Code No: 131AE **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year I Semester Examinations, December – 2019/January - 2020
ENGINEERING MECHANICS
(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, MMT, AE, MIE, PTM, CEE, MSNT)

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.

PART- A

(25 Marks)

1.a) Explain different types of force systems. [2]
b) When two forces A and B are mutually at right angles, their resultant is 10 KN. When they are inclined at 60^0, the resultant is $5\sqrt{6}$ KN. Find the individual magnitude of forces. [3]
c) What is the efficiency of a screw jack? [2]
d) Differentiate between static friction and kinetic friction. [3]
e) What is Radius of Gyration? [2]
f) State the theorems of Pappus and Guldinus. [3]
g) What is mass moment of inertia of thin rectangular plate of base *b*, height *h*, and mass density ρ. [2]
h) Explain transfer formula (or) parallel axis theorem for mass moment o inertia. [3]
i) Differentiate between kinetic energy and potential energy. [2]
j) A constant force of 30 N magnitude acts horizontally on a body of 10 Kg mass moving at 5 m/s. determine its displacement and velocity after 3 seconds. [3]

PART-B

(50 Marks)

2.a) State and prove Lami's theorem.
b) Coplanar system of force is acting on a flat plate as shown in figure 1. Determine i) the resultant and ii) x and y intercepts of resultant. [4+6]

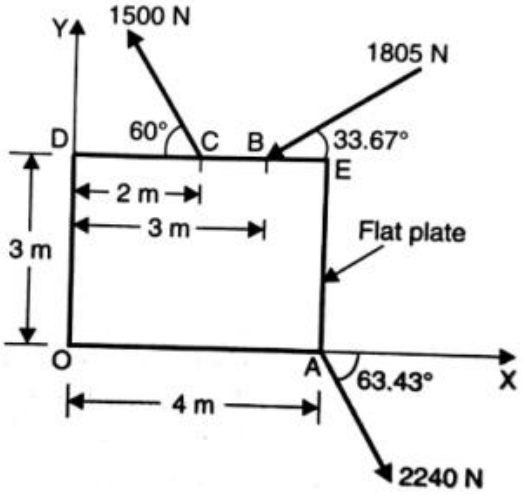

Figure: 1
OR

3. Two smooth cylinders are placed in a channel as shown in figure 2. The weight of smaller cylinder is *W* and that of larger cylinder is 3*W*. Determine contact forces at points *A*, B, *C* and *D*. take *W*=10 KN. [10]

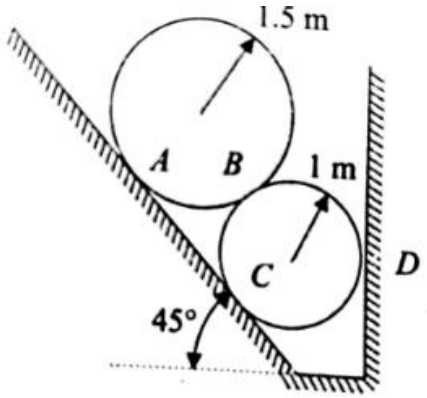

Figure: 2

4. The bodies shown in figure 3 are separated by a uniform strut weighing 100 N which is attached to the bodies with frictionless pins. The coefficient of friction under each body is 0.30. Determine the value of horizontal force P that will start the system rightward. [10]

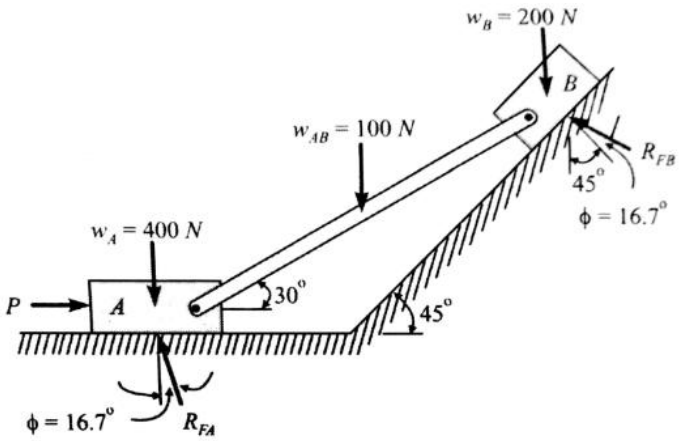

Figure: 3

OR

5. Determine the force P required to start the wedge up the wall shown in figure 4. The angle of friction of all contact surfaces is 15^0. [10]

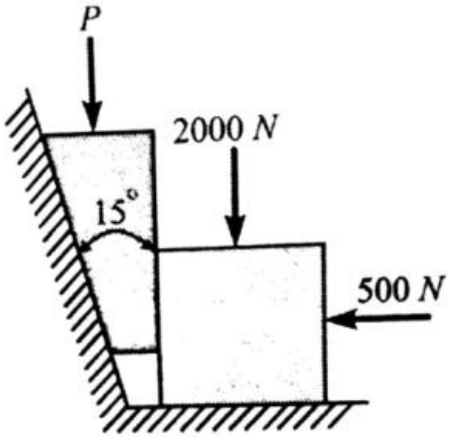

Figure: 4

6.a) Determine the location of parabolic spandrel as shown in figure 5.

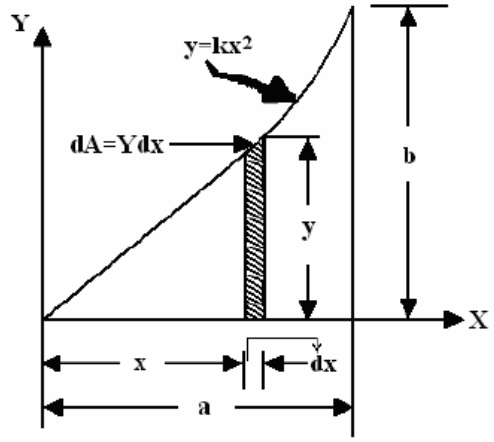

Figure: 5

b) State and prove perpendicular axis theorem for area moment of inertia. [6+4]

OR

7. For a plane section shown in figure 6, determine the area moment of inertia about horizontal and vertical centroidal axes. [10]

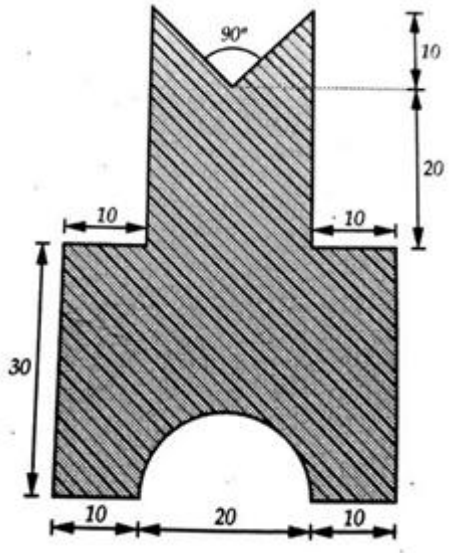

Figure: 6

8. Determine the mass moment of inertia of cone of base radius *R*, height *h*, and mass density ρ about its geometric axis. [10]

OR

9. Determine the polar mass moment of inertia of a circular ring of mean radius *R* and mass *M*. [10]

10. A block of 2 kg mass rests on a rough horizontal surface, whose coefficient of kinetic friction is 0.2. It is acted by a horizontal force of 10 N for 5 sec and then it is removed. Determine how far it would travel before coming to rest, assuming the frictional resistance to be uniform. Also, determine the total distance travelled from rest. [10]

OR

11.a) Two bodies A and B are connected by a thread and move along a rough horizontal plane (μ = 0.3) under the action of force of 400 N applied to the body B. Determine the acceleration of the two bodies and tension in the thread using D'Alembert's principle.

b) State work - energy principle. [7+3]

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