Code No: 111AC **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, October/November - 2016
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 the Parallelogram law of forces. [2]
b) Explain the procedure to construct a free body diagram? [3]
c) What is the difference between Centroid and Centre of gravity? [2]
d) Define the terms:
Polar Moment of Inertia, Radius of gyration, and Mass Moment of Inertia. [3]
e) Distinguish between Rectilinear motion and Curvilinear motion. [2]
f) Explain the displacement – time equation and displacement – time diagram. [3]
g) What is the difference between Static Friction and Dynamic Friction? [2]
h) What is the effect of centrifugal tension on the power transmitted? [3]
i) State the work – energy theorem. What is its advantage? [2]
j) When will we get the maximum frequency of oscillations of the compound pendulum? [3]

PART-B

(50 Marks)

2.a) Explain the fundamental laws of mechanics.
b) Find the resultant of the given force system shown in figure 1? [5+5]

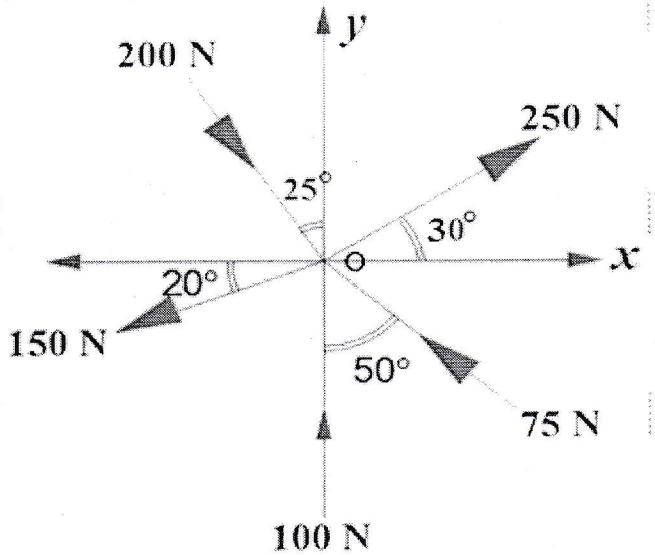

Figure: 1

OR

3.a) Forces of 2, 3, 4, 5 and 6 kN are acting at one each of the angular points of a regular hexagon towards the other angular points, taken in order. Find the resultant of the system of forces.

b) Write the equations of equilibrium of planar Systems. [6+4]

4. Determine the force ***P*** required to move the block A of weight 5000 N up the inclined plane, as shown in figure 2. The coefficient of friction between all the contact surfaces is 0.25. Neglect the weight of the wedge. [10]

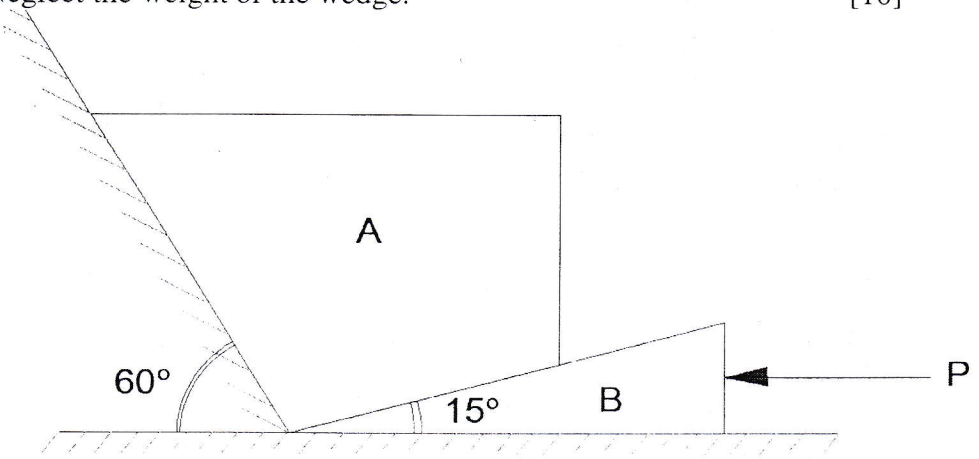

Figure: 2

OR

5.a) The pulleys of two parallel shafts 8 m apart are 60 mm and 800 mm in diameter, and are connected by a crossed belt. It is needed to change the direction of rotation of the driven shaft by adopting the open belt drive. Calculate the change in length of the belt.

b) Derive the condition for maximum power transmitted by a belt drive. [5+5]

6. Using the second theorem of Pappus, calculate the centroid of a semi –circular area of radius ***r***, if the volume of the sphere $V = \frac{4}{3}\pi r^3$. [10]

OR

7. Calculate the product of inertia I_{xy} for an angle – shaped plate shown in figure 3, if $m = 0.5$ kg, $a = 150$ mm, and $h = 25$ mm. [10]

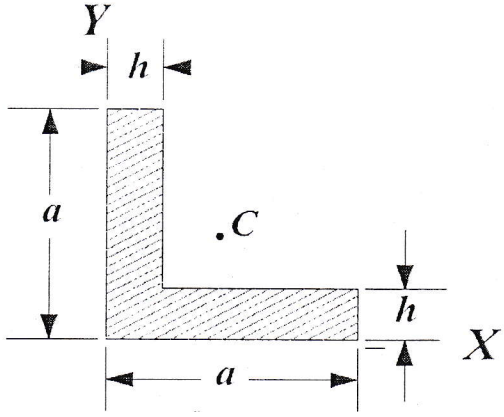

Figure: 3

8. A small grinding wheel is run by an electric motor with a rated speed of 3000 rpm. When the power is put on, the motor reaches its rated speed within 4 s, and when the power is put off, the unit comes to rest in 60 s. Assuming uniform acceleration and uniform retardation, determine: a) the angular acceleration of the wheel, b) the angular retardation of the wheel, and c) the total number of revolutions made by the wheel in reaching its rated speed and in coming to rest. [10]

OR

9. An 8 kg drum of a washing machine, shown in figure 4 has a radius of gyration of 180 mm. If the drum is subjected to a moment $M = 3\theta$ N – m, where θ is in radians, determine the angular velocity of the drum when it undergoes two revolutions. Also, compute the reactions which the fixed pin *A* exerts on the drum during the motion. [10]

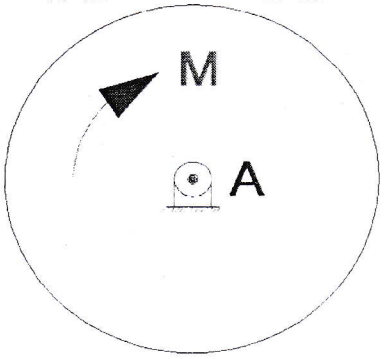

Figure: 4

10. A 45 kg body moves along the two inclines, shown in figure 5, for which the coefficient of friction is 0.2. The incline **AB** is 30 m long, while the length of **BC** is not known. If the body starts from rest at **A** and slides 30 m down the incline **BA**, how far will it then move along the other incline? What will be its velocity when it returns to **B**? [10]

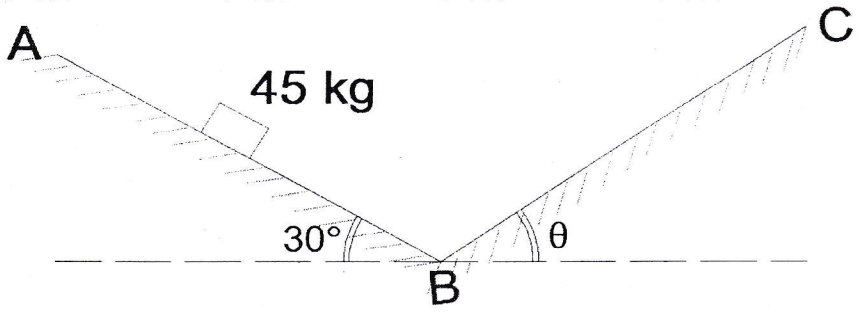

Figure: 5

OR

11.a) What is simple harmonic motion? Explain.

b) A simple pendulum is suspended from the roof of an elevator which is accelerating at a m/s^2. Assuming that the vibrations are small, determine the period of the pendulum when the elevator is (i) accelerating upward, (ii) accelerating downward, and (iii) falling freely. [4+6]

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