Punjab Engineering College (Deemed to be University), CHANDIGARH
End Term Examination (2024)

Programme: B.Tech.-I (CSE/ECE/EE/DS/AI/VLSI) **Course Code**: MA2302
Year/Semester: 23242
Course Name: Linear Algebra, Differential Equations and Vector Calculus
Maximum Marks: 50 **Time allowed**: 3 Hours

NOTES:

- All questions are compulsory.
- The candidates before starting to write the solutions, should please check the question paper for any discrepancy and ensure that they have been delivered the question paper of right course code.

Q. No.	Questions	Marks
Q1	Check whether the set of all positive real numbers u with the operations $u \oplus v = uv$ and $c \odot u = u^c$ form a vector space or not, where the symbol $\oplus$ and $\odot$ represents vector addition and scalar multiplication, respectively.	06
Q2	Let $S = \{(1,1,1), (1,2,3), (1,0,1)\}$ and $T = \{(0,1,1), (1,0,0), (1,0,1)\}$ be bases for $\mathbb{R}^3$. If $v = (-1,4,5)$, then find the coordinates of v with respect to the bases S using transition matrix and find the transition matrix from S to T.	06
Q3	Find the eigen values and corresponding eigen vectors of the matrix $A = \begin{bmatrix} 4 & 6 & 10 \\ 3 & 10 & 13 \\ -2 & -6 & -8 \end{bmatrix}$.	06
Q4	Find the orthogonal trajectories of the curves of all circle of radius 10 and centre lies on the x-axis.	05
Q5	Find the general solution of the differential equation $x\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + \frac{1}{x}y = x\sin(\log x)$.	05
Q6	Using variation of parameter, find the general solution of the differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = e^{-x}\cos x$.	05
Q7	Evaluate $\oint_C \mathrm{F}(\mathrm{r}).\,\mathrm{dr}$ counterclockwise around the boundary C of the region R by Green's theorem, where $F = \nabla(x^3\cos(xy))$, $R: 1 \le y \le 2 - x^2$.	05
Q8	Evaluate surface integral $\int\int_S \boldsymbol{F}.\boldsymbol{n}\,dA$ by using Gauss divergence theorem, where $\boldsymbol{F} = [x^3 - y^3,\ y^3 - z^3,\ z^3 - x^3]$ and S is the surface of cube $\lvert x\rvert = 1, \lvert y\rvert = 1, \lvert z\rvert = 1$.	06
Q9	Use Stokes' theorem to evaluate $\oint_C \boldsymbol{F}.d\boldsymbol{r}$ if $\boldsymbol{F} = xz\,\hat{\imath} + xy\,\hat{\jmath} + 3xz\hat{k}$ and C is boundary of the portion of the plane $2x + y + z = 2$ in the first octant, traversed counterclockwise.	06

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