



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/M.Tech(EE-OLD)/SEM-2/EEP-206/2011**

**2011**

**APPLIED MATHEMATICS FOR ELECTRICAL  
ENGINEERS**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

[ Graph sheet(s) will be supplied by the Institute. ]

Answer any five questions.

5 × 14 = 70

1. a) Reduce the quadratic form

$$6x^2 + y^2 + 18z^2 - 4yz - 12zx$$

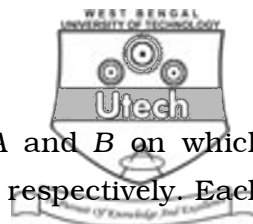
to the normal form and find its rank, index and signature and hence determine its nature.

- b) Find the absolutely smallest eigenvalue and the corresponding eigenvector of the matrix

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$

correct to 2 decimal places using the power method.

7 + 7



2. a) A firm manufactures two products A and B on which the profits earned are Rs. 5 and Rs. 8 respectively. Each product is prepared on two machines X and Y. The machine time ( in minutes ) required for these products on two machines and their availability are as shown below :

Machine	Product		Availability of machine ( minutes ) per day
	A	B	
X	2	1	400
Y	4	1	600

It is required to find the number of units of products A and B to be manufactured per day to get maximum profit. Formulate the problem as linear programming mathematical model and solve it graphically by iso-profit line method.

- b) Prove that every extreme point of the convex set of all feasible solutions of the system  $Ax = b, x \geq 0$  corresponds to a basic feasible solution. 7 + 7
3. a) What are the disadvantages of Big M method over two-phase method ?
- b) Use the two-phase simplex method to solve the following linear programming problem :

$$\text{Maximize } Z = 2x_1 + x_2 + 3x_3$$

subject to the constraints

$$x_1 + x_2 + 2x_3 \geq 5$$

$$2x_1 + 3x_2 + 4x_3 = 12$$

$$x_1, x_2, x_3 \geq 0.$$

4 + 10



4. Use the revised simplex method to solve the following linear programming problem :

$$\text{Maximize } Z = 5x_1 + 3x_2$$

subject to the constraints

$$3x_1 + 8x_2 \leq 12$$

$$5x_1 + 2x_2 \leq 10$$

$$x_1 + x_2 \leq 2$$

$$x_1, x_2 \geq 0 \quad 14$$

5. Use Wolfe's method to solve the quadratic programming problem :

$$\text{Maximize } f(x) = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$$

subject to the constraints

$$x_1 + 2x_2 \leq 2$$

$$x_1, x_2 \geq 0. \quad 14$$

6. a) Convert the following differential equation into an integral equation :

$$\frac{d^2y}{dx^2} + \lambda xy = f(x)$$

- b) Using iterative method, solve

$$y(x) = (5x/6) + (1/2) \int_0^1 xy(t) dt. \quad 7 + 7$$



7. Solve the following integral equation and discuss all its possible cases :

$$y(x) = f(x) + \lambda \int_0^1 (1 - 3xt) y(t) dt . \quad 14$$

8. A small maintenance project consists of the following jobs whose precedence relationships are given below :

<b>Job</b>	1-2	1-3	2-3	2-5	3-4	3-6	4-5	4-6	5-6	6-7
<b>Duration ( days )</b>	15	15	3	5	8	12	1	14	3	14

- Draw an arrow diagram representing the project.
- Find the total float for each activity.
- Find the critical path and the total project duration.

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