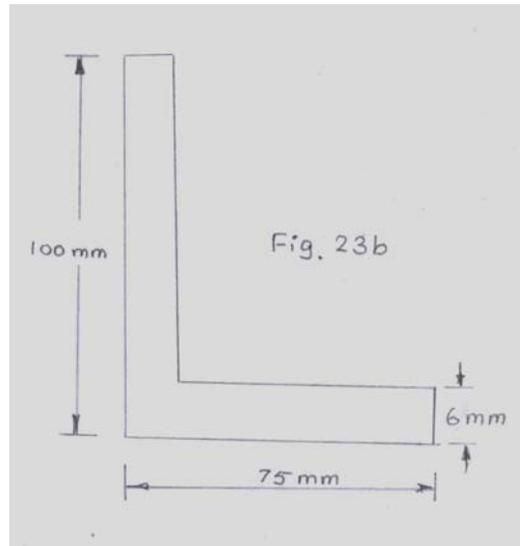

Fig 22. b
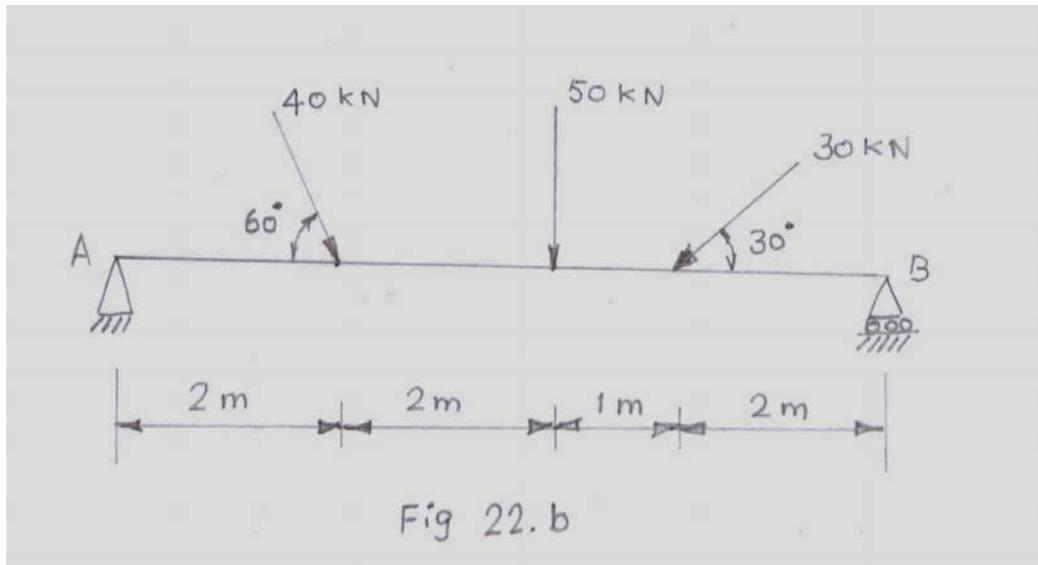
23. a) Find the moment of inertia about the centriodal axes for the composite section shown in fig. 23 a)

Fig. 23 a

b) Find the moment of inertia of a L angle shown in fig. 23 b) about the centriodal XX and YY axes.

Fig. 23b

100 mm

6 mm

75 mm

24. a) A block A weighing 1000 N rests over block B which weighs 2000 N as shown in fig 24 a). Block A is tied to wall with a horizontal string. If the coefficient of friction between A & B is 0.25 and between B and the floor is 0.33, what should be the value of P to move the block B if

    i) P is horizontal and

    ii) P acts 30° upwards to horizontal.

A

B

P

Fig 24 a
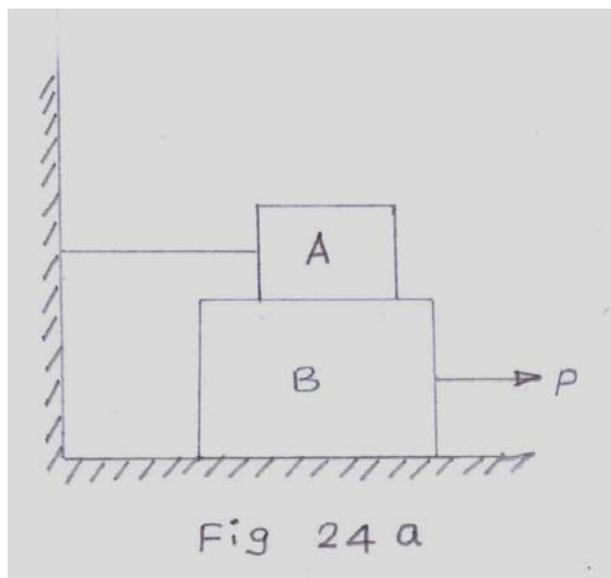
(OR)

b) A 4 m ladder weighing 250 N is placed against a smooth vertical wall with its lower end 1.5 m away from the wall. If the coefficient of friction between the ladder and the floor is 0.3, show that the ladder will remain in equilibrium in the position.
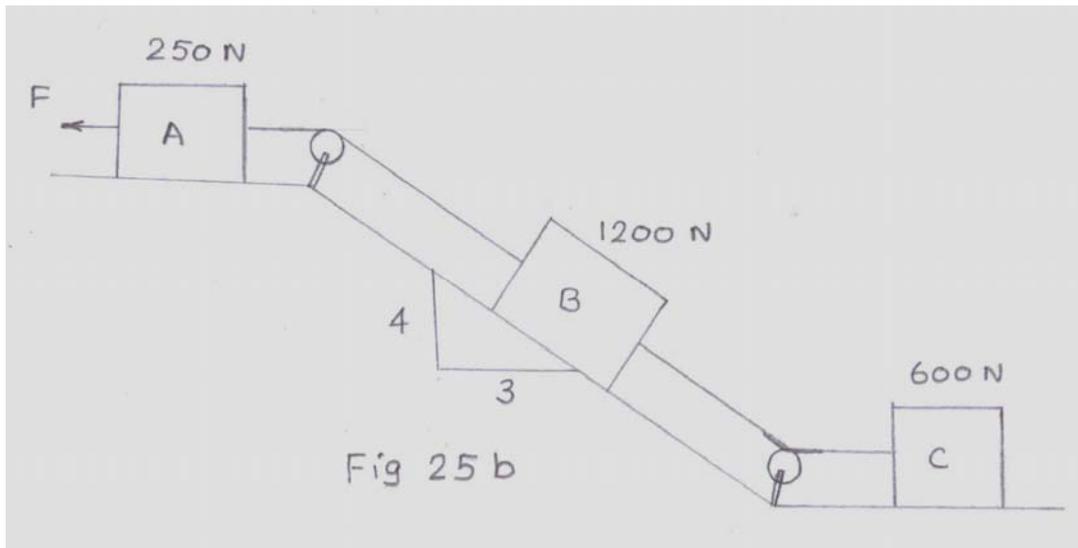
25. a) i) A motorist is traveling at 75 kmph, observes a traffic light 600meters ahead of him, turns red. The traffic light is timed to stay red for 20 seconds. If the motorist wishes to pass the light without stopping, just as it turns green, determine   (8)

        a) The required uniform acceleration of the motor

        b) The speed of the motor as it passes the light.

  ii) A lift carries a weight of 1 kN and it is moving with an uniform acceleration of 3 m/sec^2. Calculate the tension in the cable when the lift is moving upwards and downwards.   (6)

(OR)

b) Determine the force F that will give the system of bodies shown in fig 25 b), a velocity of 3 m/sec after moving 4.5 m from rest. Coefficient of friction between the blocks and the plan is 0.3. Assume pulleys are smooth.

Fig 25 b

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