

B.E / B.TECH. DEGREE EXAMINATIONS: OCTOBER / NOVEMBER 2008

Second Semester

U07GE201: ENGINEERING MECHANICS

(Common to ALL Branches)

Time: Three Hours**Maximum Marks: 100****Answer ALL Questions:-****PART A (20 x 2 = 40 Marks)**

1. If number of forces acting on a particle simultaneously is replaced by a single force, which produce the same effect as produced by the given forces, that single force is called
 - a) Resolution of force
 - b) Moment of a force
 - c) Resultant force
 - d) Concurrent forces
2. If two forces acting on a body are represented by the sides of a triangle in order their resultant is represented by the closing side of the triangle taken in opposite order is called as
 - a) Lami's theorem
 - b) Triangle law of forces
 - c) Parallelogram law of forces
 - d) Polygonal law of forces
3. A number of forces acting at a point will be in equilibrium if
 - a) all of them are inclined equally
 - b) their total sum is zero
 - c) sum of resolved parts in any two perpendicular directions are both zero
 - d) two resolved parts in two directions at right angles are equal
4. Diagram of a body which under consideration is freed from all the contact surfaces and all the forces acting on it including reactions at contact surfaces are drawn, is called as
 - a) Force diagram
 - b) Free body diagram
 - c) Motion diagram
 - d) Velocity diagram
5. Varignon's theorem is used to find
 - a) The resultant force of collinear and concurrent forces
 - b) The resultant force of parallel force system
 - c) The location of resultant force of collinear and concurrent forces
 - d) The location of resultant force of parallel force system
6. Two unlike parallel forces of same magnitude and sum of the moments of these two forces about any point is same, are said to form
 - a) Moment of force
 - b) Couple
 - c) Resultant force
 - d) Resolution of force
7. A beam is fixed at one end and simply supported at other end is called
 - a) Fixed beam
 - b) Cantilever beam
 - c) Continuous beam
 - d) Propped cantilever

8. When a body is subjected to some external forces, then resisting force is developed at the contact surfaces on which the body is supported is called
- Reaction
 - Moment
 - Resultant force
 - Couple
9. A point on a plane area such that moment of area about any axis through that point is zero is called
- Centre of gravity
 - Centroid
 - Axis
 - Centre
10. Centroid of a semicircular plane of radius of R is
- $\frac{2R}{2\pi}$
 - $\frac{4R}{3\pi}$
 - $\frac{3R}{4\pi}$
 - $\frac{R}{3\pi}$
11. Theorem which is used to find the moment of Inertia of a circular plane about its axis perpendicular to the plane surface is called
- Parallel axis theorem
 - Lami's theorem
 - Perpendicular axis theorem
 - Parallelogram law of force
12. Moment of inertia of a triangle plane of base b and height h, about its base is
- $\frac{bh^3}{12}$
 - $\frac{bh^3}{36}$
 - $\frac{b^3h}{36}$
 - $\frac{b^3h}{12}$
13. Friction is called as a force
- which causes the rotation of a body
 - which opposes the movement or tendency of movement of a body
 - which is in the direction of movement of a body
 - which is due to external forces
14. The maximum inclination of the plane on which a body, free from external forces, can start to move down is called as
- Angle of friction
 - Angle of repose
 - Cone of friction
 - Angular acceleration
15. A block of 10 N rests on an inclined plane which is having coefficient of friction 0.3. The angle of repose of the plane is
- 17.6°
 - 19.4°
 - 18°
 - 18.6°
16. Which of the following statement is wrong?
- Friction between the ladder and floor will keep the ladder stable
 - Friction between the car tyre and road keep the car roll without skidding
 - Friction between the piston and cylinder in IC engine helps to reduce the power loss
 - Friction between the leg and floor helps man walk
17. A freely falling body from a height of 'h' meter strikes the ground with velocity of
- 2gh
 - $\sqrt{2gh}$
 - $\frac{2h}{g}$
 - $\sqrt{\frac{2h}{g}}$

18. Equation of motion for a body moving with uniform motion is

a) $s = vt$ b) $s = u + vt$ c) $s = ut + \frac{1}{2}at^2$ d) $v^2 - u^2 = 2as$

u = velocity at time $t=0$; v = velocity at any time t ; s = distance ; a = acceleration

19. A body weight of W rests on an inclined plane which is θ degree inclined with ground. Give condition for the impending of motion. F - coefficient of friction.

a) $F = W \sin \theta$ b) $F = W \cos \theta$ c) $F = W$ d) $F = W \tan \theta$

20. For perfect elastic bodies coefficient of restitution is

a) 0 b) 0.5 c) 0.99 d) 1

PART B (5 x 12 = 60 Marks)

21. a) i. Write the statements of Parallelogram law of forces, Lami's theorem and Triangular law of forces. **(4 marks)**

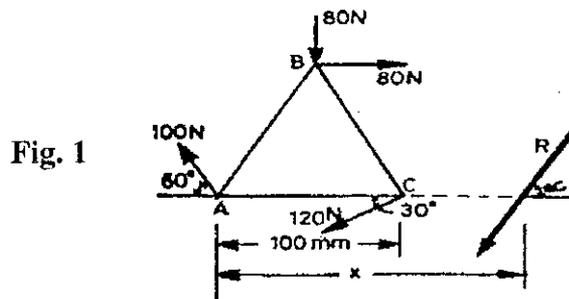
ii. The forces 10 N, 20 N, 30 N and 40 N are acting on one of the vertices of a regular pentagon, towards the other four vertices taken in order. Find the magnitude and direction of the resultant force R . **(8 marks)**

(OR)

b) Five forces are acting on a particle. The magnitude of the forces is 300 N, 600 N, 700 N, 900 N and P and their respective angles with the horizontal are 0° , 60° , 135° , 210° and 270° . If the vertical component of all the forces is -1000 N, find the value of P . Also calculate the magnitude and the direction of the resultant, assuming that the first force acts towards the point, while all the remaining forces act away from the point. **(12 marks)**

22. a) i. Explain different types of beam. **(4 marks)**

ii. Find the resultant of the force system as shown in the Fig.1 acting on a lamina of equilateral triangular shape. **(8 marks)**

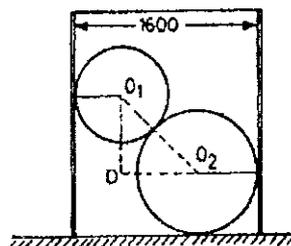


(OR)

b) i. Explain the types of loading on a beam. **(4 marks)**

ii. A hollow right circular cylinder of radius 800 mm is open at both ends and rests on a smooth horizontal plane as shown in Fig. 2. Inside the cylinder there are two spheres having weights 1 kN and 3 kN and radii 400 mm and 600 mm respectively. The lower sphere also rests on the horizontal plane. Neglecting friction, Find the minimum weight W of the cylinder for which it will not tip over. **(8 marks)**

Fig.2

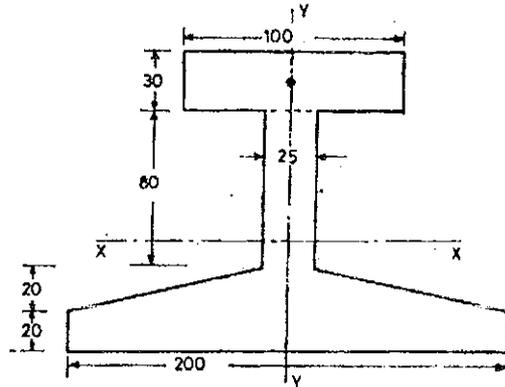


23. a) i. Determine the area of a triangle, base side 'b' and height 'h' and also determine the centroid of that triangular plane using first principle. (6 marks)
- ii. Find centroid of unequal Γ bracket $200 \times 150 \times 12$ mm. (6 marks)

(OR)

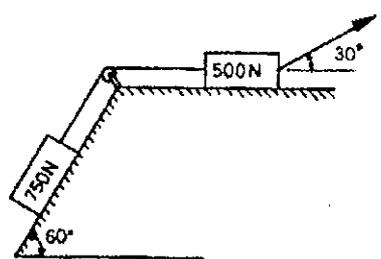
23. b) i. State Parallel axis theorem. (4 marks)
- ii. Determine the moment of inertia of the built-up section as shown in Fig.3 about its centroidal axes x-x and y-y. (8 marks)

Fig.3



24. a) i. Define the following:
 I. Limiting friction, II. Static friction, III. Dynamic friction, IV. Sliding friction,
 V. Rolling friction, VI. Coefficient of friction (4 marks)
- ii. What is the value of P in the system shown in Fig.4 to cause the motion to impend? Assume the pulley is smooth and coefficient of friction between the other contact surfaces is 0.2. (8 marks)

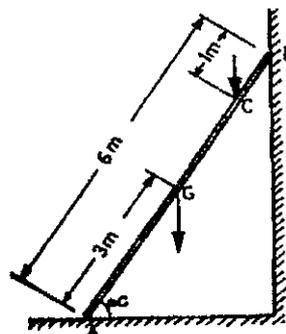
Fig. 4



(OR)

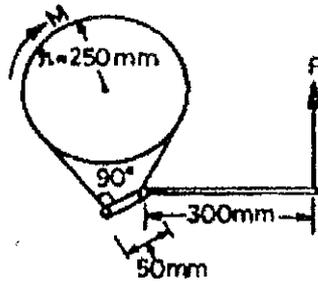
- b) i. The ladder shown in Fig. 5 is 6 m long and is supported by a horizontal floor and vertical wall. The coefficient of friction between the floor and the ladder is 0.4 and between wall and ladder is 0.25. The weight of ladder is 200 N and may be considered as concentrated at G (centroid). The ladder also supports a vertical load of 900 N at C which is at a distance of 1 m from B. Determine the least value of α at which the ladder may be placed without slipping. Determine the reaction at that stage. (8 marks)

Fig.5



24. b) ii. A torque of 300 N-m acts on the brake drum shown in Fig. 6. If the brake band is in contact with the brake drum through 250° and the coefficient of friction is 0.3, determine the force P applied at the end of the brake lever for the position shown in the Fig.6. (4 marks)

Fig. 6



25. a) i. Derive the equations of motion of a body which is in moving with uniform acceleration. (8 marks)
- ii. A ball is dropped from the top of a tower 30 m high. At the same instant a second ball is thrown upward from the ground with an initial velocity of 15 m/sec. When and where do they cross and with what relative velocity? (4 marks)

(OR)

- b) i. A cricket ball thrown by a fielder from a height of 2 m, at an angle of 30° to the horizontal, with an initial velocity of 20 m/sec, hits the wickets at height of 0.5 m from the ground. How far was the fielder from the wickets? (4 marks)
- ii. Two bodies A weighs 1500 N and B weighs 2000 N rest on the inclined planes having slope of $4/5$ and $3/5$ respectively as shown in Fig.7. In what distance will body A attain a velocity of 3 m/sec when starts from rest. (8 marks)

Fig.7

