



Reg. No. : .....

Name : .....

**Combined First and Second Semester B.Tech. Degree Examination,  
April 2014  
(2013 Scheme)  
13.105 : ENGINEERING MECHANICS (ABCEFHMNPRSTU)**

Time : 3 Hours

Max. Marks : 100

**PART – A**

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

1. State and prove Varignon's theorem.
2. State the laws of Coulomb friction.
3. State and prove Parallel axis theorem.
4. Distinguish between direct and indirect impact.
5. What is instantaneous centre for combined motion of rotation and translation of a rigid body ? **(5×4=20 Marks)**

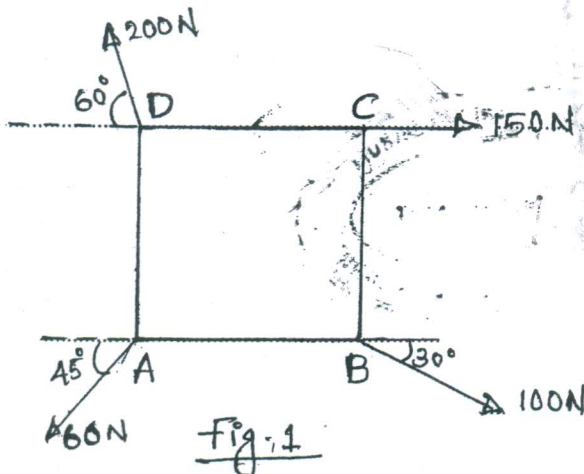


**PART – B**

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

**Module – I**

6. Forces shown act at the four corners of a square ABCD of 60 cm side. Calculate the magnitude, direction and position (relative to corner B) of their equilibrant.

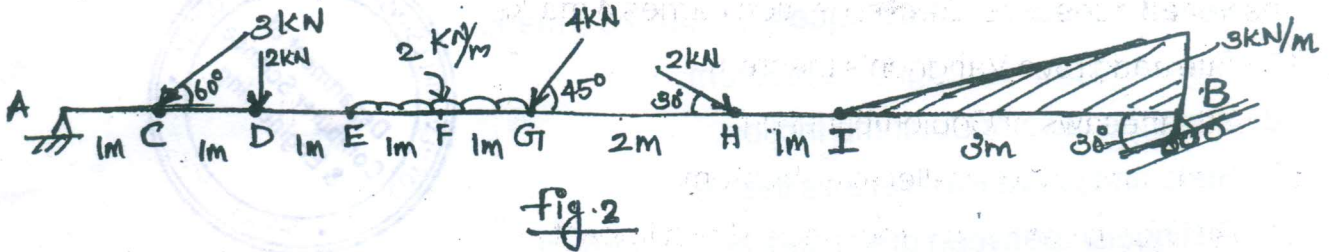




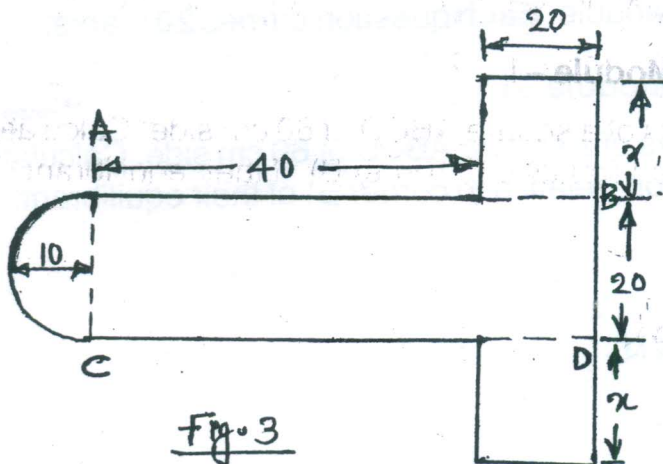
7. Three equal weightless strings are knotted together to form an equilateral triangle ABC and a weight  $W$  is suspended from A. If the triangle and weight be supported with BC horizontal by means of two strings at B and C, each at the angle of  $135^\circ$  with BC, show that the tension in BC is  $\frac{W}{6}(3 - \sqrt{3})$ .

### Module - II

8. Find the support reactions analytically.



9. Find the value of 'x', so that the centre of gravity of the uniform lamina shown in fig. 3 remains at the centre of the rectangle ABCD.





### Module – III

10. An elevator weighs 2500 N and is moving vertically downwards with a constant acceleration. Write the equation for the elevator cable tension. Starting from rest it travels a distance of 25 m during an interval of 15 seconds. Find the cable tension during this time. Neglect all other resistance to motion.
11. An inelastic ball of mass  $m_1$  is dropped from a height  $h$  above ground and at the same time a second inelastic ball of mass  $m_2$  is projected upwards vertically from the ground to meet the first ball. If immediately after the collision the two balls are at rest, show that the velocity of projection of the second ball is given

by  $\sqrt{\left(\frac{m_1 + m_2}{m_2}\right)gh}$ .



### Module – IV

12. A body is moving with simple harmonic motion and has an amplitude of 5 m and period of complete oscillation as 4 sec. Find the time required by the body in passing between two points which are at a distance of 3 m and 2 m from the centre and are on the same side.
13. A cylinder of mass 'm' and radius 'r' resting on an inclined plane is released from rest and rolls down the inclined plane without slipping. Determine : a) the acceleration of its centre of mass b) the maximum angle  $\theta$  of the inclined plane for which the body will roll without slipping c) the maximum velocity of the centre of the cylinder after it has rolled a distance of 1 m. Assume the coefficient of static friction  $\mu = 0.192$ .