Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: CE473

Course Name: Advanced Computational Techniques and Optimization

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Briefly explain different numerical methods to solve the system of linear algebraic equations. (5)

b) Obtain by Power method the numerically dominant eigen value and eigen vector of the matrix [A] = $\begin{pmatrix} 15 & -4 & -3 \\ -10 & 12 & -6 \\ -20 & 4 & -2 \end{pmatrix}$. Take the initial approximation as $[1\ 1\ 1]^T$. (10)

2 a) Explain general procedure in optimization techniques (5)

b) Find the minimum point of the function using multi-variable unconstrained optimization technique, $f = 2x^2 + xy + y^2 + yz + z^2 - 6x - 7y - 8z + 9$ (10)

3 a) Apply Gauss Seidel iteration method to solve the equations : (8)

10x + y + 2z = 44 ; 2x + 10y + z = 51 ; x + 2y + 10z = 61

b) Determine the maximum and minimum value of the single variable function $f(x) = 12x^5 - 45x^4 + 40x^3 + 5$ (7)

PART B

Answer any two full questions, each carries 15 marks.

4 a) A curve passes through the points (0,18), (1,10), (3,-18) and (6,90). Find the slope of the curve at $x = 2$ using Lagrangian interpolation. (7)

b) Evaluate $\int_0^1 \frac{1}{1+x2}$ dx using (8)

a) Trapezoidal rule , take h= 1/4

b) Weddle's rule , take h=1/6

5 a) Using Simplex method, maximize $Z = 8000\,x + 12000\,y$ (7)

subject to the constraints:

$3x + 4y \leq 60$

$x + 3y \leq 30$

$x \geq 0, y \geq 0$

b) Write the dual of the following LPP: (8)

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

Subject to:

$x_1+2x_2+4x_3 \geq 12$

$2x_1+x_2+5x_3 = 5$

$4x_1+7x_2+6x_3 \leq 8$

$x_1, x_2 \geq 0$, x_3 is unrestricted in sign

6 a) Linearize the model $y = ax^b$ to fit the following data and determine the coefficients *a* and *b.* (7)

x :	1	2	3	4	5
y :	0.5	1.7	3.4	5.7	8.4

b) Write the algorithm to solve the linear programming problem by two phase solution of simplex method (8)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Solve by Taylor's series method the equation $\frac{dy}{dx} = \frac{x^3+xy^2}{e^x}$, $y(0) = 1$ for y at $x = 0.1, x = 0.2$. (10)

b) Find the values of $u(x,t)$ satisfying the parabolic equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ in $0 < x < 5$, $t \geq 0$ and the boundary conditions $u(x,0) = 20$, $u(0,t) = 0$ and $u(5,t) = 100$ using Crank Nicholson method. Take $h = 1$. (10)

8 a) Minimize $f(x_1,x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from the point $x_1 = 0$ and $x_2 = 0$, using Newton's method. (8)

b) What is meant by unconstrained non-linear optimisation? List any five methods to solve unconstrained non-linear optimisation. (7)

c) Define the terms (5)

i)Unimodal function and

ii)Gradient of a function

9 a) Apply fourth order Runge-Kutta method to find the value of y for $x = 0.2$ in steps of 0.1, if $dy/dx = x + y^2$, given that $y(0) = 1$. (10)

b) What are the one dimensional minimization methods in numerical methods? (5)

c) Find the minimum of $f = x^2 - 1.5x$ by starting from zero with an initial step size 0.05 by unrestricted search with accelerated step size and fixed step size. (5)