CBCS SCHEME

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22SCN/SAM/SCS/SDS/SAD11

First Semester M.Tech. Degree Examination, Jan./Feb. 2023
Mathematical Foundation of Computer Science

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define vector space and give an example.	10	L1	CO1
	b.	Prove that set of all polynomials is a vector space over F.	10	L2	CO1
		OR			
Q.2	a.	Show that the intersection of two subspace of a vector space V(F) is subspace of V(F).	10	L2	CO1
	b.	Define the Linear Transformation and find the dimension of the subspaces $H = \left\{ \begin{bmatrix} a-3b+6c \\ 5a+4d \\ b-2c-d \\ 5d \end{bmatrix} \right\}$ a, b, c, d EIR	10	L2	CO1
		Module – 2			
Q.3	a.	Define the following terms i) Inner product ii) Orthogonal sets iii) Orthogonal projections.	10	L1	CO2
	b.	Find the least – squares solution of AX = b for $A = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix}$, $b = \begin{pmatrix} -3 \\ -1 \\ 0 \\ 2 \\ 5 \\ 1 \end{pmatrix}$	10	L1	CO2
		OR			
Q.4	a.	Find the curve of best fit of the type $y = ae^{bx}$ to the following data by the method of least squares x: 1, 5, 7, 9, 12 y: 10, 15, 12, 15, 21	10	L2	CO2
	b.	Fit a second degree parabola a by the method of least squares. x: 1, 2, 3, 4, 5 y: 1090, 1220, 1390, 1625, 1915	10	L2	CO2

		Module – 3			
Q.5	**a.**	Find the eigen valves and eigen vectors of $A = \begin{bmatrix} 2 & -1 & 0 \\ 3 & -2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	**10**	**L2**	**CO3**
	b.	Define orthogonal sets and show that $\{u_1, u_2, u_3\}$ is an orthogonal set, where $u_1 = \begin{pmatrix} 3 \\ 1 \\ 1 \end{pmatrix}$, $w_2 = \begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix}$, $w_3 = \begin{pmatrix} -1/2 \\ -2 \\ 7/2 \end{pmatrix}$	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	Find QR factorization of $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$	**10**	**L2**	**CO3**
	b.	Explain the principal component analysis.	**10**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the following : i) Level of significance ii) Testing of hypothesis iii) Alternative hypothesis	**10**	**L1**	**CO4**
	b.	Define the student's t-test and A machinist is making engine parts with axle diameter of 0.7 inch. A random sample of 10 parts shows that means diameter 0.742 inch with S.D of 0.04 inch. On the basis of this sample would you say that the work is inferior?	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	The following table gives the number of aircraft accidents that occurred during the various days of the week. Find whether the accidents are uniformly distributed over the week.	**10**	**L2**	**CO4**
	b.	Explain the one-way classification of ANOVA.	**10**	**L2**	**CO4**

Day	S	M	T	W	T	F	S	Total
No. of accidents	14	16	8	12	11	9	14	84

		Module – 5			
Q.9	a.	Define the periodic function and obtain the Fourier series of $f(x) = x \sin x$ in $0 < x < 2\pi$.	10	L2	CO5
	b.	Define integral transform and find the Fourier transform $f(x) = \begin{cases} 1 & \lvert x \rvert < 1 \\ 0 & \lvert x \rvert > 1 \end{cases}$ and hence deduce that $\int_0^\infty \frac{\sin x}{x} dx$.	10	L2	CO5
		OR			
Q.10	a.	State and prove convolution theorem.	10	L2	CO5
	b.	Derive the formula for Parseval's formula.	10	L2	CO5

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