

2E2005

Roll No.

Total No of Pages: 4

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B. Tech. I Year II Sem. (Main/Back) Exam., May - 2019  
205 Engineering Mechanics

Time: 3 Hours

Maximum Marks: 80  
Min. Passing Marks: 26

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.

Use of following supporting material is permitted during examination.  
(Mentioned in form No. 205)

1. NIL

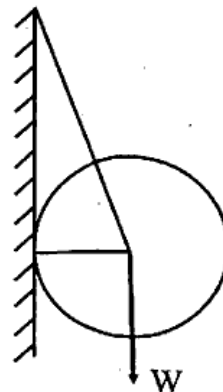
2. NIL

**UNIT-I**

- Q.1 (a) State and prove Varignon's Theorem. [6]  
(b) The resultant of two forces P and Q acting at a point is R, if Q is doubled, the force R also gets doubled and if Q is reversed, R is again doubled. Show that the ratio of P, Q and R is given by [10]  
 $P : Q : R = \sqrt{2} : \sqrt{3} : \sqrt{2}$

**OR**

- Q.1 (a) What do you know about virtual work? Explain with the help of example. [6]  
(b) A smooth sphere of radius r and weight W hangs by a light string of length  $\ell$ . One end of the string is fastened to a point on the sphere where its other end is fixed to a point on a smooth vertical wall. Determine the reaction of the wall and the tension in the string. [10]



[2E2005]

Page 1 of 4

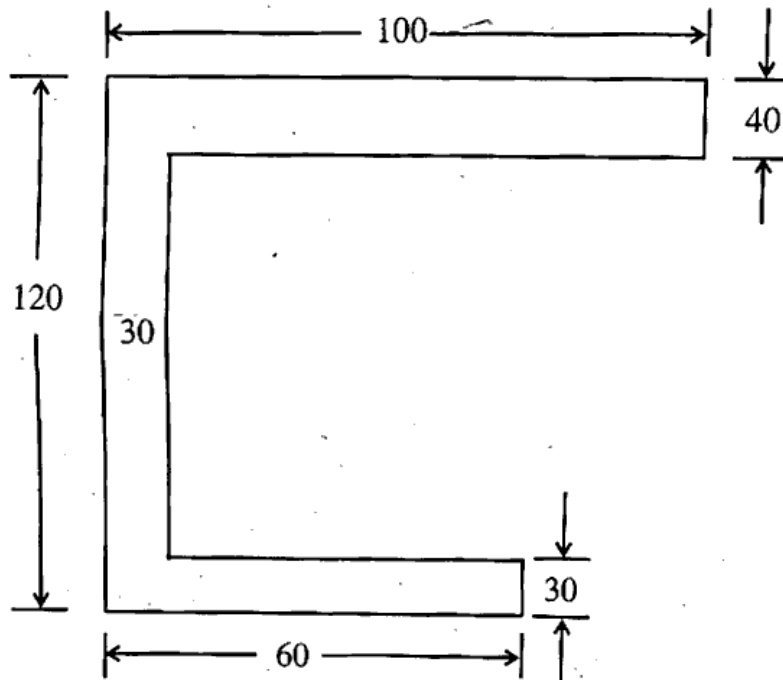
[11140]

## UNIT- II

- Q.2 (a) Draw neat sketch of third system of pulleys and obtain expression of mechanical advantage, velocity ratio and efficiency. [6]
- (b) The effort required to lift a load of 250N is 160N and 375N is 170N respectively using a lifting machine. If the velocity ratio of the machine is 20, find out the following – <http://www.rtuonline.com> [10]
- (a) Law of machine
- (b) Efficiency of the machine at 250N and 375N loads.
- (c) Effort lost in friction in both the cases.

OR

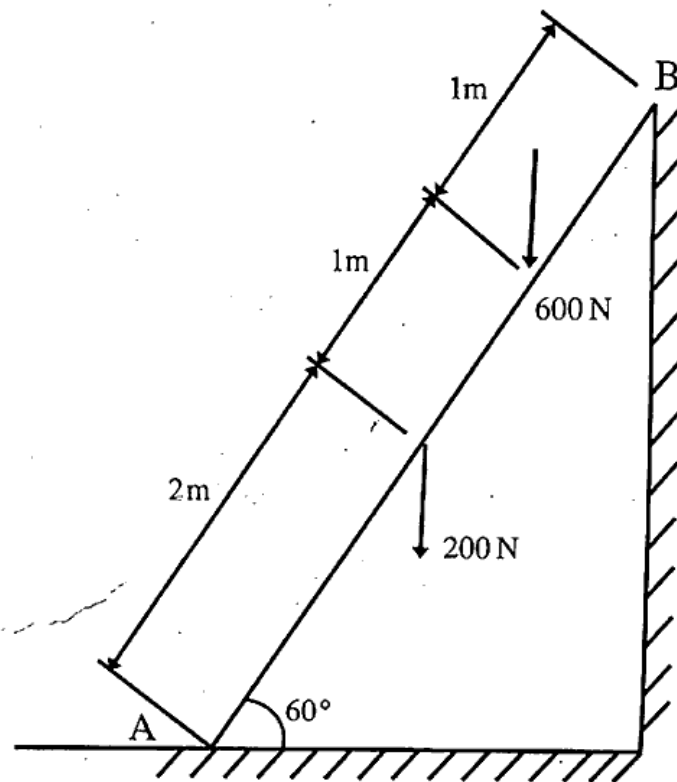
- Q.2 Find the moment of inertia of the following fig. about XX and YY axis. [16]



## UNIT- III

- Q.3 (a) A ladder of length 4 m weighing 200 N is placed against a vertical wall as shown in fig. The co-efficient of friction between the wall and the ladder is 0.2 and that between the floor and the ladder is 0.3. The ladder in addition to its own weight

has to support a man weighing 600 N at a distance of 3m from A. Calculate the minimum horizontal force to be applied at A to prevent slipping. [10]



(b) What are the various law of friction? Explain. [6]

Explain different types of friction also.

**OR**

Q.3 (a) What do you mean by velocity ratio? What is the effect of slip on velocity ratio? [6]

(b) In an open belt drive the sum of the diameters of two pulleys is 60 cm. they are running at 1500 and 3000 rpm. Determine the diameter of each pulley assuming the total slip of the system is 5%. The pulley running at 1500 rpm is the driver pulley. [10]

### UNIT- IV

Q.4 (a) Derive an expression for the maximum height and range of a projectile traversed by a stone thrown with an initial velocity of  $u$  and an inclination of  $\theta$ . [6]

- (b) A shot is fired with a velocity of 30 m/s from a point 15 m in front of a vertical wall 6 m high. Find the angle of projection to the horizontal to enable the shot to just clear the top of the wall. [10]

**OR**

- Q.4 (a) What do you know about D' Alembert principle? Explain. [6]
- (b) The speed of a truck, moving at constant speed of 30m/s, is reduced to 20 m/s, in a distance of 200m. Determine- [10]
- (i) The acceleration assuming it to be constant
- (ii) The time taken

Also determine the distance in which the truck can be brought to a stop with the acceleration calculation in part (i).

**UNIT- V**

- Q.5 (a) What do you understand by the term energy? Explain various forms of mechanical energies. [6]
- (b) A 40 ton rail car travels at 4 km/h and collides with a 100 ton wagon on the same track, moving in the opposite direction at 1.2 km/h. Find their velocities immediately after impact assuming no loss of energy. What is the impulse between them? [10]

**OR**

- Q.5 (a) Explain the principle of momentum for a particle and rigid body, Principle of Conservation of Angular momentum and angular momentum of rigid body. [6]
- (b) A hammer mass of 1 kg is used to drive a nail of 100 gms into a timber log. The striking hammer velocity is 10 m/s and nail is driven inside 1 cm with each blow. Find the resistance of the timber to penetrate the nail and the energy lost in driving the nail 5 cm inside the timber. [10]

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