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M.E. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

First Semester

Control and Instrumentation/ Power Electronics and Drives/
Power systems Engineering

MA 149 — APPLIED MATHEMATICS FOR ELECTRICAL ENGINEERS

(Regulation 2002)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is Jordan canonical form?

2. Define least square approximations.

3. Define strong and weak variations.

4. What is Ritz method?

5. What is Transportation problem?

6. Define slack and surplus variables.

7. Tell two features of Dynamic programming.

8. What is the optimality principle of Dynamic programming?

9. Define Autocorrelation function.

10. Write two properties of Cross-correlation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Test for an extremum the functional $v[y(x)] = \int_{x_0}^{x_1} (y^2 + 2xyy')dx$ with $y(x_0) = y_0, y(x) = y_1$. (8)

(ii) Explain the variational problem involving several unknown functions. (8)

Or

(b) (i) Find the curves on which the functional $\int_0^1 [(y')^2 + 12xy]dx$ with $y(0) = 0$ and $y(1) = 1$ can be extremized. (6)

(ii) Solve the boundary value problem $y'' + y + x = 0$ $(0 \le x \le 1)$ given that $y(0) = 0$ and $y(1) = 0$ using Rayleigh-Ritz method. (10)

12. (a) (i) Tell about the Matrix norms. (4)

(ii) Explain singular value Decompositions. (4)

(iii) What do you mean by Pseudo inverse? Explain the same. (8)

Or

(b) (i) Narrate QR algorithms? (8)

(ii) Explain the "generalised Eigen vectors"? (8)

13. (a) Minimize $z = 4x_1 + x_2$

subject to $3x_1 + 4x_2 \ge 20$

$-x_1 - 5x_2 \le -15$

$x_1, x_2 \ge 0.$

(16)

Or

(b) Solve the following Transportation problem to maximize profit and give criteria for optimality.

Profit (Rs.)/Unit

Destination

Origin	1	2	3	4	Supply
A	40	25	22	33	100
B	44	35	30	30	30
C	38	38	28	30	70
Demand	40	20	60	30	

(16)

14. (a) (i) Apply the technique of Dynamic programming for the linear programming problem given below : (8)

Maximize $z = 4x + 5y$,

subject to $x \le 4$

$y \le 6$

$3x + 2y \le 18$

$x, y \ge 0$

(ii) Obtain an integer solution by Dynamic programming :

Minimize $z = 3x_1 + 4x_2 + 5x_3$

Subject to $x_1 + 2x_2 + x_3 \leq 6$

$x_1 - x_2 + 2x_3 \leq 4$

$x_1, x_2, x_3 \geq 0.$

(8)

Or

(b) An investor has Rs. 50,000 to invest. He has three alternatives to choose :

The estimated returns for different amount of capital invested in each alternative are tabulated. Zero allocation returns Rs. 0. What is the optimal investment policy?

Amount (Rs.)	Alternative		
	1	2	3
10,000	10	20	10
20,000	10	20	20
30,000	30	20	20
40,000	40	30	30
50,000	40	30	40

(16)

15. (a) (i) Prove that the Random process $\{X(t)\}$ with constant mean is mean Ergodic if $\lim_{T\to\infty}\left\{\frac{1}{4T^2}\int_{-T}^{T}\int_{-T}^{T} C(t_1, t_2)dt_1, dt_2\right\} = 0$. (8)

(ii) If the auto correlation function of a stationary Gaussian process $\{X(t)\}$ is $R(\iota) = 10e^{-|\iota|}$, prove that $\{X(t)\}$ is ergodic both is mean and correlation. (8)

Or

(b) (i) Express the auto correlation functions of the proess $[X'(t)]$ interms of the autocorrelation function of the process $\{X(6)\}$. (8)

(ii) If the input to a time-invariant , stable linear system is a WSS process, the output will absolute a WSS process. (8)

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