Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh semester B.Tech examinations (S), September 2020

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) Solve the following system of equations using Gauss-Seidel method: (9)

$8x-3y+2z=20;4x+11y-z=33;6x+3y+12z=35$.

b) Explain the errors in numerical methods. (6)

2 a) Find the largest eigen value and corresponding eigen vector of matrix (8)

$$A=\begin{pmatrix}9 & 1 & 8\\ 7 & 4 & 1\\ 1 & 7 & 9\end{pmatrix}.$$

b) Explain optimization procedure and constrained optimization. (7)

3 a) Find the extreme points of the function using multi variable unconstrained optimization technique (9)

$f(x_1, x_2) = x_1^3+x_2^3+2x_1^2+4x_2^2+6$

b) Define slack variable, surplus variable, and artificial variables. (6)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Apply Lagrange's formula to find $f(5)$. Given that, (8)

$f(1)=2, f(2)=4, f(3)=8, f(7)=128$.

b) The pressure and volume of a gas are related by the equation $pV^\gamma = k$, γ and k being constants. Fit this equation to the following set of observations: (7)

p(kg/cm2)	0.5	1.0	1.5	2.0	2.5	3.0
V(litres)	1.62	1.00	0.75	0.62	0.52	0.46

5 a) Using simplex method solve the LPP: Maximize $z = x_1 + x_2 + 3x_3$ subject to (8)

$3x_1 + 2x_2 + x_3 \le 3; 2x_1 + x_2 + 2x_3 \le 2; x_1, x_2, x_3 \ge 0$.

b) Write the dual of the following LPP; Minimize $z = 2x_1 + 3x_2 + 4x_3$ subject to $2x_1 + 3x_2 + 5x_3 \geq 2; 3x_1 + x_2 + 7x_3 = 3; x_1 + 4x_2 + 6x_3 \leq 5; x_1, x_2 \geq 0, x_3$ is unrestricted. (7)

6 a) Evaluate $\int_0^{1.2} e^{-x^2} dx$ using (i) Simpson's 1/3rd rule (ii) Simpson's 3/8th rule , taking h=0.2. (9)

b) Convert the following LPP to the standard from: (6)

Maximize $Z = 3x_1 + 5x_2 + 7x_3$

subject to $6x_1 - 4x_2 \leq 5$ $\quad 3x_1 + 2x_2 + 5x_3 \geq 11,$

$4x_1 + 3x_3 \leq 2$ $\quad x_1, x_2 \geq 0$

PART C

Answer any two full questions, each carries 20 marks.

7 a) Solve $y' = y^2 + x; y(0) = 1$ by using Taylor series method and compute $y(0.1)$ and $y(0.2)$. (10)

b) Solve by Crank Nicholson's implicit method $u_t = u_{xx}, 0 < x < 1, \ t > 0$ with $u(x,0) = 100(x - x^2), u(0,t) = 0$ and $u(1,t) = 0$. Compute u for one time step with h=0.25 (10)

8 a) Using steepest descent method. minimize $f(x_1, x_2) = 2x_1^2 + x_2^2$ with the starting point (1,2) .(2 iterations only) (10)

b) Find the minimum of $f = x^2 - 1.5x$ by starting from 0 with an initial step size 0.05 by unrestricted search with (i) Fixed step size (ii) Accelerated step size (10)

9 a) Find $y(0.1)$ and $y(0.2)$ correct to four decimal places by Runge-Kutta fourth order method given by $\frac{dy}{dx} = y - x; y(0) = 2.$ (10)

b) List out any five unconstrained optimization techniques. (5)

c) Explain: (5)

i) Unimodal Function

ii) Gradient of a function

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