Code No: 111AC **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, November/December - 2015
ENGINEERING MECHANICS
(Common to CE, ME, MCT, MMT, AE, AME, MIE, PTE, CEE, MSNT, AGE)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.
Illustrate your answers with NEAT sketches wherever necessary

PART- A

(25 Marks)

1.a)	State and explain the law of equilibrium of two forces.	[2]
b)	Explain the Equilibrium of Spatial Systems.	[3]
c)	State the Laws of Friction.	[2]
d)	Describe the different types of flat belt drives.	[3]
e)	State the theorems of Pappus.	[2]
f)	What are the three Products of Inertia of a material body? Explain.	[3]
g)	What is Fixed Axis Rotation? Explain.	[2]
h)	Explain the curvilinear motion by rectangular component method.	[3]
i)	Distinguish between impulse and momentum.	[2]
j)	Explain the concept of Simple Harmonic Motion.	[3]

PART-B

(50 Marks)

2.a) State and prove Lami's theorem.

b) The block shown in Figure 1 is acted upon by its weight ***W***, a horizontal force ***F***, and the pressure ***P*** exerted by the inclined plane. The resultant ***R*** of these forces is parallel to the inclined plane. Determine ***P*** and ***R.*** Does the block move up or down the incline? [4+6]

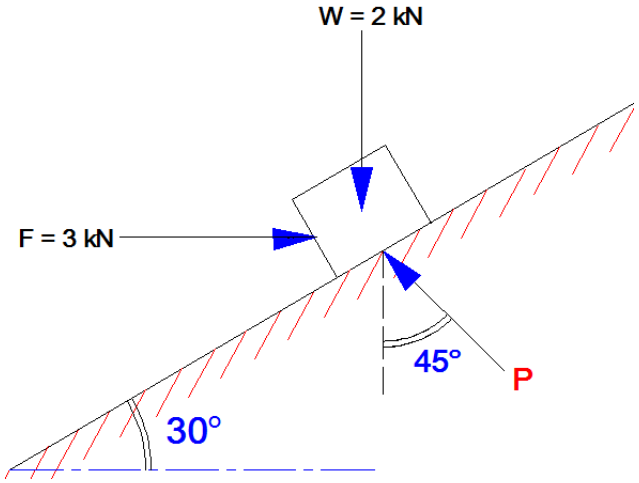

Figure: 1

OR

3. A 75 N vertical force is applied to the end of a bar 3 m long which is attached to a shaft at ***O*** as shown in figure 2. Determine:

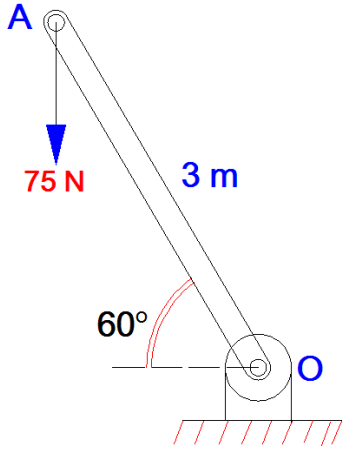

Figure: 2

a) The moment of the 75 N force about ***O***

b) The magnitude of the horizontal force applied at ***A*** which creates the same moment about ***O***

c) The smallest force applied at ***A*** which creates the same moment about ***O***

d) How far from the shaft at ***O*** a 200 N vertical force must act to create the same moment about ***O***? [10]

4. A screw jack is used to raise a load of 5 tonnes. The pitch of single start square threads used for the screw is 24 mm, and the mean diameter is 72 mm. Find the force to be applied at the end of a 1.2 m long handle when the load is lifted with constant velocity and rotates with the spindle. Take μ = 0.2. [10]

OR

5. The power transmitted by a belt drive is 18 kW. The diameter of one of the pulleys is 80 cm which runs at 300 rpm. The permissible stress in the belt material is 300 N/cm^2. Thickness of the belt =8 cm, μ = 0.3, and density of the belt material = 0.95 gm/cm^3. Determine the width of the belt required. [10]

6. A right circular cone made of steel has a height of 500 mm and a base diameter of 600 mm. A hole 150 mm deep and 200 mm diameter is drilled from the centre of the base of the cone and filled with lead. Lead weighs 11370 kg / m^3 and steel weighs 7850 kg / m^3. Determine the mass moment of inertia of the resulting solid *w.r.t.* its geometrical axis. [10]

OR

7. A homogeneous slender wire 300 mm long is bent in two right angles, as shown in figure 3. Determine the coordinates of its centre of gravity. [10]

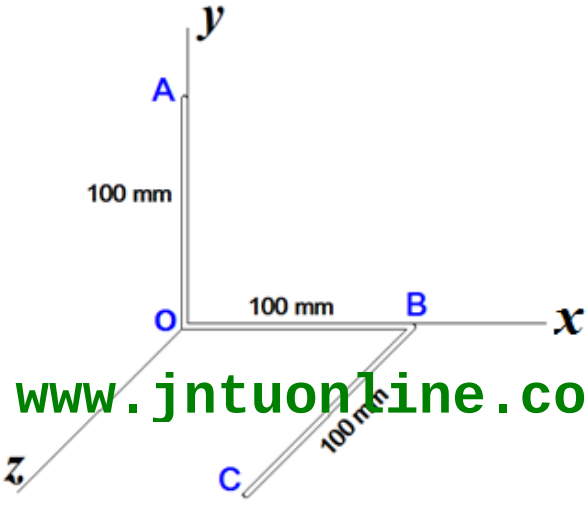

Figure: 3

8. A particle is thrown with an initial velocity of 10 m/s at an angle of 45^0 with the horizontal. If another particle is thrown from the same position at an angle of 60^0 with the horizontal, find the velocity of the latter for the following situations**:**
a) Both have same range
b) Both have same time of flight. [5+5]

OR

9. A homogeneous sphere weighing 200 N and of radius 15 cm is rolling down an inclined plane, as shown in figure 4. Determine the angular acceleration of the sphere and the linear acceleration of its mass centre, if $\mu = 0.2$. [10]

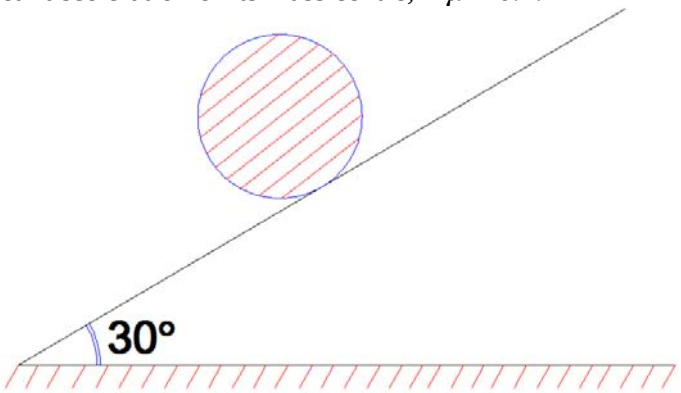

Figure: 4

10.a) Write the Work – Energy equations for translation of a particle.
b) After the block in figure 5 has moved 3 m from rest, the constant force **P** is removed. Find the velocity of the block when it returns to its initial position. Take $\mu = 0.2$. [4+6]

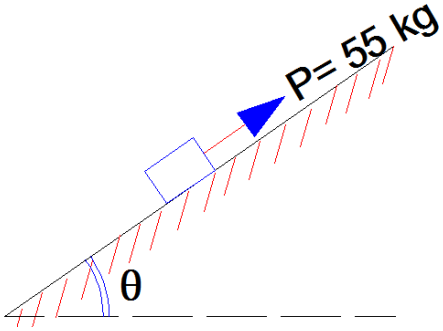

Figure: 5

OR

11.a) What is torsion pendulum? How does it produce torsional vibration?
b) A weight $W = 50$ kg is suspended from two springs in series, as shown in figure 6. If $k_1 = 5$ N/mm, and $k_2 = 3.5$ N/mm, compute the period of free vibration when W is placed vertically from its equilibrium position.. [4+6]

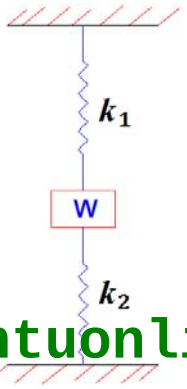

Figure: 6

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