C 31708

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COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2007

EN 04-107 (B) : ENGINEERING MECHANICS (B)

(Common to ME, PE, AM)

[2004 admissions]

Time : Three Hours

Maximum: 100 Marks

Name

Reg. No

- I. (a) State and illustrate the conditions of static equilibrium of a rigid body under coplanar forces.
 - (b) Two concurrent forces of magnitude 25 N and 10 N make angles 15° and 45° respectively with the horizontal. Find a single equivalent force to replace the two forces.
 - (c) State and explain the theorem of Pappus. Describe how this theorem can be applied to locate the centre of gravity of a semi-circular lamina.
 - (d) Find the force in member AC of the simple equilateral truss shown in Fig.1.



- (e) Train A, 150 m. long moving at 50 kmph is over taken by train B, 100 m. long moving at 70 kmph on a parallel track. Find the time taken by train B to cross train A completely.
- (f) A mass of 2.5 kg. tied by a string to a point on a smooth surface is describing a circle of radius 1 m. If the mass rotates once in every 50 second, find the tension in the string.
- (g) Discuss (i) Plastic impact ; (ii) Elastic impact ; (iii) Semi-elastic impact.
- (h) Under what circumstances are cylindrical coordinates preferred to the rectangular coordinates and under what conditions are the path coordinates preferred to both ?

 $(8 \times 5 = 40 \text{ marks})$

II. (a) A pulley of 1 m. diameter weighing 1 kN is subjected to forces as shown in Fig. 2. Determine the resultant force and its line of action with respect to AOB.

$$\begin{array}{c} A \\ 0 \\ \hline B \end{array} \end{array} \rightarrow 4 \text{ kN} \\ Fig. 2 \\ \hline B \end{array}$$

(15 marks) Turn over

Or

(b) A 100 kg homogeneous smooth sphere rests on the two inclines as shown in Fig. 3. Determine the contact forces A and B.



(15 marks)

III. (a) Two blocks of weight 10 kN each rest on a rough inclined plane and are connected by a short piece of string as shown in Fig. 4. If the coefficients of friction are 0.2 and 0.3 respectively for the lower block and the upper block, find the angle of inclination of the plane for which sliding will impend.



Or

(15 marks)

(b) A cable of mass kg per metre of its horizontal span is suspended between two points on the same level 350 m. apart and has a sag of 50 m. Find the maximum tension, tension at midlength and the total length of the cable.

(15 marks)

IV. (a) At the instant t = 0, a locomotive starts to move with uniformly accelerated speed along a circular curve of radius r = 600 m. and acquires by the end of the first 60 seconds of motion a speed equal to 15 mph. Find the tangential and normal accelerations at the instant t = 30 seconds.

Or

(b) A small wooden block of mass 0.5 kg. rests on a horizontal turn table at a distance of 50 mm. from the axis of rotation. If the coefficient of friction between the block and the table is 0.5, find the speed of rotation of the turn table at which the block will just slip off the table.

(15 marks)

(15 marks)

(15 marks)

(a) A ball collide with another ball having twice its mass moving with 1/7th of its velocity in the same direction. If the coefficient of restitution between them is 0.75, show that the first ball comes to rest after striking the second ball.

Or

V.

(b) A particle of mass 'm' moves in an X-Y plane. The coordinates of the particle at any instant are given by $x = a \cos t \omega t$ and $y = b \sin \omega t$, where a, b and ω are constants. Determine the angular momentum of the particle with respect to the origin of the coordinate system.

(15 marks)

 $[4 \times 15 = 60 \text{ marks}]$