B.Tech. (ECE) 4th Semester (G-Scheme)
Examination, July–2022
MATHEMATICS - III
Paper– B.S.C.-Math-202-G
Partial Differential Equations and Numerical Methods

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt **five** questions in total by selecting **one** question from each unit. **Question No 1 is compulsory.***

1. (a) Define Partial Differential equation.

(b) Differentiate between linear and non-linear partial differential equations.

(c) Solve $x^2 \frac{\partial u}{\partial x} + y^2 \frac{\partial u}{\partial y} = 0$ by method of separation of variables.

(d) Define initial and boundary conditions.

(e) Write Newton's forward difference formula.

(f) Write Euler method for solution of ordinary differential equations.

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Unit-I

2. (a) Solve the following partial differential equations.

   (i) $(mz - ny)P + (nx - \ell z)q = \ell y - mx$.

   (ii) $y^2 p - xy\,q = x(z - 2y)$

3. Solve $2xz - px^2 - 2qxy + pq = 0$, by Charpit's method.

Unit-II

4. Solve $= \frac{\partial^3 z}{\partial x^3} - 2\frac{\partial^3 z}{\partial x^2\,\partial y} = 2e^{2x} + 3x^2y$

5. Obtain D' Alembert's solution of the wave equation.

Unit-III

6. Find the positive root of $x^4 - x = 10$ correct to three decimal places, by using

   (i) Bisection method

   (ii) Newton - Raphson method

7. Evaluate $\int_0^1 \frac{dx}{1+x}$, by applying

   (i) Trapezoidal rule

   (ii) Simpson's $\frac{1}{3}$rd rule.

Unit-IV

8. Apply Runge-Kutta method to find an approximate value of y for $x = 0.2$ in steps of 0.1, if $\frac{dy}{dx} = x + y^2$, given that $y = 1$, where $x = 0$.

9. Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ in $0 < x < 5$, $t \geq 0$ given that $u(x, 0) = 20$, $u(0, t) = 0$, $u(5, t) = 100$. Compute u for the time step with $h = 1$ by Crank-Nicholson method.