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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2017

Branch: Mechanical

Stream(s): Machine Design

Manufacturing and Automation

Course Code & Name: **01ME7111: ADVANCED NUMERICAL METHODS**

Answer any two full questions from each part

Limit answers to the required points.

Max. Marks: 60

Duration: 3 hours

PART A

1.
 - a. Find by Newton-Raphson method, correct to three decimal places the root between 0 and 1 of the equation $x^3 - 2x + 5 = 0$ (4 Marks)
 - b. Using Regula Falsi method solve $x^2 - \log x - 12 = 0$ up to three decimal places (3 Marks)
 - c. Explain the concept of ill conditioned equations. (2 Marks)
2.
 - a. Solve the systems of equations by gauss- Jordan method (4 Marks)
$$\begin{aligned} x + y + z &= 9 \\ 2x - 3y + 4z &= 13 \\ 3x + 4y + 5z &= 40 \end{aligned}$$
 - b. Solve the systems of equations by Relaxation method (5 Marks)
 $9x - y + 2z = 9, x + 10y - 2z = 15, 2x - 2y - 13z = 17$
3.
 - a. Use Newton Raphson method solve the equations $x^2 + y^2 = x, x^2 - y^2 = y$ with $x_0 = 0.8, y_0 = 0.4$. (7 Marks)
 - b. Explain the concept of Newton Raphson method in solving transcendental equations. (2 Marks)

PART B

4. a. Find $y'(x)$ given (4 Marks)

| | | | | | |
|--------|---|---|----|----|----|
| x | 0 | 1 | 2 | 3 | 4 |
| $y(x)$ | 1 | 1 | 15 | 40 | 85 |

Hence find $y'(x)$ at $x=0.5$.

- b. Evaluate $\int_0^5 \frac{dx}{4x+5}$ by (a) trapezoidal rule (b) Simpson one third rule. (5 Marks)

5. a. Obtain a relation of the form $y=ab^x$ for the following data by method of (6 Marks)

least squares <http://www.ktuonline.com>

| | | | | | |
|-----|-----|------|------|------|-------|
| x | 2 | 3 | 4 | 5 | 6 |
| y | 8.3 | 15.4 | 33.1 | 65.2 | 127.4 |

- b. Discuss the measures of correlation (3 Marks)

6. a. From the following table of half yearly premium for policies maturing at different ages estimate the premium for policies maturing at age 46 and 63. (5 Marks)

| | | | | | |
|-------------|--------|-------|-------|-------|-------|
| Age x | 45 | 50 | 55 | 60 | 65 |
| Premium y | 114.84 | 96.16 | 83.32 | 74.48 | 68.48 |

- b. Find $y'(x)$ and $y''(x)$ at $x=51$ from the following data

| | | | | | |
|-----|-------|-------|-------|-------|-------|
| x | 50 | 60 | 70 | 80 | 90 |
| y | 19.96 | 36.65 | 58.81 | 77.21 | 94.61 |

(4 Marks)

PART C

7. a. Using Runge-Kutta method of fourth order find $y(0.1), y(0.2)$ and $y(0.3)$ given that $y' = 1 + xy; y(0) = 2$ (7 Marks)
- b. Discuss the concept of Euler's method in solution of ordinary differential equations (5 Marks)
8. a. Solve $\nabla^2 u = 0$ in $0 \leq x \leq 4; 0 \leq y \leq 4$ given that $u(0, y) = 0; u(4, y) = 8 + 2y; y(x, 0) = 0.5x^2, y(x, 4) = x^2$ with $\Delta x = \Delta y = 1$ (10 Marks)
- b. Discuss different types of partial differential equations. (2 Marks)
9. a. Solve $\nabla^2 u = 8x^2y^2$ in the square mesh given $u = 0$ on the four boundaries dividing the square into 16 sub squares of length 1 unit (6 Marks)
- b. Apply Picard's method to find the second approximations to the values of y and z corresponding to $x = 0.1$ given that $\frac{dy}{dx} = z, \frac{dz}{dx} = x^3(y+z)$ given that $y(0) = 1$ and $z(0) = 1/2$ (6 Marks)