

Code No: R05010302

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B.Tech I Year Examinations, June - 2014

ENGINEERING MECHANICS

(Mechanical Engineering)

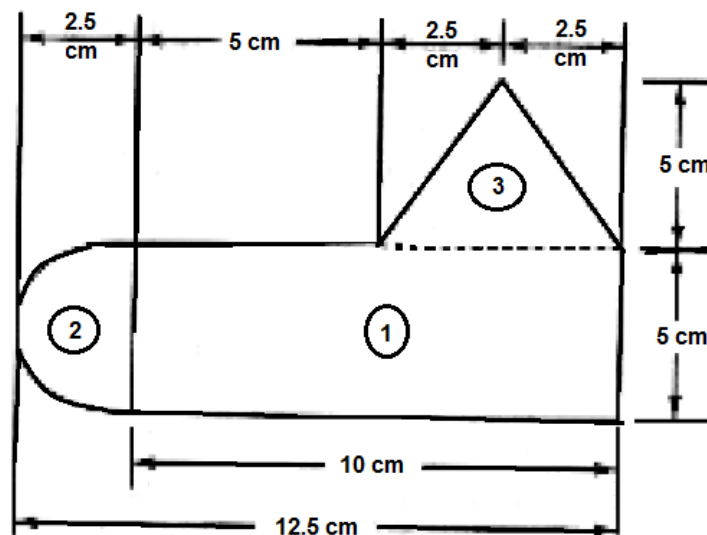
Time: 3 hours

Max. Marks: 80

Answer any five questions
All questions carry equal marks

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- 1.a) State and prove the varignon's theorem with neat sketch.
- b) The magnitude of two forces is such that when acting at a right angle produce a resultant force of $\sqrt{20}$ N and when acting at 60° produce a resultant equal to $\sqrt{28}$ N. Find the magnitude of the forces.
- 2.a) A load of 1.5 kN, resting on an inclined rough plane, can be moved up the plane by a force of 2 kN applied horizontally or by a force of 1.25 kN applied parallel to the plane. Find the inclination of the plane and coefficient of friction.
- b) A screw jack has square threads of mean diameter of 100 mm and a pitch of 12.5 mm. Determine the force that must be applied to the end of 500 mm lever i) to raise ii) to lower a weight of 50 kN. Find the efficiency of the jack, is it self-locking? Assume $\mu = 0.20$.
- 3.a) Derive the ratio of tensions for rope and V-belt drives for transmitting the maximum power.
- b) Power is to be transmitted between two shafts by a V-belt whose mass is 0.9 kg/m length. The angle of lap is 170° and the groove angle is 45° . Assuming the coefficient of friction between the belt and the pulley to be 0.17. Find:
i) Velocity of the belt for maximum power ii) power transmitted at this velocity.
- 4.a) Write the different methods to determine the centre of gravity of simple figures. Explain any one method.
- b) Find the C.G. of the uniform lamina as shown in figure below.



- 5.a) How would you find out the moment of inertia of a plane area?
 b) Derive an equation for moment of inertia of the
 i) A rectangular section
 ii) A circular section and
 iii) A triangular section about centroidal axis.
- 6.a) How would you study the motion of a body with graphical approach? Discuss the uses of such diagrams.
 b) Two electric trains A and B leave the same station on parallel lines. The train A starts with a uniform acceleration of 0.2 m/sec^2 and attains a speed of 45 kmph. When the steam is reduced to keep the speed constant. The train B leaves 1 minute after, with a uniform acceleration of 0.4 m/sec^2 to attain a maximum speed of 72 kmph. When the train B will overtake the train A?
- 7.a) State and prove work – energy equation.
 b) Two bodies of weights 50 N and 10 N are connected to the two ends of a light inextensible string which passes over a smooth pulley. The weight 10 N is placed on a rough inclined plane of angle of inclination 20° while the weight of 50 N hangs vertically downward. If the coefficient of friction between the body and the plane is 0.2, make calculations for the
 i) Acceleration of the system,
 ii) Tension induced in the string and
 iii) The distance moved by the body in 3 seconds starting from rest.
- 8.a) Define the terms i) Amplitude ii) Time period iii) Frequency and iv) SHM.
 b) A particle executes SHM with a frequency of 12 oscillations per minute. When the particle lies at a distance of 10 cm from the mean position, its velocity equals 65 percent of maximum velocity. Determine:
 i) The distance between two extreme positions of the particle
 ii) The maximum acceleration of the particle and
 iii) Velocity of the particle when it is at a distance of 8 cm from the centre of oscillation.
