KERALA AGRICULTURAL UNIVERSITY
B.Tech.(Agrl. Engg.) 2022 Admission
I Semester Final Examination - March 2023

Sacs.1101 | **Engineering Mathematics I (2+1)** | **Marks:50**
Time: 2 hours

I Fill in the blanks **(10x1=10)**

1. Taylor's Series upto 3 terms is __________
2. One of the asymptote of $x^3 + 3x^2y - 4y^3 - x + y + 3 = 0$ is __________
3. The second partial derivative f_{xx} of $x^3y^2 + y^5$ is __________
4. General form of Bessel's equation is __________
5. $J_0(x) =$ __________
6. If $u = u(x, y)$ where $x = x(t), y = y(t)$ then the expression for $\frac{du}{dt} =$ __________.
7. $\nabla \cdot \vec{F}$ is called __________ of F
8. In vector calculus the notation ∇ represents the expression __________
9. If $\vec{r} = x\vec{\imath} + y\vec{\jmath} + z\vec{k}$, then $\nabla \cdot \vec{r} =$ _______.
10. If $\vec{F}$ and $\vec{G}$ are vector point functions, then $\nabla \cdot (\vec{F} + \vec{G}) =$ _______

II Write short notes on ANY FIVE of the following **(5x2=10)**

1. If $\vec{F} = 3xy\vec{\imath} - y^2\vec{\jmath}$, evaluate $\int_C \vec{F} \cdot \vec{dr}$ where C is the arc of the parabola $y = 2x^2$ from (0,0) to (1,2).
2. If $x = r\cos\theta$ and $y = r\sin\theta$, then find $\frac{\partial(x,y)}{\partial(r,\theta)}$
3. Find the CF for $\frac{d^2y}{dx^2} + y = cosec\, x$
4. If $u = x^2 + y^2 + z^2$, where $x = e^t, y = e^t\sin t$ and $z = e^t\cos t$, find $\frac{du}{dt}$.
5. Find the function whose gradient is $(y^3 + 2xy + 3x^2 + 2xy^2)\,\vec{\imath} + (4y^3 + x^2 + 2x^2y + 3xy^2)\,\vec{\jmath}$.
6. Let $f(x, y, z) = x^2y^3e^z$ Find the $grad f$.
7. Find the directional derivative of $\phi = x^2yz + 4xz^2$ at the point P in the direction of PQ, where P is (1,-2,-1) and Q is (3,-3,-2).

III Answer ANY FIVE of the following **(5x4=20)**

1. If $u = x\log(xy)$, where $x^3 + y^3 + 3xy = 1$, find $\frac{du}{dt}$.
2. Find the stationary values of $x^4 + y^4 - 2x^2 + 4xy = 2y^2$.
3. Solve the differential equation $(D^2 + 4)y = \sin 2x$
4. Show that $\vec{F} = (y^2 - 2xz^2)\vec{\imath} + (2xy - z)\vec{\jmath} + (2x^2z - y + 2z)\vec{k}$ is irrotational and hence find its scalar potential.
5. If $\vec{F} = (3x^2 + 6y)\vec{\imath} - 14yz\vec{\jmath} + 20xz^2\vec{k}$, evaluate $\int_C \vec{F} \cdot d\vec{r}$ from (0,0,0) to (1,1,1) along the curve C given by $x = t, y = t^2, z = t^3$.
6. Solve: $\cos x\frac{dy}{dx} - y\sin x = y^2\cos^2 x$
7. If $u = \frac{yz}{x}, v = \frac{xz}{y}, w = \frac{xy}{z}$, then evaluate $\frac{\partial(u,v,w)}{\partial(x,y,z)}$.

IV **Write an essay on ANY ONE of the following** **(1x10=10)**

1. Solve: $\frac{d^3y}{dx^3} - 7\frac{dy}{dx} - 6y = x^2 + \sin x + e^{4x}$
2. Verify Gauss's Divergence theorem for $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$, where S is the surface of the cuboid formed by the planes $x = 0, x = a, y = 0, y = b, z = 0$ and $z = c$.

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