

13 fY%aKsh

GRADE 13

E

meh

Hour

I

**m<uq jdr mÍCIKh - 2020**

**First Term Examination - 2020**

ixhqla; .Ks;h - »»

**COMBINED MATHS – II**

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

**Part - A**

01. When the train **X** is passing the station **A** with a constant velocity **V**, another train **Y** is starting from rest moving with the constant acceleration **f** reaches maximum velocity **V**, and then it travels with constant velocity **V**, in a certain time and finally stops at the station **B**, retardation **f**. At this time train **X** is moving with the velocity **V** in a certain time and is then uniformly retards with a retardation **f** to stop train at **B** train **X** comes to the station **t** seconds after **Y**.

Draw velocity time graphs for **X** and **Y** in the same diagram. Hence show that **t =**

02. Two smooth spheres of weight **W** and radius **r** are inside a smooth hemisphere of radius **R (R > r)** touching each other. Draw a force diagram and using the triangle of forces, find the reactions between the spheres.

03. A man can swim with a speed **V** in still water and a river of width **d** flows with a speed **U (V > U)** relative to the earth. The man is at a point on one side of the bank of the river and wishes to swim to point opposite side of the other bank. Find the minimum time for it.

04. If two pair of opposite edges of a tetrahedron are at right angles. By using the scalar produce of the vectors, prove that the third pair is also at right angle.

05. **ABC** is an equilateral triangle and the forces. **3p , 4p** and **5p** act along the sides respectably. Find the resultant of the forces. Also find the distance from **A**, where the line of action of the resultant cuts **BC**.

06. Prove that, there are two possible angles for the motion of a projectile for given velocity and the given horizontal range.

07. Uniform rod **AB** of weight **W** and length **2*a*** is kept with end **B** against a rough wall and other end **A** on a rough horizontal ground, the rod is on the point of slipping. The coefficient of friction at **A** and **B** are show that the inclination of the rod to the vertical is **tan-1 =** where **()**

08. Prove by a vector method the midpoints of the sides of a quadrilateral are the vertices of a parallelogram.

09. One end of a light inextensible string passes over

P

O

Q

3g

2g

a smooth fixed pulley carries a particle **P** of mass **2kg**.

The string passes under a smooth pulley of mass **3kg**.

The other end of the string is attached to the ceiling at **O**.

The system moves freely under gravity. Find the

acceleration of particle **P** and the tension in the string.

10. An inextensible string of length **l**  is fixed at one end **A** and carries at its other end **B** a particle of mass **m**, which is rotating in a horizontal circle whose centre is **l cos**  vertically below **A**, will a constant angular velocity **W**. Prove that

**Part – B**

11. A balloon is released from a points **O** on the grounds at **t = 0**, is moving with uniform acceleration **f** vertically upward. When **t = T** a stone is projected with a velocity **U** vertically upward to touch the balloon gently.

Show **U = T (f + )**

Find the distance from the grounds when the stone is at its maximum height.

12. **A, B** and **C** are three airport. **O** is situated such that **OA = OB = OC = am** and **AB = BC = CA** respectively. A plane can flies in still air with a velocity **U**. A wind blows with a velocity **Vms-1 (V < u)** in the direction of **OA**. The plane flies from **A to B**, then **B to C** and finally **C to A** show that the time taken to the which journey is **2a**

13. Let **O, A, B** and **C** be four points on a plane and

when and are non-parallel vectors.

i. Express and in terms of **,**

ii. Find the value of , when **A, B** and **C** are collinear.

(b). **ABC** is an equilateral triangle of side **2m**. The middle points of **AB, BC** and **CA** are **L, M, N** respectively forces of Newton **1, 2, 3, P, Q** and **I** act along respectively show that the system of force are not in equilibrium.

i. If the system of forces reduce to a couple them show that **P = 2** and **Q = 3**

ii. If the system of forces reduces to a single force, passing through the point **N** then show that **Q = 5**

14. (a). **A, B** and **C** are smooth similar equal cylinder of weight **W**. **A** and **B** are rest

simultaneously upon two smooth inclined planes of inclination to the horizontal. The planes which meet in horizontal line ***l*** each cylinder **C** is kept on **A, B** Axis of each cylinder are parallel to the line ***l***. Find the reaction between **A** and **B**. Show also that, if  then the cylinder are not topple.

(b). A uniform rod **AB** of weight **W** is at rest inclined at an angle **30o** with the end **A** in contact with a rough horizontal surface. The coefficient of friction between the rod and the surface is . A light inextensible string tied to the end **B** and the other end of the string is fixed to a point **p**, above **B**. The string makes an angle **60o** to the horizontal. If **A** and **P** are on the same side at the vertical line passing through **B**, then show that  **>**

15. A bomb explodes at a height h from the ground and its debris are thrown in every direction, with a velocity of Show that the debris fall twice at **t1** and **t2 (t2 > t1)** a horizontal distance **d** from the point vertically below the point of explosion, if **d < 2**  Show also that the time interval between then occasions **is t2 – t1 2**

16. A smooth wedge of inclination is placed on a smooth horizontal table. An inextensible light string of length **2*l***, to the extremities of which masses **M** and **M1 (M > M1)** are attached, passes round a smooth peg **P** which projects from the inclined upper face of the wedge. Initially the particles are close to each other at a distance ***l*** from the peg, each portion of the string being taut and lying on a line of greatest slope of the inclined face. Prove that the acceleration of the wedge before the light particle **M1** reaches the peg is,

P

M

M1

M

where **M** is the mass of the wedge.

Also to be assumed that the distance of the peg **P** from the bottom edge of the wedge is greater than **2*l***

Deduce that when the particle **M1**reaches the peg **P**, the wedge has travelled a distance on the table.

17. A particle rests at a point **A** on the smooth outer surface of a horizontal circular cylinder. It is projected with a velocity **U** along the tangent to the cylinder on a plane perpendicular to its axis, The point **A** is at a height **h** above the level of the axis of the cylinder. Show that the particle leaves the surface immediately if **U2 > gh**, but it **U2 < gh** it leaves the surface at a depth of  from the level of **A**

Further, show that the velocity of the particle at the instant it leaves the surface is