Reg. No. : ....

Name : ....

Combined First and Second Semester B.Tech. Degree Examination, May 2015
(2013 Scheme)
13.105 : ENGINEERING MECHANICS (ABCEFHMNPRSTU)

Time : 3 Hours

Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Explain clearly how there are 3 independent conditions of equilibrium for concurrent force systems.

2. Distinguish between static friction and dynamic friction.

3. State and explain the theorems of Pappus and Guldinus.

4. State and illustrate D'Alembert's principle to plane motion.

5. Distinguish between centrifugal and centripetal forces. **(5×4 = 20 Marks)**

PART – B

Answer **one full** question from **each** Module. **Each** question carries **20** marks.

Module – I

6. Two smooth circular cylinders each of weight 100 N and radius 15 cm are connected at their centres by a string AB of length 40 cm and rest upon a horizontal plane as shown in figure 1. The cylinder above them has a weight of 200 N and radius 20 cm. Find the force in the string AB and the pressure produced in the floor at the point of contact D and E.
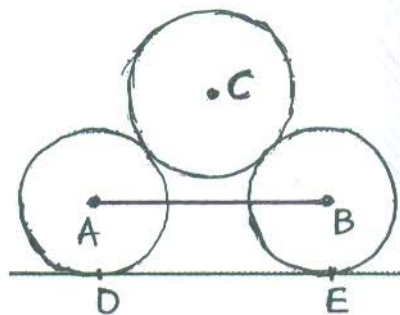

Figure 1

7. A telegraph pole assumed to have no force bending it out of vertical has five sets of horizontal wires radiating from it, viz, the first due North, the second 75° West of North, the third 15° South of West and the fourth 30° East of South. The tensions of these four sets of wires are 100 N, 60 N, 80 N and 120 N respectively. Find the direction of the fifth set of wires and its tension.

Module – II

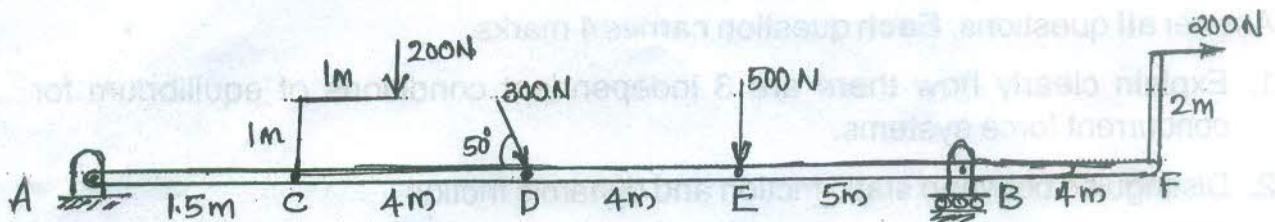8. Find the Support reactions.

Fig. 2

9. A block A weighing 2500 N resting on a horizontal surface supports a block B weighing 1000 N as shown in Fig. 3. Block B is connected to a string which is attached to a vertical wall. Find the horizontal force P which should be applied on block A so as to just move it towards left. Coefficient of friction = 0.35 for all contact surfaces. Find also the tension in the string.
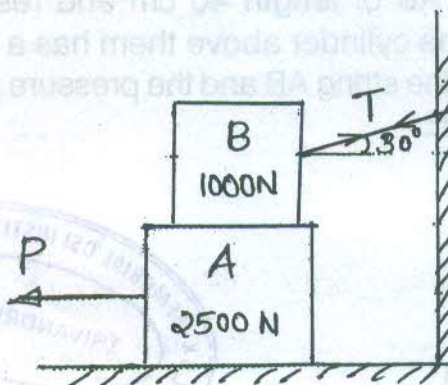
Fig. 3

Module – III

10. a) State and explain the laws of rotary motion.

    b) An elevator weighing 7000 N is ascending with an acceleration of 4 m/s². During this ascend its operator whose weight is 700 N is standing on the scales placed on the floor. What is the scale reading ? What will be the total tension in the cables of the elevator during this motion.

11. Three perfectly elastic balls A, B and C of masses 2 kg, 6 kg and 12 kg are moving in the same direction with velocities 12 m/s, 4 m/s and 2 m/s respectively. If the ball A strikes with the ball B, which in turns, strikes with the ball C, prove that the balls A and B will be brought to rest by the impact.

Module – IV

12. A uniform spherical ball of mass 'm' and radius 'r' is projected along a rough horizontal plane with an initial linear velocity of V_0 and zero angular acceleration. The coefficient of friction between the ball and the plane is μ . Determine the time after which the ball will start rolling without sliding. Also find the linear and angular velocities of the ball at the time.

13. When a cyclist is riding west at 24 km/hour, he finds the rain meeting him at an angle of 45° with the vertical. When he rides at 16 km/hr he meets the rain at angle of 30° with the vertical. What is the actual velocity in magnitude and direction of the rain ?

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