UNIVERSITY OF GUJRAT

A WORLD CLASS UNIVERSITY

(B.A/B.Sc. Part-I)

Mathematics B-Course (Paper-II)

Roll No: _____

Time Allowed : 3 hrs
Max. Marks : 50
Pass Marks : 33%

Attempt **FIVE** Questions in all. Select **TWO** Questions from **Section-A** and **THREE** from **Section-B.**

Section-A

1- a) By vector method prove the Sine Law of Trigonometry. 5

b) Show that $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$ 5

2. a) Differentiate $\frac{\vec{r} \times \vec{a}}{\vec{r} \cdot \vec{a}}$ where $\vec{a}$ is a constant vector 5

b) Determine a vector which has $2\cos 2t\,\hat{i} + 2\sin 2t\,\hat{j} + 4\hat{k}$ as its derivative and $\hat{i} + \hat{j} + \hat{k}$ as the value at t = 0. 5

3- a) If vector function $\vec{f} = (x + 3y)\hat{i} + (x - 2z)\hat{k} + (y - 2z)\hat{j}$ then find div $\vec{f}$. 5

b) Show that curl $(\vec{a} \times \vec{r}) = 2\vec{a}$ where $\vec{a}$ is a constant vector 5

Section-B

4- a) How would you calculate the magnitude and direction of the resultant of two concurrent forces $\vec{P}$ and $\vec{Q}$? 5

b) Three forces P, Q, R acting at a point are in equilibrium. The angle between P and Q is double of the angle between P and R Prove that $R^2 = Q(Q - P)$. 5

5- a) The smallest force which can support a body of weight W on a smooth inclined plane is of magnitude P. Show that the horizontal force necessary to support the same body on the same plane has magnitude $\frac{PW}{\sqrt{W^2 - P^2}}$. 5

b) AB and AC are similar uniform rods of weight W and length b, smoothly joined at B and fastened at A to a smooth ring sliding on AC. The system is hung on a smooth pin at A. Show that rod AC makes with the vertical an angle $\tan^{-1}\frac{b}{a + \sqrt{a^2 - b^2}}$ as tan . 5

6- a) A small ring of weight w can slide freely upon a smooth thin rod AB, attached to end A of the rod is a string which passes through a small smooth ring at B and supports a weight W. If the rod is vertical. Find the tension on the string and the pressure between the rod and the string. 5

b) A rod 4 ft long rests on a rough floor against the smooth edge of table of height 3 ft. If the rod is on the point of slipping when inclined at an angle of 60° to the horizontal. Find the coefficient of friction. 5

7- a) Find C.G of a uniform right circular solid cone. 5

b) Find C.G of the area of $x^{2/3} + y^{2/3} = a^{2/3}$ between two consecutive cusps. 5

8- a) Define Virtual Work and Workless Constraints. Write down any three workless constraints. 5

b) A uniform rod of length 2a rests in equilibrium against a smooth vertical wall and upon a smooth peg distant b from the wall, the rod is inclined to the wall at an angle $\sin^{-1}\left(\frac{b}{a}\right)^{1/3}$. 5