**KERALA AGRICULTURAL UNIVERSITY**
**B.Tech.(Food Technology) 2021 Admission**
**I Semester Final Examination -May 2022**

**Beas.1102** **Engineering Mathematics I (2+0)** **Marks: 50**
**Time: 2 hours**

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

1. A point in which a function is neither maximum nor minimum is called ____________.
2. The stationary points of the function $f(x) = x^2 + y^2$ is ______________.
3. The equation of the form $y = px + f(p)$ is known as ___________ equation.
4. A differential equation $Mdx + Ndy = 0$ is said to be exact differential equation if the condition _______________ satisfy.
5. An equation of the form $x^2 y'' - xy' + y = \log x$ is called __________ differential equation.
6. The complementary function of $(D^2 - 3D + 2)y = 0$ is __________
7. The particular integral of $(D^2 + 3D + 2)y = e^x$ is ______________

**Choose the correct answer**

8. Stoke's Theorem converts
   a) Line integral to surface integral
   b) Surface integral to volume integral
   c) Line integral to volume integral
   d) None of these
9. $\int_c udx + vdy =$ ________
   a) $\iint_R \frac{\partial v}{\partial x} + \frac{\partial u}{\partial y} dxdy$
   b) $\iint_R \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y} dxdy$
   c) $\iint_R \frac{\partial u}{\partial x} - \frac{\partial v}{\partial y} dxdy$
   d) $\iint_R \frac{\partial u}{\partial y} - \frac{\partial v}{\partial x} dxdy$
10. Define Jacobian $J\left(\frac{u, v}{x, y}\right)$

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

1. Evaluate $\underset{x \to 0}{lt} \frac{x - \sin x}{x^3}$
2. If $u = x^2 + e^{xy}$ find the first order partial derivatives $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$
3. Given $f(x, y) = e^x \sin y$. Show that the function satisfy the Laplace equation $f_{xx} + f_{yy} = 0$

4. Show that the differential equation $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$ is exact.
5. Modify into Clairaut's form and hence find the general solution of $(p+1)^2(y - px) = 1$
6. Find grad $\phi$ when $\phi = 3x^2y - y^3z^2$
7. Find the curl of the vector $\vec{v} = xyz\,\hat{i} + 3x^2y\,\hat{j} + (xz^2 - y^2z)\,\hat{k}$

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

1. Find the Maclaurin's series expansion of $\sin x$ up to three non zero terms.
2. If $u = \log(x^2 + y^2)$ verify that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$
3. If $w = f(x - y, y - z, z - x)$ Show that $w_x + w_y + w_z = 0$
4. Solve the differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 5 + e^{2x}$
5. Prove that $Div\left(Curl\ \vec{v}\right) = 0$ or $\nabla.(\nabla \times \vec{v}) = 0$
6. Find $\iint_S \vec{F}.\hat{n}\ dS$ using divergence theorem where $\vec{F} = (2x + 3z)\hat{i} - (xz + y)\hat{j} + (y^2 + 2z)\hat{k}$ and S is the surface of the sphere whose volume is $36\pi$ cubic units
7. If $\vec{F} = (3x^2 - 3yz)\hat{\imath} + (3y^2 - 3xz)\hat{\imath} + (3z^2 - 3xy)\hat{\imath}$ Find $div\vec{F},\ curl\vec{F}$

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

1. Locate all the relative maxima, minima and saddle points of the function $f(x, y) = 3x^2 - 2xy + y^2 - 8y$
2. Solve by the method of variation of parameters $\frac{d^2y}{dx^2} + 4y = \tan 2x$

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