AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
SPECIALIZED ENGINEERING PROGRAMS
JUNIOR COMMUNICATION ENGINEERING PROGRAM

SPRING 2022 **Assignment #5** **Total: 5 marks**

PHM212s: Special Functions, Complex Analysis & Numerical Analysis

Instructor Name: Dr. Makram Roshdy, Dr. Betty Nagy **1/8**

Name: **ID:** **Deadline: Week 14**

Please, Solve each problem in its assigned place ONLY (the empty space below it)

Numericl solution of Ordinary Differential Equations

Use at least 4 decimal places in your calculations

1) $y' = x + y$, $y(0) = 0$. Find $y(0.4)$ using the following:

a) Exact Method

b) Euler Method with h = 0.1

c) Euler Method with 10 steps

d) Runge-Kutta Method with h = 0.4

e) Runge-Kutta method with 2 steps.

2) $y' = x - y$, $y(1) = 2$. Find $y(0.5)$ using Runge-Kutta method with 2 steps.

3) $x' = x - y - t, y' = 4x - 2y, x(0) = 1 \ \& \ y(0) = 0$

Find $x(0.2) \& \ y(0.2)$ using Runge-Kutta method with h=0.1

4) $x'' + t^2x' + 3x = t,\ x(0) = 1\ \&\ x'(0) = 2$

Find $x(0.2)$ using Runge-Kutta method with h=0.1

Numericl solution of Partial Differential Equations

5) Find U (x, y) such that $\nabla^2 U(x,y) = 0$ over a rectangle 20 x 15 cm using a grid with step size h = 5, and the boundary conditions: U (x, 0) = 0, U (x, 15) = 0, U (0, y) = 0, U (20, y) = 100. Use Gauss-Seidel method to solve the resulting linear system. **Accurate to 2D**

6) Solve (using **h = 1/3**) the Dirichlet problem

$$\nabla^2 u(x, y) = 3(x^2 + y^2) \quad in \quad R$$
$$and\ u(x, y) = y - x \quad on \quad \partial R$$

Here ∂R is the boundary of R and R is the region in the unit square $0 \le x \le 1$ and $0 \le y \le 1$. Perform 5 steps of Gauss-Seidel method with the initial approximation $u_{11}^{(0)} = u_{12}^{(0)} = u_{21}^{(0)} = u_{22}^{(0)} = 0$.

Best wishes,

Dr. Makram Roshdy, Dr. Betty Nagy