ABES Engineering College, Ghaziabad

Department of Applied Sciences & Humanities

Session: 2023-24 **Semester: I** **Section: All**

Course Code: BAS-103 **Course Name: Engineering Mathematics-I**

Assignment 5

Date of Assignment: **Date of submission:**

S.No.	KL	CO	PI	Question	Marks
1	K3	CO5	1.2.1, 1.3.1, 2.1.3, 2.4.1	Find the directional derivative of $\frac{1}{r^2}$ in the direction $\vec{r}$ of where $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$.	5
2	K3	CO5	1.2.1, 2.2.5, 2.1.3, 2.4.3	Show that $\vec{A} = (6xy + z^3)\hat{i} + (3x^2 - z)\hat{j} + (3xz^2 - y)\hat{k}$ irrotational . Find the velocity potential $\emptyset$ such that $\vec{A} = \vec{\nabla}\emptyset$.	5
3	K3	CO5	1.3.1, 2.2.3, 2.4.2	Find the directional derivative of $\vec{\nabla}.(\vec{\nabla}\emptyset)$ at the point $(1,-2,1)$ in the direction of the normal to the surface $xy^2z = 3x + z^2$,where $\emptyset = 2x^3y^2z^4$.	5
4	K3	CO5	2.2.4, 2.2.5, 2.3.2, 2.4.1	Find the work done in moving a particle in the force field $\vec{F} = 3x^2\hat{i} + (2xz - y)\hat{j} + z\hat{k}$ along the curve defined by $x^2 = 4y, 3x^3 = 8z$ from $x = 0$ to $x = 2$.	5
5	K3	CO5	2.2.5, 2.3.2, 2.4.2, 2.4.3, 3.3.2,	Verify the divergence theorem for $\vec{F} = (x^3 - yz)\hat{i} - 2x^2y\hat{j} + 2\hat{k}$ taken over the cube bounded by the planes $x = 0, x = a, y = 0, y = a, z = 0, z = a$.	5
6.	K3	CO5	5.1.1, 10.1.2, 2.4.3,	Verify Green's theorem in the plane for $\int_C [(xy + y^2)dx + x^2dy]$, where C is closed curve of the region bounded by $y = x$ and $y = x^2$.	5
7.	K3	CO5	12.1.1, 12.1.2	Verify Green's theorem by evaluating $\int_C [(x^3 - xy^3)dx + (y^2 - 2xy)dy]$, where C is the square having the vertices at the point $(0,0), (2,0), (2,2) \& (0,2)$	5
8.	K3	CO5	1.3.1, 2.2.3,	Find $\vec{\nabla} log r^n$	5

9.	K3	CO5	5.1.1, 10.1.2, 10.3.1, 2.4.1,	**Find the constants b such that $\vec{A} = (bxy - z^3)\vec{i} + (b-2)x^2\vec{j} + (1-b)xz^2\vec{k}$ has its curl identically equal to zero.**	5
10.	K3	CO5	1.2.1, 1.3.1, 2.1.3, 2.4.1	**Verify the Stoke's theorem for $\vec{F} = y\,\vec{i} + z\,\vec{j} + x\,\vec{k}$ and surface S is the portion of the sphere $x^2 + y^2 + z^2 = 1$ above the xy –plane.**	5

Answers:

1. $-\frac{2}{r^3}$
2. .$\emptyset = 3x^2y + xz^3 - zy + c$
3. $\frac{1724}{\sqrt{21}}$
4. 16
5. $\frac{n\vec{r}}{r^2}$
6. 4
8. $\frac{n\bar{r}}{r^2}$ 9. b=-2,4