

APJ Abdul Kalam Technological University

First Semester M. Tech Degree Examination, December 2016

Cluster: Kollam

Branch: EEE

Specialisation: Industrial Instrumentation and Control

Subject: 02EE6211 ADVANCED ENGINEERING MATHEMATICS

Time : 3 hours

marks : 60

(Answer all questions. Each question carries 9 marks)

Part A

1. (a) If $f(x,y) = x^2 + \frac{xy}{3}$, $0 < x < 1$, $0 < y < 2$ and 0 otherwise. Find (i) $P(X < Y)$ (ii) $P(X < 1/2 / y < 1/2)$ (iii) $P(X < 1/2, Y > 1/2)$
(b) If x_1, x_2, x_3 is a random sample of size 3 from a population with mean μ and variance σ^2 . T_1, T_2 , and T_3 are the estimates used to estimate the mean value μ . Where $T_1 = x_1 + x_2 - x_3$, $T_2 = 2x_1 - 4x_2 + 3x_3$, $T_3 = \frac{1}{3}(x_1 + x_2 + x_3)$
(i) Are T_1 and T_2 unbiased
(ii) Find the value of λ such that T_3 is an unbiased estimate of μ
(iii) With this value of λ is T_3 a consistent estimate.
(iv) which is the best estimator.
2. (a) Use dynamic programming method to solve the following problem.
Maximize $Z = 2x_1 + 3x_2$ subjected to
$$2x_1 + x_2 \leq 43$$
$$2x_2 \leq 46$$
$$x_1, x_2 \geq 0$$

(b) Minimize $f = 2x_1^2 + x_2^2$ by using the Steepest descent method with the starting point (1,2).
3. (a) Solve the following IPP using Gomory's cutting plane method. Max $Z = 7x_1 + 9x_2$ sub to $-x_1 + 3x_2 \leq 6$, $7x_1 + x_2 \leq 35$, $x_1, x_2 \geq 0$ are integers.
(b) Minimize $f(x) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting point (0,0) using Hooke & Jeev's method. $\epsilon = 0.01$

4. (a) State and prove orthogonality property of Legendre polynomial
 (b) Prove that $J_{-n}(x) = (-1)^n J_n(x)$

4 X 9 = 36

PART B

(Answer any TWO full questions, each question carries 12 marks)

5. (a) Find an orthonormal basis for the subspace spanned by $(1,-1,0,0)$, $(0,1,-1,0)$ and $(0,0,1,-1)$.

- (b) Find the least square solution of $AX = b$ for $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}$ $b = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$ Also find the least square Error.

- (c) Find the basis for the null space of a matrix $A = \begin{bmatrix} -3 & 6 & -1 & 1 & -7 \\ 1 & -2 & 2 & 3 & -1 \\ 2 & -4 & 5 & 8 & -4 \end{bmatrix}$

6. (a) Find the curve of fixed perimeter which encloses maximum area.

- (b) Find the curve on which $\int_0^{\pi/2} (y'^2 - y^2 + 2xy) dy$, $y(0) = 0$, $y(\pi/2) = 0$ can be extremised

- (c) Find the curve joining (x_1, y_1) and (x_2, y_2) which can be rotated about the X axis to have minimum surface area.

7. (a) Find the singular value decomposition of $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \\ 0 & 0 \end{bmatrix}$

- (b) Find the projection of $u = (1,-2,3,-4)$ along $V = (1,2,1,2)$

- (c) Prove that sphere is a solid figure of revolution which for a given surface area has maximum Volume.

2 X 12 = 24

