KUMARAGURU
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ME DEGREE EXAMINATIONS: JAN 2015

(Regulation 2014)

First Semester

POWER ELECTRONICS AND DRIVES

P14MAT105**:** Applied Mathematics for Electrical Engineers

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The taxicab norm of the matrix $A = \begin{pmatrix} 5 & 4 \\ -3 & 1 \end{pmatrix}$ [K$_3$]

   a) 7   b) 5

   c) 13   d) Does not exists

2. Consider the following statements   [K$_2$]

   1) $\begin{pmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{pmatrix}$ is a Jordan canonical form

   2) Singular values exists only for square matrices.
   3) Singular values exists only for singular square matrices.
   4) The minimum polynomial m(λ) for an n x n matrix A is the monic polynomial of maximum degree for which m(A)=0.

   Which of these statements are not correct?
   a) 1,2   b) 3,4

   c) 1,2,4   d) 1,3,4

3. Assertion (A) : The shortest curve joining two points in a plane surface is a straight line.   [K$_2$]

   Reason (R): The shortest curve joining two points in any surface is a straight line.

   a) both A and R are individually true but R is the correct explanation of A

   b) both A and R are individually true but R is not the correct explanation of A

   c) A is true but R is false

   d) A is false but R is true

4. Consider the following statements [K₃]

   1) Calculus of variation deals with finding extrema of a function having 2 variables only.

   2) The Ritz method is used to obtain an approximate solution of variational problems.

   3) $f - y' \dfrac{\partial f}{\partial y'} = c$ is an Euler's equation.

   4) The closed plane curve of given length that encloses the larger area is a circle.

 Which of these statements are correct?

  a) 2,3   b) 1,3,4

  c) 1,2,3,4   d) 2,3,4

5. Match the following: [K₁]

List I	List II
A) $a_1x_1[k] + a_2x_2[k]$	1) Time shifting
B) $x^{(m)}[k]$	2) Time convolution
C) $x[k - m]$	3) Linearity
D) $x_1[k] * x_2[k]$	4) Time scaling

Codes:

	A	B	C	D
a.	4	1	2	3
b.	3	4	1	2
c.	3	1	4	2
d.	4	3	2	1

6. Match the following: [K₁]

List I	List II
A) Fourier series	1) real frequency
B) Fourier Transform	2) complex frequency
C) Z-Transform	3) non periodic function
D) Discrete Fourier Transform	4) Periodic function

Codes:

	A	B	C	D
a.	4	3	2	1
b.	3	2	4	1
c.	2	1	4	3
d.	4	3	1	2

7. Assertion (A) : The wavelet transform of a constant is equal to zero. [K₄]

 Reason (R): The wavelet transforms have no closed analytical solutions.

  a) both A and R are individually true but R is the correct explanation of A

  b) both A and R are individually true but R is not the correct explanation of A

c) A is true but R is false   d) A is false but R is true

8. The steps involved in computing CWT is   [K$_4$]

1.Choose mother wavelet

2. Analyze W(a, b) for different values of a.

3. Apply the given function to the mother wavelet.

4. Find W(a, b)

    a) 1-3-4-2   b) 2-3-1-4

    c) 3-4-1-2   d) 4-1-2-3

9. The cardinality of fuzzy sets on any universe is   [K$_1$]

    a) Infinity   b) less than infinity

    c) 0   d) Not defined

10. The steps involved in computing membership functions using Genetic algorithm. [K$_2$]
        1. Assume some membership functions and their shapes.
        2. Identify the functional mapping for a system.
        3. Form a membership function as bit string.
        4. Obtain optimum membership function.
    a) 1-2-4-3   b) 2-1-3-4

    c) 3-4-1-2   d) 4-1-2-3

PART B (10 x 2 = 20 Marks)

11. Do all matrix norms satisfy sub-multiplicative property? If not give example.   [K$_3$]

12. Find a generailsed eigen vector of rank 3 for the matrix $A = \begin{bmatrix} 7 & 1 & 2 \\ 0 & 7 & 1 \\ 0 & 0 & 7 \end{bmatrix}$ [K$_1$]

corresponding to the eigen values $\lambda = 7$.

13. Formulate the Euler Poisson equation for the functional   [K$_1$]

$$I[y(x)] = \int_0^1 (360 x^2 \, y - y^{''2}) dx.$$

14. State Brachistochrone problem.   [K$_5$]

15. Discuss the difference between Fourier series and Fourier Transform.   [K$_1$]

16. Calculate the unilateral z-transform for the time-limited sequence,   [K$_2$]

$$x[k] = \begin{cases} 1, k = 0,1 \\ 2, k = 2,5 \\ 0, otherwise \end{cases}$$

17. Define continuous time wavelet transform.   [K$_2$]

18. State the admissible condition of the wavelet transforms.   [K$_6$]

19. What are the basic fuzzy operations? [K$_1$]

20. List the characteristics of neural network. [K$_2$]

PART C (6 x 5 = 30 Marks)

21. Show that $B = \dfrac{1}{3}\begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{pmatrix}$ is the pseudo-inverse of $A = \begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{pmatrix}$. [K$_4$]

22. Among the curves connecting the points A (3, 5) & B (4, 7), find the curve on which an extremum of the functional $v[y(x)] = \int_{3}^{4} y'(x)[1 + x^2 \, y'(x)] \, dx$ can be attained. [K$_5$]

23. Expand the Fourier series of the periodic function $f(x) = \begin{cases} 4 + x & if -4 < x < 0 \\ 4 - x & if \ 0 < x < 4 \end{cases}$. [K$_2$]

24. Determine the inverse Z- transform of the function $X(z) = X_1(z) + X_2(z)$ where $X_1(z) = \dfrac{4z}{(z-1)^2}$, $X_2(z) = \dfrac{z}{z^2 - 7z + 12}$. [K$_5$]

25. Explain Multi resolution Analysis in wavelet transform [K$_6$]

26. Explain the operations of genetic algorithm [K$_5$]

PART D (4 x 10 = 40 Marks)

27. Construct a singular value decomposition for $A = \begin{pmatrix} 7 & -9 \\ 4 & -6 \end{pmatrix}$. [K$_5$]

28. Solve the boundary value problem $y'' - 6x = 0$, $y(0) = 0$, $y(1) = 1$ by Rayleigh Ritz method. Also compare with exact solution at x=0.25. [K$_5$]

29. Construct CWT of the Haar wavelet function using $f(t) = \begin{cases} 1 & 0 \leq t < 1 \\ 0 & , \ otherwise \end{cases}$ [K$_6$]

30. If $\tilde{A} = \{(6, 0.9), (7, 0.3), (8, 0.8), (9, 0.5)\}$, $\tilde{B} = \{(6, 0.3), (7, 0.8), (8, 0.5), (9, 0.2)\}$ then
    Determine (1) union   (2) intersection   (3) Disjunctive sum
    Verify (1) De Morgan's laws
           (2) Excluded middle laws [K$_6$]

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