B.Tech. 2nd Semester Examination, 2021

ME 203: ENGINEERING MECHANICS

Full Marks: 70   **Time: 3 Hours**

Answer Any **Five** Questions.

1. a) State and explain Lami's Theorem.
   b) A simply supported beam AB, 8m long is supported and loaded as shown inFig.1. Determine the reactions at supports A & B.
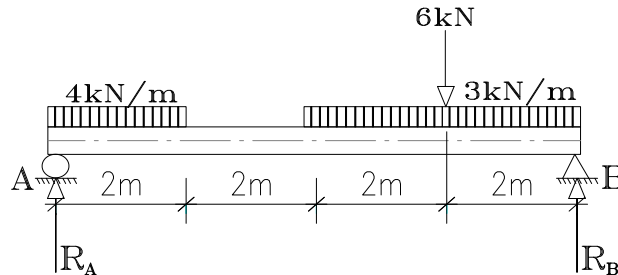

Fig. 1

4+10=14

2. a) What do you mean by limiting angle of friction?
   b) A body "A" of weight 20 kN is to be raised by means of horizontal force P as shown in the Fig.2. The weight is constrained to move up vertically by the application of a horizontal force P_1. What are the magnitude of P_1 and P if the coefficient of friction at all the surfaces contact is 0.25. Weight of "B" is negligible.
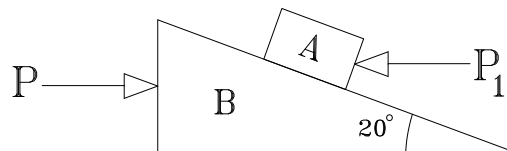

Fig. 2

2+12=14

3. a) What do you mean by a Truss? How are these classified?
   b) Calculate the axial forces Si (S1, S2, S3, S4, S5 and S6) in each bar of the cantilever truss supported and loaded as shown in Fig. 3.
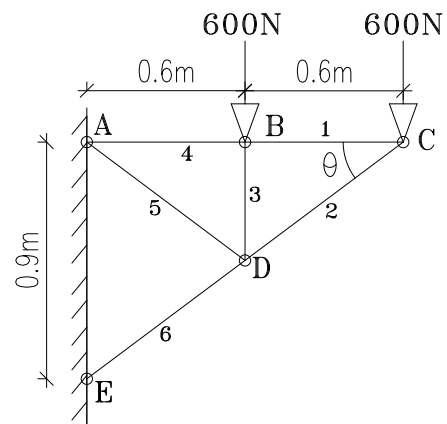
Fig. 3

2+12=14

4. Define centroid. Find the centroid shaded area of Fig. 4A. What is the radius of gyration of an area? Compute the moments of inertia of the shaded rectangle (Fig. 4B) (all unit in mm)
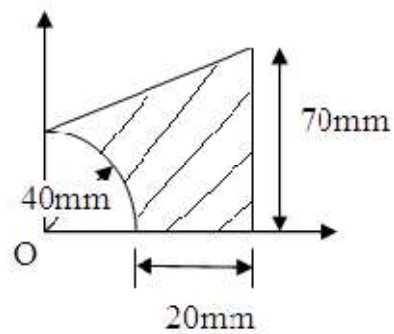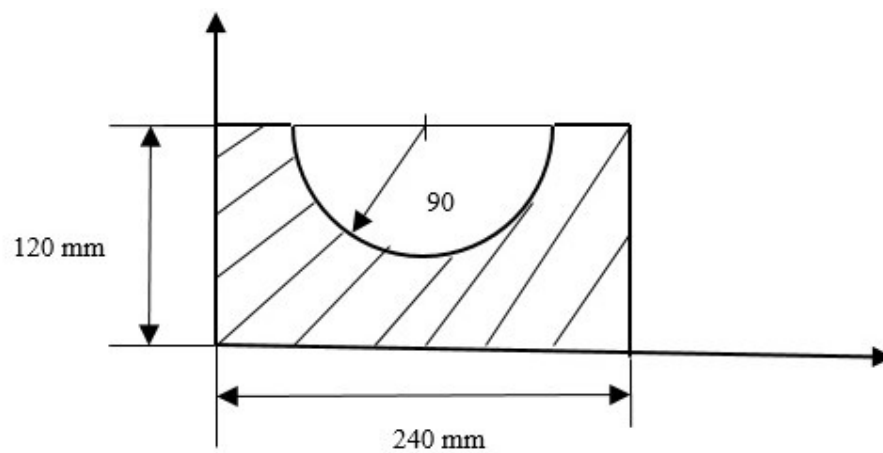

Fig. 4A

Fig. 4B

2+4+2+6=14

5. (a)A bullet is fired at an angle of 30⁰ up the horizontal with velocity 100 m/s from the top of a tower, 50 m high. Determine followings

(i) The time of Flight (ii) The horizontal range along the ground (iii) The maximum height the bullet can attain from the ground (iv) The velocity of the bullet after 6 s.

Assume horizontal ground at the foot of tower.

(b) A projectile is aimed at a target on the horizontal plane and falls 12m short when the angle of projection is 15⁰, while overshoots by 24 m when the angle is 45⁰. Find the angle of projection to hit the target.

$$8+6=14$$

6. A body of mass(A) =125 kg is rest on a rough plane inclined at 12⁰ to the horizontal. It is pulled up the plane by means of light flexible rope running parallel to the plane and passing over light frictionless pulley at the top of the plane as shown in figure below. The portion of the rope beyond the pulley hangs vertically down and carries a mass of (B)= 81.5 kg at it's end.

If the co–efficient of friction for the plane and the body is 0.25, Find the followings.

(i) Tension in the rope.

(ii)Acceleration with which the body moves up the plane, and

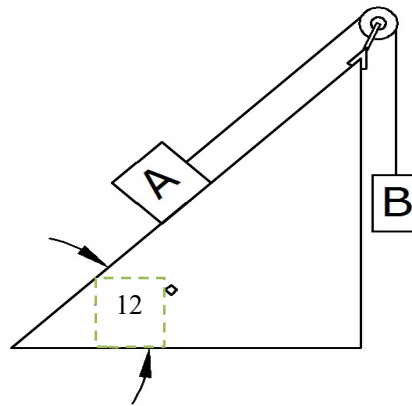(iii)The distance moved by the body in 3 sec after staring from rest.

Fig. 5

$$5+5+4=14$$

7. State Work Energy equation and derive work energy equation for pure translation. Define the term power.

$$2+10+2=14$$

8. (a)While carrying out experiment (tensile test) in the laboratory; following observations were made. Diameter of the specimen d=12.5 mm. length of the specimen (gauge length) is 50 mm, load at proportionality limit is 3000 kg and load at yield point is 3100 kg. Maximum load is 5250kg. Strain at proportionality limit is 0.11%. Final length (l') is 64 mm. Diameter over neck is measured as 9.72mm. Calculate the following

Modulus of Elasticity (E), Proportional limit, Ultimate stress, % elongation, % reduction in area and allowable Stress based on yield point, considering factor of safety as 1.75.

(b) Draw stress strain curve for mild steel specimen and define Elastic limit, yield point, UTS and true stress.

$$10+4=14$$