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Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (Automation &amp; Robotics) (2012 &amp; Onwards) (Sem.-3)

**ENGINEERING MECHANICS**

Subject Code : BTAR-303

M.Code : 63003

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

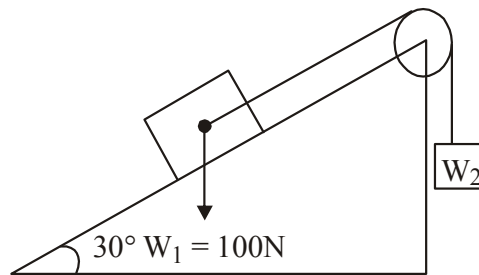
1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A****Answer briefly :**

1. Define the term free body diagram.
2. Define coplanar forces.
3. State Lami's theorem.
4. Define coefficient of Friction and limiting friction.
5. Define the term friction. How does it come into play?
6. Differentiate between kinematics and Kinetics.
7. State D' Alembert's principle.
8. Explain the principle of conservation of mechanical energy.
9. Define the following terms in relation to belt drives :  
  
Crowning of pulleys and creep.
10. What is Newton's law of gravitation?

### SECTION-B

11. State and derive Moment of Momentum Equation.
12. During a test, a rocket is travelling upward at 75 m/s, and when it is 40 m from the ground, its engine fails. Determine the maximum height reached by the rocket and its speed just before it hits the ground. While in motion, the rocket is subjected to a constant downward acceleration of  $9.81 \text{ m/s}^2$  due to gravity. Neglect the effect of air resistance.
13. A block of weight  $W_1 = 100 \text{ N}$  rests on an inclined plane and another weight  $W_2$  is attached to the first weight through a string as shown in figure 1. If the coefficient of friction between the block and plane is 0.3, determine the maximum and minimum values of  $W_2$  so that equilibrium can exist.



**FIG.1**

14. A uniform ladder weighing 80 N rests against a smooth vertical wall at a height of 12 m above the ground; the foot of the ladder being 10 m from the wall. Determine the pressure due to wall.
15. Describe the working of a Weston's differential pulley block.

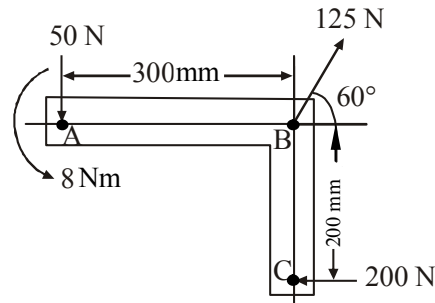
### SECTION-C

16. Setup the following expression for the flat belt drive.

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

Where  $T_1$  and  $T_2$  are the tensions on the tight and slack sides of the belt,  $\theta$  is the angle of contact and  $\mu$  is the coefficient of friction between the belt and the pulley.

17. An angle bracket has been subjected to three forces and a couple as shown in figure 2. Determine the resultant of this system of forces. Proceed to locate the points where the line of action of the resultant intersects line AB and the line BC.



**FIG.2**

18. A wheel of radius 0.5 m is turned to advance upon a right-handed screw of pitch 1 cm. At an instant, wheel is turned at a rotational speed of 2 rad/sec, determine the velocity and acceleration of the hand held at wheel. If the wheel was accelerated rotationally at  $0.6 \text{ rad/s}^2$ , what would be the velocity and acceleration of wheel?

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**