Bangladesh University of Business and Technology (BUBT)

Faculty of Engineering and Applied Sciences

Department of Mathematics and Statistics

B.Sc. Engg. in CSE Regular Program

Midterm (Online) , Fall 2021-22

Course Title: Coordinate Geometry and Vector Calculus

Course Code: MAT 111

Course Teacher: Md. Faishal Badsha (MFB)

Submission Time: Jan.07 , before 06:00 p.m **Intake:47** **Full marks: 40**

Answer all the questions. The number in the square bracket at the right-hand side indicates the full marks. Please attach your answer script in pdf format in Google classroom.

Use α=11th and β=10th digit of your ID

CO1	1.	a.	Convert the scalar $\vec{F} = x^{(2+\alpha)}y^3z^{(4+\beta)}$ and $\vec{G} = xy^{(5+\beta)} - 3z^3$ into vector and then prove that the perpendicular vector which is perpendicular both the converted vector is solenoidal	**[05]**
		b.	Prove that $\nabla^2 r^n = n(n+1)r^{n-1}$, Where n is constant.	**[05]**
CO1	2.	a.	Suppose $\vec{A} = x^{(2+\alpha)}y^{(3+\alpha)}z^{(4+\beta)}\hat{\imath} - 2xz^{(3+\beta)}\hat{\jmath} + x^{(4+\alpha)}z^3\hat{k}$ and $\vec{B} = 2z\hat{\imath} + y^2\hat{\jmath} - x^4\hat{k}$.Find $\frac{\partial^5}{\partial x^2 \partial z^2 \partial y}(\vec{A} \times \vec{B})$ at (1+ α, 0- α, $-2-\beta$).	**[05]**
		b.	Find the directional derivative of the function $P = 10^{\alpha x - y + z}$ in the direction toward the line joining the points $(\alpha+1, -2, -\beta-3)$ and $(1, -2, 4)$	**[05]**
CO3	3.	a.	Find the total work done in moving a satellite in the force field is given by $\vec{F} = \alpha yz\hat{\imath} + zx\hat{\jmath} + \beta xy\hat{k}$ along the orbit C given by $x = \cos t^5$, $y = \sin t^2$, $z = t^4$ from $t = 0$ to $= \pi$	**[05]**
		b.	Suppose $\vec{A} = (3x+y)\hat{\imath} - x\hat{\jmath} + (y-2)\hat{k}$ and $\vec{B} = 2\hat{\imath} - 3\hat{\jmath} + \hat{k}$. Evaluate $\oint_c (\vec{A} \times \vec{B}) \times d\vec{r}$ around the circle in the yz-plane having center at the origin and radius of 3.	**[05]**
CO3	4.	a.	An un identified flying object(UFO) moves along a curve whose parametric equations are $x = 2t^{(4+\beta)}$, $y = t^{(2+\alpha)} - (4+\alpha)t$, $z = -t - 5$ where t is time. Find the component of its velocity and acceleration at time $t = 4$ in the direction toward the line joining the points $(\alpha+3, 2, \beta+5)$ and $-3, \alpha-1, -\beta+6)$	**[05]**
		b.	Suppose an electric bulb emit light as an scalar field defined by $L = 4x^{(\alpha+3)}y^{(\alpha-7)}z^8$ Find the rate of change of light along X, Y and Z- axes at point $(\alpha-6, 8+\beta, -5)$	**[05]**