ADMISSION NUMBER

School of Computing Science and Engineering

Bachelor of Technology in Computer Science and Engineering
Semester End Examination - Jun 2024

Duration : 180 Minutes
Max Marks : 100

Sem II - C1UC222B - Engineering Mathematics-II

General Instructions
Answer to the specific question asked
Draw neat, labelled diagrams wherever necessary
Approved data hand books are allowed subject to verification by the Invigilator

1) Let $T:\mathbb{R}^3 \to \mathbb{R}^2$ be defined by $T(a_1, a_2, a_3) = (3a_1 - 2a_2 + a_3, a_1 - 3a_2 - 2a_3)$. Find the matrix associated with T with respect to standard basis. K1(3)

2) Find the general solution of second order linear homogeneous differential equation $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 0$. K2(4)

3) Find the directional derivative of $f(x,y,z) = xy^2 + 4xyz + z^2$ at the point $(1,2,3)$ in the direction of $3i + 4j - 5k$. K2(6)

4) Apply separation of variable method to solve the following partial differential equation $2u_t + u_x = 0$. K3(6)

5) Determine whether the differential equation $cos(x+y)dx + (2y + cos(x+y))dy = 0$ is exact. If exact, solve it. K3(6)

6) Evaluate the line integral $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the boundary of the region defined by $x = 0, y = 0, x + y = 1$. K3(9)

7) **Solve:** $x^2y'' - 3xy' + 3y = 3ln(x)$ K3(9)

8) Find the general solution of the following heat equation: $u_t - u_{xx} = 0$; with initial condition $u(0,t) = 0 = u(L,t)$. K4(8)

9) Solve $y'' - 2y' - 8y = e^x sinx$. K4(12)

10) Solve: $\frac{d^2y}{dx^2} - \frac{dy}{dx} = e^{3x}$ with initial condition $y(0) = 1, y'(0) = 2$. K5(10)

11) Solve: K5(15)

$x^2y'' - 5xy' + 6y = 21ln(x)$

OR

Consider the set $B = \{v_1, v_2, v_3\}$ where vectors: $v_1 = (1,1,1), v_2 = (1,1,2), v_3 = (1,2,-4)$. Is B an orthonormal set? If not, find the orthonormal set corresponding to set B using Gram-Schmidt orthogonalization process. K5(15)

12) Let $u(x,t)$ be the solution of initial value problem K6(12)

$u_t - u_{xx} = 0$, $u(0,t) = 0, u(80,t) = 0$

and $u(x,0) = 100sin(\pi x/80)$.

Find the solution u.

OR

Let S consist of the following vectors in $\mathbb{R}^4$: $u_1 = (1,1,0,-1), u_2 = (1,2,1,3)$, $u_3 = (1,1,-9,2)$, $u_4 = (16,-13,1,3)$. Show that K6(12)

1. *S* is orthogonal,
2. *S* forms a basis of $\mathbb{R}^4$.