LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**B.Sc.** DEGREE EXAMINATION – **MATHEMATICS**

FIFTH SEMESTER – NOVEMBER 2012

# MT 5506/MT 4501 - MECHANICS - I

 Date : 03/11/2012 Dept. No. Max. : 100 Marks

 Time : 9:00 - 12:00

 **PART – A**

**Answer ALL questions: (10 x 2 = 20 marks)**

1. State the conditions for equilibrium of a system of concurrent forces.
2. State the law of parallelogram of forces.
3. Define torque of a force.
4. State any two laws of friction.
5. Find the resultant of two velocities 6 mt/sec and 8 mt/sec inclined to each other at an angle

of 30.

1. Define angular velocity.
2. Define momentum.
3. State the principle of conservation of linear momentum.
4. Define range of flight for a projectile.
5. Define the coefficient of elasticity.

**PART – B**

**Answer any FIVE questions: (5 x 8 = 40 marks)**

1. State and prove Lami’s theorem.
2. A uniform plane lamina in the form of a rhombus one of whose angles is 120° is supported by two forces of magnititudes P and Q applied at the centre in the directions of the diagonals so that one side is horizontal. Show that if P > Q, then P2 = 3Q2.
3. State and prove Varignon’s theorem on moments.
4. Two particles weighing 2 kg and 1 kg are placed on the equally rough slopes of a double inclined plane whose inclinations with the horizontal are 60° and 30° respectively. The particles are connected by a light string passing over a smooth pulley at the common vertex of planes. If the heavier particle is on the point of slipping downwards, show that the coefficient of friction is 
5. A particle is dropped from an aeroplane which is rising with acceleration f and t secs after this; another stone is dropped. Prove that the distance of between the stones at time t’ after the second stone is dropped is .
6. Two particles of masses m1 and m2 (m1 > m2) are connected by means of light inextensible string passing over a light, smooth, fixed pulley. Discuss the motion.
7. Show that when masses P and Q are connected by a string over the edge of a table, the tension is the same wheter P hangs and Q is on the table or Q hangs and P is on the table.
8. Two balls impinge directly and the interchange their velocities after impact. Show that they are perfectly elastic and of equal mass.

**PART – C**

**Answer any TWO questions: (2 x 20 = 40 marks)**

1. a) Two strings AB and AC are knotted at A, where a weight W is attached. If the weight

 hangs freely and in the position of equilibrium, with BC horizontal,

 AB : BC : CA = 2 : 4 : 3, show that the tensions in the strings are 

 b) A system of forces in the plane of Δ ABC is equivalent to a single force at A, acting

 along the internal bisector of the angle BAC and a couple of moment G1. If the moments

 of the system about B and C are respectively G2 and G3, prove that (b+c) G1 = bG2 + cG3.

(10 + 10)

1. a) Two unlike parallel forces P and Q (P>Q) act at A and B respectively. Show that if the

 direction of P be reversed, the resultant is displaced through the distance .

 b) A particle moving in a st. line is subject to a resistance KV3 producing retardation

 where v is the velocity. Show that if v is the velocity at any time t when the distance is

 s,  and  where u is the initial velocity. (10 + 10)

1. Derive the equation to the path of the projectile in the form 
2. A particle falls under gravity in a medium where the resistance varies as the square of the velocity. Discuss the motion.

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