SE - sem-IV (CBSGS) Electrical - N11101 28/12/16
Numerical Methods and Optimization Techniques

Q.P. Code : 544100

(3 Hours) [Total Marks: 80

N.B.:

- Question No. 1 is compulsory.
- Answer any **three** from the remaining five questions.
- Assume suitable data if necessary and justify the same.
- Figures to the right indicate the marks.

1 Each question carry five marks 20

a What is significant figures? What are the rules on determining how many significant figures are in a number? Identify the number of significant figures in 0.00800.

b Compare Graphical and simplex method to solve a linear programming problem. How the multiple solution condition can be identified from the graphical and the simplex method?

c Given three data points (1,6) and (3,28), (5,35). Estimate 'x' at y=20 using Lagrange's method

d Given $\frac{dy}{dx} = x^2(1+y)$ and y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979, evaluate y(1.4) till the error is less than 1% using Adams-Bashforth method.

2 a Integrate the following set of differential equations using three approximations of Picard's method. Calculate the values of y and z at x=1 by assuming that at x=0, y=4 and z=6. 10

$\frac{dy}{dx} = -0.5y$; $\frac{dz}{dx} = 4-0.3z-0.1y$

b Write the algorithm to find the root of an equation using secant and false position method. Compare the selection of guesses in each iteration of secant and false position method. 10

3 a What is meant by curve fitting? Compare least square fitting technique with interpolation technique. Using Newton's Divided difference method of order '3' find 'y' at x =2.5 from the following data with maximum accuracy. 10

x	0	1	1.5	3	3.5
y	1	0.5	-1	7	8.2

b A series RL circuit with R = 50 Ω and L = 10 H has a voltage V = 150 sin 1000t is applied at t = 0 by the closing of a switch. The differential equation to represent the system is given as $Ri + L\frac{di}{dt} = V$. Find the current at t = 1sec taking h=0.5 using fourth order Runga Kutta method. 10

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4 a Obtain the roots of following systems of equations using N-R method $f(x,y)=x^2+xy-10$ and $g(x,y)=y+3xy^2-57$ with the initial guesses as $x_0=1.5$ and $y_0=3.5$. Do only two iterations. 10

b Solve the following LP problem using Simplex method. 10

Maximize $Z = 3x + 2y$

subject to: $2x + y \leq 18$

$2x + 3y \leq 42$

$3x + y \leq 24$

$x \geq 0 , y \geq 0$

5 a What is LU decomposition? What is the advantage of solving a set of linear algebraic equations using LU decomposition? Calculate the LU decomposition of 10

$$A=\begin{bmatrix}1 & 3 & 2\\ 2 & 8 & 5\\ 1 & 11 & 4\end{bmatrix}.$$

b A firm is engaged in producing two products. A and B. Each unit of product A requires 2 kg of raw material and 4 labour hours for processing, whereas each unit of B requires 3 kg of raw materials and 3 labour hours for the same type. Every week, the firm has an availability of 60 kg of raw material and 96 labour hours. One unit of product A sold yields Rs.40 and one unit of product B sold gives Rs.35 as profit. Formulate this as a Linear Programming Problem and determine how many units of each of the products should be produced per week so that the firm can earn maximum profit using graphical method. 10

6 a What are the different type of errors in numerical computation? How these errors are propogated under addition and multiplication? 10

b Explain suitable techniques to solve the following optimization problem. 10

1. Multivariable optimization problem with no constraint.
2. Multivariable optimization problem with equality constraint.
