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**m<uq jdr mÍCIKh - 2021**

**First Term Examination - 2021**

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**COMBINE MATHS – II**

**Answer all the questions of Part A and any five questions of Part B.**

**Part - A**

01. In a motor car race a car A is 600 m from the finishing point and its travelling with a velocity 60ms-1, with uniform acceleration ms-1. Find the time taken to finish the race.

02. Two forces P and Q act at a point and are such that it the direction of one force is reversed, the resultant R, turned through a right angle. Show that P=Q.

03. Two uniform smooth spheres each of radius -*a* and weight *w* lie at rest touching each other inside a fixed smooth hemisphere bowl of radius 3*a*. Show that the reaction between two spheres is

04. A particle is projected with a velocity from a fixed point O. Its horizontal and vertical velocity components are U and . Where and U are positive constant. Find the horizontal range of the particle in terms of and U.

A

B

05. A particle A of mass m and particle B of mass km are attached

to the two ends of a light inextensible string which passes over

a smooth fixed pulley. The system is released from rest,

with the string taught, as shown in the figure. The particle

A moves downwards with the acceleration .

Show that

06. A stone is dropped vertically downward from the top of a tower. When it travelled x meters, another stone is dropped from a point which is y meters below the top of the tower. Both stones hit the ground at the same time. Show that the height of the tower is

07. Let and , where t is a constant. Find the value of t, Such that

and are perpendicular to each other.

08. A particle of mass 6kg is attached to one end of a light inextensible string and its other end is suspend from a point A, the string is held inclined at angle to the horizontal by means of a horizontal force applied to the particle. If , Find the value of the force applied to the particle and the tension in the string.

09. A uniform ladder rests on a rough floor and against an equally rough vertical wall, the coefficient of friction beging both wall and the floor. Show that, the inclination of the ladder to the wall is twice the angle of friction.

10. The velocity of two particles A and B are and respectively. The velocity of A relative to B is . Find the values of p and q.

**Part – B**

11. (a). Two trains P and Q travel by the same route from rest at station A to rest at station B. Train P has constant acceleration for first third of the time, constant speed fro the second third and constant retardation for last third of the time. Train Q has constant acceleration for the first of the distance, constant retardation for the last third of the distance.

i. Sketch the v – t graphs for the motion of P and Q separately.

ii. Hense or otherwise, show that the times taken by the two trains P and Q are in the ratio

(b). Relative to the ship S1 , which is travelling due north at a speed of 20kmh-1, the velocity of speed boat is in the direction 45o east of north. Relative to a second ship S2 which is travelling due south at a speed 20 kmh-1 the velocity of the boat is 30o, east of north.

Show that the direction of the speed boat is , east of north.

12. (a). A particle is projected from the origin O with a velocity V and an angle to the horizontal, and it is passing through a point

Show that,

A particle is projected from a point on the ground so as to pass first over a vertical wall of height h, at a horizontal distance “*a*” from the point of projection. Show that its strikes the ground at a distance beyond the wall, U being the horizontal velocity component.

(b). A smooth wedge of mass M and an angle is kept on a smooth horizontal plane. A particle of mass m is projected up the face with a velocity U.

i. Show that the reaction between the particle and the wedge is

ii. If = and the particle returns back to the point of projection after a time T, then show that,

T =

13. (a). One end of a uniform rod of weight w is hinged to a wall and the other end is supported by an inextensible string. The rod and the string are inclined at the same angle to the horizontal. Show that,

i. The tension in the string is .

ii. The reaction at the hing is .

(b). A beam whose centre of gravity divides it into two portion *a* and b, is placed inside a smooth sphere. If be the inclination to the horizontal in all position of equilibrium and 2 be the angle subtended by the beam at the centre of the sphere, the show that,

14. (a). i. The position vectors of the points A, B, C and D are , , and respectively. If p and q are constants and ABCD is a parallelogram.

Find the values of p and q.

Also find the angle AC.

ii. If and are perpendicular vectors then prove that .

(b). Forces of magnitude 3F, 7F, F, 2F, mF and nF act along the sides

and of a regular hexagon ABCDEF.

Find the values of m and n if,

i. The six forces reduce to a couple

ii. the system reduces to a single force along AD.

15. (a). The rhombus ABCD is formed by joining freely, four uniform rods AB, BC, CD and DA each of length 2*a* and weight W, at the points A, B, C and D. The system is suspended from A and kept in equilibrium by a light rod BD. If AC = then show that,

i. reaction at the joint C is Cot

ii. the thrust in rod BD is .

2 W

A

B

C

D

30o

30o

(b).

The framework is formed by joining five light rods AB, BC, CD, AD and AC and rests in a vertical plane on smooth supports at B and D at the same horizontal level. A weight of 2W carries at A.

Draw a stress diagram, using Bow’s notations determine the stress in each rod indicating whether they are tensions or thrusts.

16. A uniform rod AB of length 4*a* and weight W rests with one end on level ground and leans against a cylinder of radius *a*, such that the point of contact between the rod and the cylinder is uniform and of weight W, and rest on the ground with its axis perpendicular to the vertical plane.

i. Find the frictional forces and the normal reactions each point of contact.

ii. If is the coefficient of friction at each point of contact show that for equilibrium to be possible if,

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