KERALA AGRICULTURAL UNIVERSITY
B. Tech. (Food Technology) 2024 Admission
III Semester Final Examination – January 2026

BES 2118 **Engineering Mathematics – I (2+0)** **Marks: 50**
Time: 2 hours

I **Answer the following** **(10x1=10)**

1. Expand sinx in Taylor's series form about $x = \pi/4$.
2. Define asymptote of a curve.
3. Find $\frac{\partial u}{\partial x}$ if $u = x^y$.
4. If $x = r\cos\theta$, $y = r\sin\theta$ then find the Jacobian x, y with respect to r, θ.
5. State Green's theorem
6. Write Bernoullis differential equation.
7. Solve $\frac{dy}{dx} + y = x$.
8. Find the Particular integral of $(D^2 + 1)y = \cos 3x$.
9. Write the Cauchy's homogeneous linear differential equation.

Fill in the blanks

10. $\Gamma(1/2) = ...$

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

1. Using Maclaurin's series expand tanx upto the term containing x^5.
2. Find the radius of curvature of $x^3+y^3 = 3axy$ at the point (3a/2, 3a/2).
3. Given that $u = \sin(x/y)$, $x = e^t$ and $y = t^2$. Find du/dt.
4. Express $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$ in terms of gamma function.
5. Solve $(D^3 + 1)y = 0$.
6. Define (i) Scalar point function and (ii) Vector Point function. Give one example to each.
7. If $R = xi + yj + zk$ then show that curl(R) = 0

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

1. Trace the curve $r = a \sin 3\theta$.
2. If $z = f(x + ct) + \phi(x - ct)$, then prove that $\frac{\partial^2 z}{\partial t^2} = c^2 \frac{\partial^2 z}{\partial x^2}$
3. Find the volume of the sphere of radius 'a'.
4. Verify exactness and solve $(x^2 - ay)dx = (ax - y^2)dy$
5. Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$
6. Solve $dx/dt = 5x + y$; $dy/dt = y - 4x$.
7. If $F = (x + y + 1)i + j - (x + y)k$ then show that F curlF = 0

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

1. (a) Find the maximum and minimum distance of the point (3, 4, 12) from the sphere $x^2 + y^2 + z^2 = 1$;
   (b) Evaluate $\int_1^2 \int_1^3 xy^2 dxdy$
2. Verify Green's theorem for $\int_C [xy(xy + y^2)dx + x^2dy]$, where C is bounded by $y = x$ and $y = x^2$

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