KERALA AGRICULTURAL UNIVERSITY

B.Tech. (Agrl. Engg.) 2020 Admission

I Semester Final Examination-November 2021

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

Time: 2 hours

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

1. $\lim_{x\to 0} \frac{Cos\ x\ -\ e^x}{Sin\ x}$ is ____________.
2. $\lim_{n\to\infty} \left(1+\frac{1}{n}\right)^n$ is ____________.
3. If $f(x,y) = 2x^2y^2 - \sin x$, then the value of the partial derivative $\frac{\partial f}{\partial y}$ is ____________.
4. The degree of the homogeneous function $f(x,y) = tan\left(\frac{x^5+y^5}{x+y}\right)$ is ____________.
5. The integrating factor of $sec^2y\ \frac{dy}{dx} + 2x\tan y = x^3$ is ____________.
6. The degree of the differential equation $\frac{d^2y}{dx^2} - 8\left(\frac{dy}{dx}\right)^3 + 4y = 0$ is ____________.
7. The solution of the differential equation $(D^2)y = 0$ is ____________.
8. Find the value of C if the vector $\vec{F} = (x+3y)\hat{\imath} + (y-2z)\hat{\jmath} + (x+Cz)\hat{k}$ is solenoidal.
9. If $\varphi(x,y,z) = x+y+z$ then the gradient is ____________.
10. If $\vec{r} = x\hat{\imath} + y\,\hat{\jmath} + z\hat{k}$, then evaluate curl $\vec{r}$ is ____________.

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

1. Find the Maclaurin's series of $f(x) = \frac{1}{1-x}$
2. If $u = \frac{x^2}{y}$, $v = \frac{y^2}{x}$, then find the Jacobian of u and v with respect to x and y.
3. Show that $(1+4xy+2y^2)dx + (1+4xy+2x^2)dy$ is an exact differential equation.
4. Verify Euler's Theorem for the function: $u = x^3 - 3x^2y + 3xy^2 + y^3$.
5. Evaluate $\int_1^3 \int_{-1}^1 (2x-4)\,dy\,dx$
6. Solve $(y-px)^2 = 1+p^2$.
7. Find the scalar potential whose gradient is $2xyz\,\hat{\imath} + (x^2z+1)\hat{\jmath} + x^2y\hat{k}$.

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

1. If $u = f(y-z,\ z-x,\ x-y)$ show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$
2. Discuss the maxima and minima of $f(x,y) = 3x^2 - 2xy + y^2 - 8y$.
3. Change the order of integration and hence evaluate $\int_0^a \int_y^a \frac{x}{x^2+y^2}\,dxdy$
4. Evaluate $\iiint_V xyz\,dV$ where V is the solid in the first octant that is bounded by the parabolic cylinder $z = 3-x^2$ and the planes $z=0, y=x$, and $y=0$.
5. Solve the differential equation:$(x^2-2x+2y^2)dx + 2xy\,dy = 0$.
6. Solve $y'' + y = tan\ x$ using the method of variation of parameters.
7. Use Green's Theorem to evaluate $\oint_C (2x-y)dx + (x+y)dy$, where C is the boundary of the circle $x^2+y^2 = a^2$

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

1. Solve $(D^2 + 3D + 2)y = e^{-x} + x^3 + \sin x$
2. Verify Gauss divergence theorem for $\vec{F} = x\,\hat{\imath} + z\hat{\jmath} + yz\hat{k}$ taken over the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$.

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