

Name:.....

Reg. No:.....

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATIONS

Electrical and Electronics Engineering

(Power Systems)

04 MA 6303 - Applied Mathematics

Time: Three hrs

Max. Marks: 60

PART A

(Answer all questions. Each question carry 3 marks).

1. Find Z- transform of $\cos n\theta$ (3)

2. Find the curve on which the functional $\int_0^1 (y')^2 + 12xy dx$ with $y(0) = 0, y(1) = 1$ can be extremized. (3)

3. Show that the function $y(x) = (1 + x^2)^{-3/2}$ is a solution of the volterra integral equation (3)

$$y(x) = \frac{1}{1 + x^2} - \int_0^x \frac{t}{1 + x^2} y(t) dt.$$

4. Show that mean is an unbiased estimate. (3)

5. What is a natural cubic spline. Write general form of a spline with two subintervals. (3)

6. Write the general stage formula for a Discrete markov chain. (3)

7. Define innerproduct space. Using standard innerproduct of \mathbb{R}^n , evaluate $\langle x, y \rangle$ for $x = (1, -1, 3)$ and $y = (2, 1, 1)$. (3)

8. Let T be the linear operator on $M_2(\mathbb{R})$ given by $T(A) = A^T$ for any $A \in M_2(\mathbb{R})$. Find the matrix of T with respect to the standard ordered basis of $M_2(\mathbb{R})$. (3)

PART B

(Answer all questions)

9. (a) Find $Z((n + 1)^2)$ (6)

(b) Find $Z(\sin(3n + 5))$

OR

10. (a) Find the fourier sine transform of $e^{-|x|}$. (6)

(b) Find the Fourier cosine transform of $f(x) = \begin{cases} x & \text{if } 0 < x < 2 \\ 0 & \text{if } x > 2 \end{cases}$

11. Find the extremals of the functional $\int_{x_1}^{x_2} \frac{1 + y^2}{(y')^2} dx$ (6)

OR

12. Find the geodesics on a right circular cylinder of radius a . (6)

13. Solve $y(x) = x + 2 \int_0^x \cos(x-t)y(t) dt$ using transform method. (6)

OR

14. Solve the volterra integral equation $y(x) = 1 + x + \int_0^x (x-t)y(t) dt$ using the successive approximation method. (6)

15. (a) Find the maximum likelihood estimate for mean of a Normal distribution. (6)

(b) Prove that sample mean is an unbiased estimator of population mean.

OR

16. Assume that a computer system is in anyone of the three states: busy, idle and under repair respectively, denote 0,1,2. Observing its state at 2.0pm everyday, we get the TPM. Assume equal probability initially. (6)

$$\begin{bmatrix} 0.6 & 0.2 & 0.2 \\ 0.1 & 0.8 & 0.1 \\ 0.6 & 0.0 & 0.4 \end{bmatrix}$$

Find out the third stage probabilities. Also determine the steady state probability.

17. (a) Write the algorithm for natural cubic spline formation. (6)

(b) Derive the equation of the natural cubic spline interpolating the following table

OR

18. (a) Fit a parabolic curve to the following data using least square method (6)

x	0	1	2	3
y	1	2	3	10

(b) Solve the equation $\nabla^2 u = 0$ for the square mesh with boundary values $b_1 = b_2 = b_3 = b_4 = 60, b_5 = 50, b_6 = b_{12} = 40, b_7 = 30, b_8 = b_{11} = 20, b_9 = 10, b_{10} = 0$.

19. Let T be the linear operator on \mathbb{R}^3 defined by $T(x_1, x_2, x_3) = (3x_1 + x_3, -2x_1 + x_2, -x_1 + 2x_2 + 4x_3)$. (6)

(a) What is the matrix of T in the standard ordered basis of \mathbb{R}^3 .

(b) What is the matrix of T in the ordered basis $\{\alpha_1, \alpha_2, \alpha_3\}$ where $\alpha_1 = (1, 0, 1), \alpha_2 = (-1, 2, 1), \alpha_3 = (2, 1, 1)$

OR

20. Let V be the vectorspace of all 2×2 matrices over the field \mathbb{F} . Let W_1 be the set of matrices of the form $\begin{bmatrix} x & -x \\ y & z \end{bmatrix}$ and let W_2 be the set of matrices of the form $\begin{bmatrix} a & b \\ -a & c \end{bmatrix}$. (3)

(a) Prove that W_1 and W_2 are subspaces of V .

(b) Find the dimensions of W_1, W_2 and $W_1 + W_2$.