Register Number: …………………….

M.E. DEGREE EXAMINATIONS: JANUARY 2011

First Semester

POWER ELECTRONICS & DRIVES

MAT505: Applied Mathematics for Electrical Engineers

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 2 = 20 Marks)

1. Find $\|X\|_2$ for the vector $X = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$.

2. Define pseudo inverse of a matrix A.

3. State Euler-Lagrange equation for a functional to be extremum.

4. Show that the shortest curve joining two points is a straight line.

5. A continuous random variable X has a probability density function $f(x) = K x^2 e^{-x}; x \geq 0$. Find *K*.

6. If the moment generating function of a random variable X is $\frac{2}{2-t}$, find the standard deviation of X.

7. Name two random process with independent increments.

8. Show that the spectral density function of a real random process is an even function.

9. What are the basic fuzzy operations?

10. Define the composition of fuzzy relations using max-min composition.

PART B (5 x 16 = 80 Marks)

11. (a). Find a generalized eigen vector of rank 2 corresponding to the eigen value $\lambda = 4$ for the matrix $A = \begin{bmatrix} 4 & 0 & 0 & 0 \\ 1 & 5 & 1 & 0 \\ -1 & -1 & 3 & 0 \\ 0 & 0 & 0 & 3 \end{bmatrix}$

(OR)

(b) Find the pseudo inverse of $A = \begin{bmatrix} 2 & 2 & -2 \\ 2 & 2 & -2 \\ -2 & -2 & 6 \end{bmatrix}$

12. (a) Estimate the lowest eigen value of the equation $-\frac{d^2 y}{dx^2} = \lambda y, \quad 0 \le x \le 1$ with boundary conditions $y(0) = 0, \ y(1) = 0.$ Compare with exact solution.

(OR)

(b) Find an approximation solution by Ritz method, of the differential equation $\frac{d^2u}{dx^2} - u = x, \quad 0 \le x \le 1$ with boundary conditions $u(0) = u(1) = 0.$ Verify the solution by any direct method. (Use only two basic functions.)

13. (a) If X is a random variable whose probability density function is

$$f(x) = \begin{cases} Ae^{-x}, & 0 < x < \infty \\ 0 & otherwise \end{cases}$$

Find the value of (i) A (ii) mean of X (iii) variance of X (iv) third moment about the mean (v) the moment about the origin.

(OR)

(b).A random variable X has density function given by

$$f(x) = \begin{cases} 2e^{-2x}, & x \ge 0 \\ 0 & x < 0 \end{cases}$$

Obtain the moment generating function and the first four moments about the origin.

14. (a) If $X(t) = A\cos(\omega t + \phi)$ is a random process with A and ω as constants and ϕ is a uniform random variable in the interval 0 to 2π , find the autocorrelation function of the process.

(OR)

(b) A wide-sense stationary random process X(t) has the autocorrelation function as $R_{XX}(\tau) = 2 + e^{-4|\tau|} + \cos 8\pi\tau$. Find the power density spectrum of the process.

15. (a) The task is to recognize English alphabetical characters (F,E,X,Y,I,T) in an image processing system. Define two fuzzy sets $\overline{I}$ and $\overline{F}$ to represent the identification of characters I and F,

$$\overline{I} = \{(F,0.4),(E,0.3),(X,0.1),(Y,0.1),(I,0.9),(T,0.8)\}$$

$$\overline{F} = \{(F,0.99),(E,0.8),(X,0.1),(Y,0.2),(I,0.5),(T,0.5)\}$$

(i). Find the following: $\overline{I} \cup \overline{F}$, $\overline{I} - \overline{F}$, $\overline{F} \cup \overline{F}^{\,c}$

(ii). Verify De Morgan's law $(\overline{I} \cup \overline{F})^{c} = \overline{I}^{c} \cap \overline{F}^{c}$.

(OR)

(b) Briefly write a note on (i) Neural networks and (ii) genetic algorithms.

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