2E2005

2E2005 paper

B.Tech. (Sem.II) (Main/Back) Examination - 2014

205 Engineering Mechanics

[Total Marks : 80]

[Min. Passing Marks : 24]

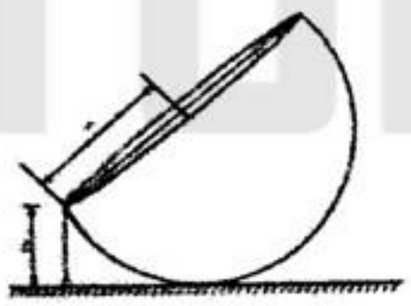
[Time : 3 Hours]

Instructions to Candidates :
Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Unit - I

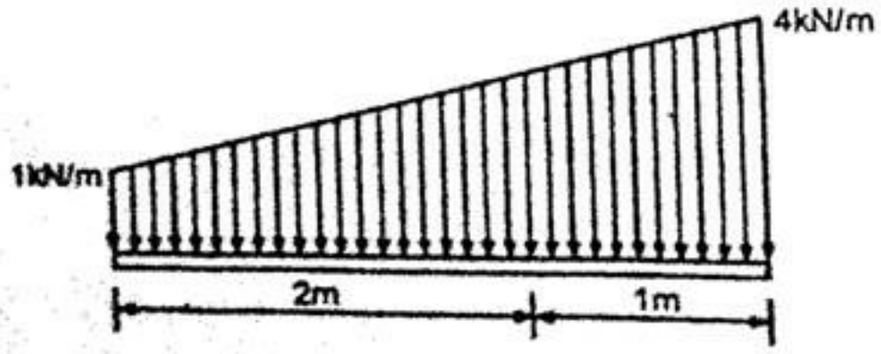
1. (a) State and prove Lami's theorem. What are the limitations of Lami's theorem to find out resultant of forces. (4+2)

(b) A hemisphere of radius 'r' and weight 'W' is placed with its curved surface on smooth table and a string of length $l(<r)$ is attached to a point on its rim and to a point on table as shown in figure. Prove that tension in string $T = \frac{3W}{8} \times \frac{r-l}{\sqrt{2rl-l^2}}$. (10)

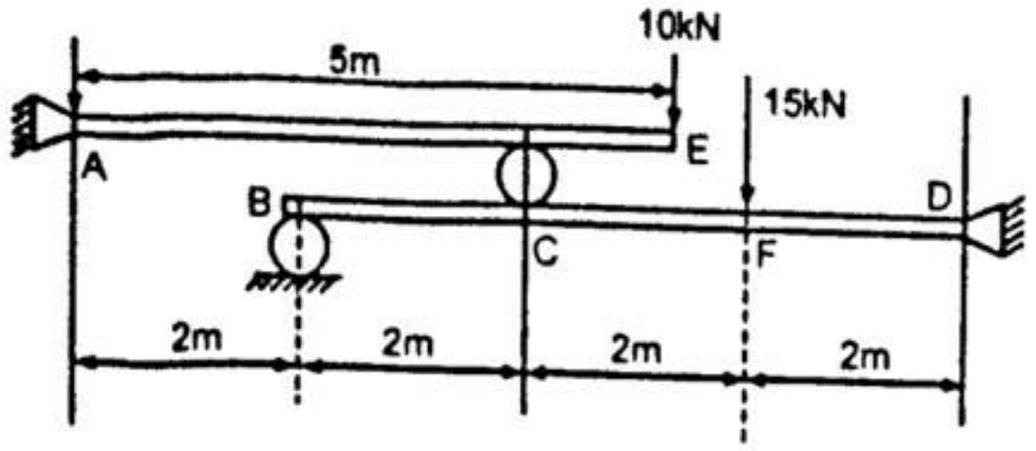


OR

1. (a) Determine reaction at beam support for given leading conditions.



(b) Determine reaction value at the roller support B and C using virtual work method.

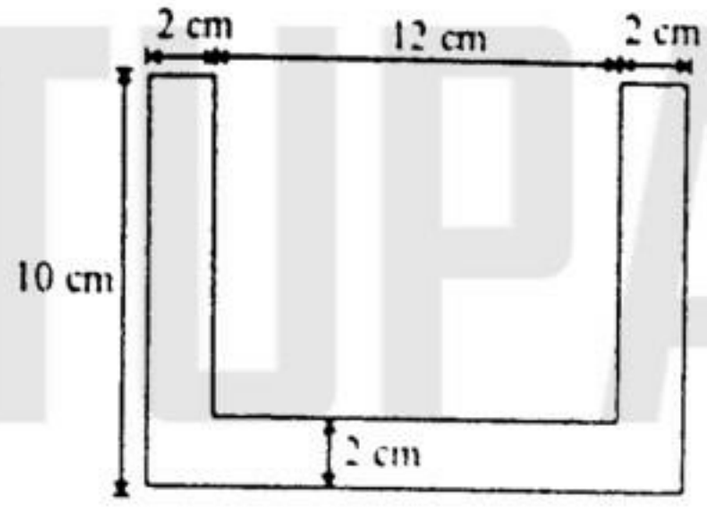


(8)

Unit - II

2. (a) State following theorems concerning moment of inertia for a plane area:
   (i) Parallel axes theorem
   (ii) Perpendicular axes theorem (2+2)

   (b) Find area moment of inertia of section shown in figure, about x-axis and y-axis passing through centroid of the section.



(12)

OR

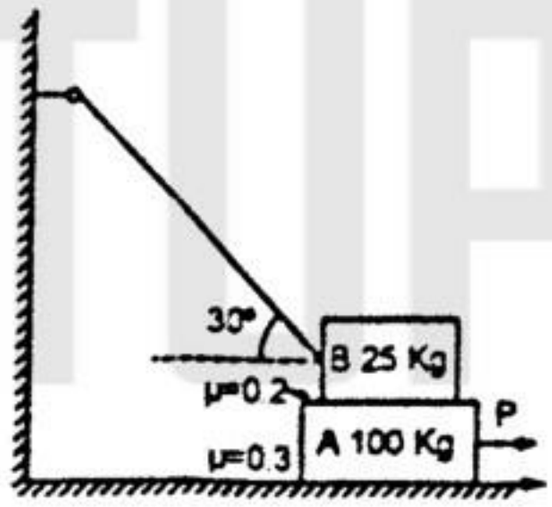
2. (a) How does the mechanical advantage and efficiency varies with load? (6)

   (b) A single purchase winch crab has the following particulars :
   Number of teeth on pinion = 16
   Number of teeth on spur wheel = 96
   Length of lever arm = 70 cm
   Diameter of load drum = 20 cm
   It is observed that an effort of 60 N lifts a load of 1800 N and an effort of 120N lifts load of 3960N.
   (i) Find efficiency in two cases (5)
   (ii) Determine loss of load and loss of effort in two cases. (5)

Unit - III

3. (a) A ladder of mass 35 Kg and length 10 m rest against a vertical wall and it is inclined at 60° to horizontal. The coefficient of friction for all surfaces is 0.25. How far up the ladder can a 72 kg person climb before the ladder begins to slip. (8)

   (b) Block A of mass 100 kg rests on horizontal surface and supports another Block B of mass 25 kg on top of it. Block B is attached to a vertical wall by on inclined string as shown in figure. Determine force P applied to lower block that will necessary to cause slipping to impend.



(8)

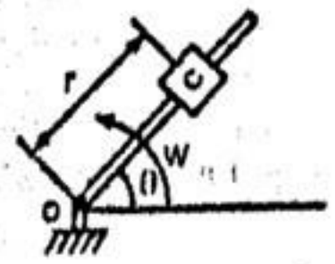
OR

3. (a) Drive expression for length of belt of a cross belt drive. (8)

   (b) Two pulleys of diameter 0.6 m and 0.3 m connected by cross belt drive are 3.5 m apart. Power transmitted is 5 KW. The permissible load on belt is 2.5 N/mm width of belt, larger pulleys make 220 rpm, thickness of belt is 5 mm, and coefficient of friction between belt and pulley is 0.35. Determine.
   (i) Length of belt (2)
   (ii) Width of belt (4)
   (iii) Initial tension in belt (2)

Unit - IV

4. (a) The motion of slider c is defined by the relation $r = 3t - t^2$ and $\theta = 2t$, where r is in meters and t is in seconds and θ in radians. Determine radial and transverse component of acceleration at t = 2 sec. (8)

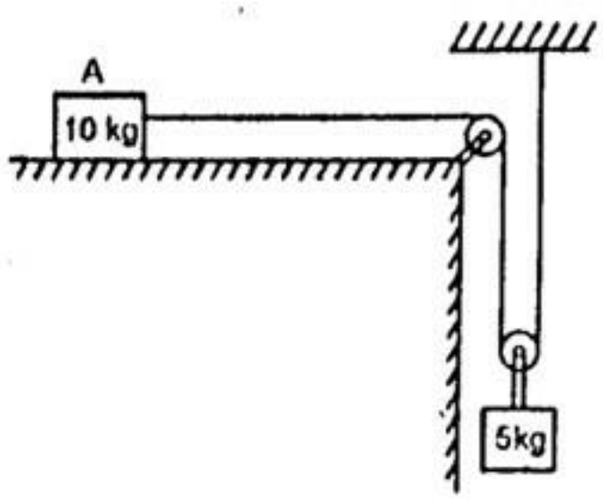


(b) Two vehicles are moving towards each other with velocities 20 m/sec and 15 m/sec. when distance between them is 150 m. Drivers of both vehicles apply their brake. In this condition they were able to just avoid accident. Assuming constant retardation in each case, find out :
(i) Retardation of each vehicle. (3)
(ii) Time required to stopvehicles (3)
(iii) Distance travelled by each vehicle while slowing down. (2)

OR

4. (a) A bird is sitting on tree of 9.57 m height. A hunter throws a stone towards bird but just before being hit by stone bird flies horizontally with 7.35 m/sec velocity. But stone hit the bird during downward motion after rising 4.9 m higher that level. Determine projection velocity. (8)

(b) A pulley, string and mass arrangement is shown in figure. When 10 kg block is released it moves with an acceleration of g/9. Find out coefficient of friction between block and table surface. (8)



Unit - V

5. (a) A wagon of 60 kN weight starts from rest and moves 30 m down on surface with 1% gradients. If selling resistance of track is 5N/kN, determine velocity of wagon at 30 m distance. If wagon impact is absorbed by a spring which compress 1 cm by 25 kN weight. Determine how much this spring will be compressed. (8)

(b) A ball of mass 3 kg moving with velocity of 3 m/s has an indirect collision with a ball of equal mass moving with a velocity of 4.5 m/s. The velocity of first ball and second ball makes an angle of 30° and 60° with line of impact respectively. If coefficient of restitution is 0.9, find magnitudes and directions of final velocities of two balls. (8)

OR

5. (a) State the impulse-momentum relation. A ball of 2 kg is thrown straight up into the air with an initial velocity of 15 m/sec. Calculate the time of flight of the ball using impulse momentum theorem. (4+4)

(b) A solid sphere of mass 'm' and radius 'r' is rolled down in a semi cylinderical cavity. Sphere rolls in cavity without slipping what is linear velocity of sphere at bottom of cavity? (8)