STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted during the academic year 2019 – 2020 and thereafter)

B.C.A. DEGREE EXAMINATION, NOVEMBER 2023
THIRD SEMESTER

COURSE	**:**	**ALLIED – CORE**
PAPER	**:**	**MATHEMATICS FOR COMPUTER SCIENCE – I**
SUBJECT CODE	**:**	**19MT/AC/MS35**
TIME	**:**	**3 HOURS** **MAX. MARKS : 100**

SECTION – A (10 X 2 = 20)
ANSWER ANY TEN QUESTIONS

1. Find the Eigen values of the matrix $\begin{bmatrix} 1 & 2 \\ 5 & 4 \end{bmatrix}$.
2. State Cayley Hamilton theorem.
3. Find a_0 of the Fourier series for the function $f(x) = x$ in $0 \leq x \leq 2\pi$.
4. Find the sine series for the function $f(x) = x$ in $(0, \pi)$.
5. If $\vec{r} = x\,\vec{i} + y\,\vec{j} + z\,\vec{k}$ is a unit vector, then show that $x\frac{dx}{dt} + y\frac{dy}{dt} + z\frac{dz}{dt} = 0$.
6. Show that the vector $\vec{A} = x^2z^2\vec{i} + xyz^2\vec{j} - xz^3\vec{k}$ is solenoidal.
7. Define Complete graph with an example.
8. Prove that the sum of the degrees of the vertices of a graph G is twice the number of edges.
9. What is optimization problem?
10. Define Feasible solution of LPP.
11. Find the product of the eigen vales of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{bmatrix}$.
12. Find $\nabla\emptyset$ at (1,3,2) where $\emptyset = 2xz - y^2$.

SECTION – B (5 X 8 = 40)
ANSWER ANY FIVE QUESTIONS

13. Find the eigen vectors of $\begin{bmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{bmatrix}$.
14. Find the Fourier series for the function $f(x) = \frac{x}{2}$ in $-\pi < x < \pi$ and deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots$
15. Find the value of the constants a, b, c so that $\vec{F} = (x + 2y + az)\vec{i} + (bx - 3y - z)\vec{j} + (4x + cy + 2)\vec{k}$ is irrotational.
16. In a graph G, prove that every $u - v$ path contains a simple $u - v$ path.
17. A company produces two types of leather belts A and B. A is of superior quality and B is of inferior quality. The respective profits are Rs. 10/- and Rs. 5/- per belt. The supply of raw material (leather) is sufficient for making 850 belts per day. For belt A special type of buckle is required and only 500 are available per day. There are 700 buckles available for belt B per day. Belt A needs twice as much time as that required for belt B and the company can produce 500 belts if all of them were of the type A. Formulate a linear programming model for the above problem.

18. Verify Cayley Hamilton theorem for the matrix $\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$

19. Solve the following LPP by graphical method

$$\text{Minimize } z = 20x_1 + 10x_2$$
$$\text{subject to}$$
$$x_1 + 2x_2 \le 40$$
$$3x_1 + x_2 \ge 30$$
$$4x_1 + 3x_2 \ge 60$$
$$x_1, x_2 \ge 0$$

SECTION – C **(2 X 20 = 40)**

ANSWER ANY TWO QUESTIONS

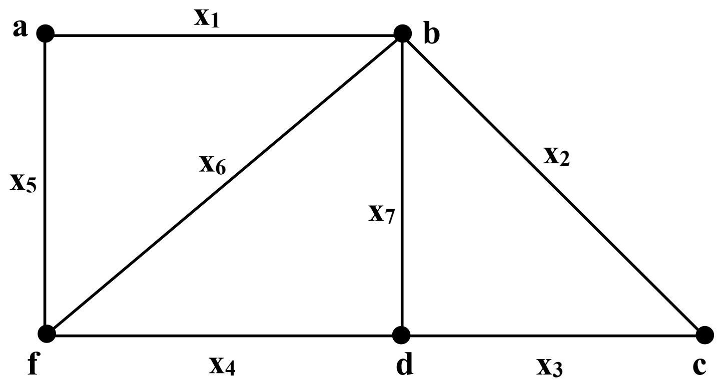
20. (a) Diagonalize the matrix $A = \begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$.

(b) If $\phi = 3x^2y - y^3z^2$, find $grad\ \phi$ at the point $(1, -2, -1)$.

21. (a) Find the Fourier series for the function $f(x) = \begin{cases} x, & 0 \le x \le \pi \\ 2\pi - x, & \pi \le x \le 2\pi \end{cases}$

(b) Show that $\nabla^2 \log r = \frac{1}{r^2}$.

22. (a) Define Adjacency and Incidence matrix of a graph. Also find the Adjacency and Incidence Matrix of the following graph.



(b) Using simplex method, solve

$$\text{Maximize } z = x_1 + x_2 + 3x_3$$
$$\text{subject to}$$
$$3x_1 + 2x_2 + x_3 \le 3$$
$$2x_1 + x_2 + 2x_3 \le 2$$
$$x_1, x_2, x_3 \ge 0$$

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