

2E2307	Roll No. _____	Total No of Pages: 4
2E2307 B. Tech. II Sem. (Main) Exam., May – 2018 OE -101 Engineering Mechanics		

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks: 28

Instructions to Candidates:

Attempt any five questions including Question No. 1, which is Compulsory. 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

Q.1 COMPULSORY,

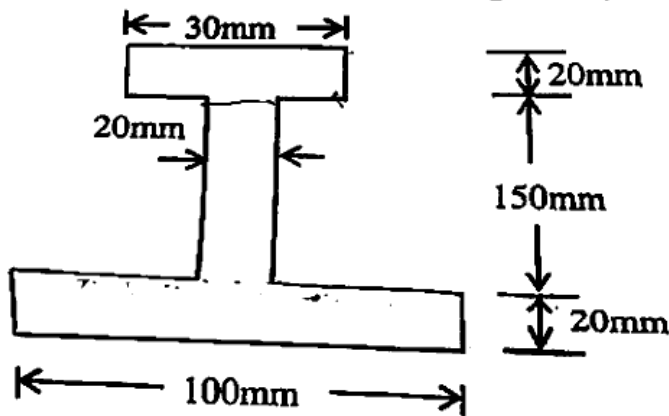
Answers for each sub-question be given in about 25 words. [8×2=16]

- (a) The resultant of two forces P and Q is at right angle to P. Show that the angle between the forces is $\cos^{-1}(-P/Q)$
- (b) What is meant by an axis/plane of symmetry of a body in the context of centroid/centre of gravity?
- (c) Mention the forces which are generally omitted while applying the principle of virtual work.
- (d) What is cone friction? State its significance
- (e) Two cars are moving in the same direction with a speed of 45km/hr and a distance of 10km separates them. A car coming from opposite direction meets these two cars at an interval of 6 min. Determine the speed of this car. 46

- (f) A cricket ball of mass 175gm is moving with a speed of 36km/hr. What average force will be required to stop the ball in 0.2 seconds?
- (g) Determine the force necessary to produce an acceleration of 4 m/s^2 in a mass of 250kg.
- (h) Differentiate between scalar and vector quantities. How a vector quantity is represented?

Q.2 (a) What is free body diagram? Explain with the help of suitable example with neat sketch. [4]

(b) Find the Moment of Inertia of a given figure about centroidal axis. [12]

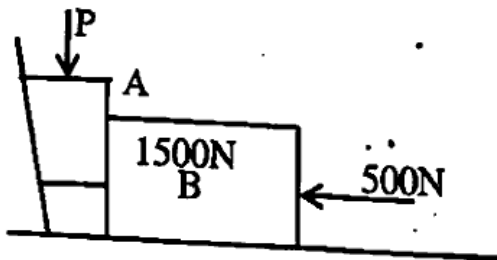


(figure not in scale)

Q.3 (a) State the principle of virtual work, and explain how it can be used for solving problems in statics. [6]

(b) A uniform ladder of weight 250N rests against a smooth vertical wall and a rough horizontal floor making an angle of 45° with horizontal. Find the forces of friction at floor using principle of virtual work. [10]

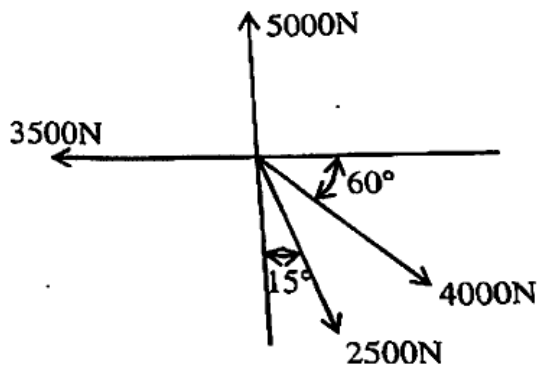
Q.4 Determine the force P required to start the wedge shown in sketch. [8]



The angle of limiting friction for all surfaces of contact is 15° ($\mu = \tan 15^\circ$)

(b) Find the resultant of given force system and also find its direction.

[8]



(Figure not in scale)

Q.5 (a) A train started from rest and accelerated. The acceleration at any instant is given by $\left(\frac{7}{V}+2\right) \text{ m/s}^2$, where V is the velocity of train in m/s. at given instant. Find the distance in which train will attain a velocity of 60km/hr. [8]

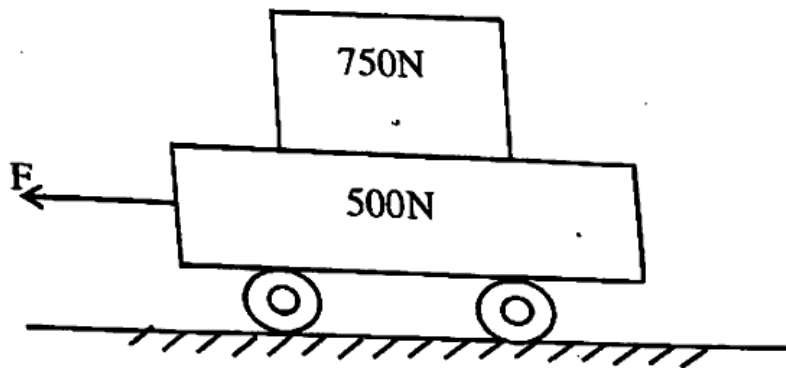
(b) Two balls are projected from the same point in direction inclined at 60° and 30° with horizontal. Calculate the ratio of their velocities of projection if: [8]

- (i) The ball attain the same height (max.)
- (ii) The range are equal for balls

Q.6 (a) Define D'Alembert principle and Newton's Law of gravitation. [6]

(b) A 750N crate rests on a 500N cart. The coefficient of friction between crate and cart is 0.3 and between cart and road is 0.2. If the cart is to be pulled by a force (shown in sketch), such that crate does not slip. Determine: [1]

- (i) Max. Allowable magnitude of force F
- (ii) The corresponding acceleration of cart.



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[11980]

- Q.7 (a) State and prove the law of Conservation of Energy. (Draw neat sketch also) [8]**
(b) A ball of mass 6kg is dropped from a height of 12cm on a spring of stiffness 510 N/m. The maximum deflection of the spring is? [8]
- Q.8 (a) Explain linear and angular momentum. [3]**
(b) Write the impulse- momentum equation and mention its application. [3]
(c) Two bodies weighing 300N and 450N are hung to the ends of a rope passing over on Ideal pulley. With what acceleration would the heavier body come down? What is the tension in rope? Obtain solution by using: [10]
(i) The principle of work and energy.

OR

- (ii) Principle of Impulse and Momentum.**
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