Q4) a) Attempt any one of the following. **[5]**

i) State Fubini's theorem. Write the formula for change of cartesian coordinates to polar coordinates in a double integral.

ii) Write the equations of relationship between rectangular coordinates (X, Y, Z) and the spherical coordinates (ρ, θ, ϕ). Hence find the rectangular coordinates of a point $\left(2, \frac{\pi}{2}, \frac{\pi}{2}\right)$ in spherical coordinates.

b) Attempt any one of the following. **[5]**

i) Evaluate

$$\int_1^2 \int_0^{2z} \int_0^{\ln x} xe^{-y}\, dy\, dx\, dz$$

ii) Evaluate

$$\int_0^1 \int_{3y}^{3} e^{x^2}\, dx\, dy$$

by reversing the order of integration.

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Total No. of Questions : 4]

SEAT No. : ____

PA-2113

[Total No. of Pages : 2

[5901]-102
S.Y. B.Sc.
MATHEMATICS (Paper - II)
MT-232 (A) : Numerical Methods and its Applications
(2019 Pattern) (CBCS) (Semester - III) (23112A)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of calculator is allowed.***

Q1) **Attempt any Five of the following :** **[5 × 1 = 5]**

a) Define absolute error.

b) Write the formula to find first approximation x_1 in Regula-Falsi method with initial approximations a and b.

c) Simplify E^3x^2 take $h = 1$.

d) Prove that $\nabla(k) = 0$ where k is constant.

e) Write the formula for $\frac{dy}{dx}$ at $x = x_n$ in terms of ∇.

f) Write Runge-Kutta second order formulae to solve $\frac{dy}{dx} = f(x, y)$ with initial condition $y(x_0) = y_0$.

g) Write the formula for $y_1^{(n)}$ in modified Euler's method.

Q2) a) **Attempt any ONE of the following :** **[5]**

i) Explain Bisection method to find root of $f(x) = 0$.

ii) Derive Lagrange's interpolation formula.

P.T.O.

b) **Attempt any ONE of the following :** **[5]**

i) Evaluate $\int_0^6 e^x dx$ by Simpson's $\frac{3}{8}$ rule using the data e = 2.71, e^2 = 7.38, e^3 = 20.08, e^4 = 54.59, e^5 = 148.41, e^6 = 403.42.

ii) Solve $\frac{dy}{dx} = -y$ with $y(0) = 1$ by Euler's method. Take $h = 0.01$ and obtain $y(0.01)$, $y(0.02)$, $y(0.03)$

Q3) a) **Attempt any ONE of the following :** **[5]**

i) Explain Taylor's series method to solve initial value problem.

ii) Explain modified Euler's method to solve $\frac{dy}{dx} = f(x, y)$ with $y(x_0) = y_0$.

b) **Attempt any ONE of the following :** **[5]**

i) Find the real root of $x^2 - 2x - 1 = 0$ between 1 and 3 by Regula-Falsi method (perform two iterations)

ii) Prove that $\Delta \log f(x) = \log\left\{1 + \frac{\Delta f(x)}{f(x)}\right\}$.

Q4) a) **Attempt any ONE of the following :** **[5]**

i) Write the rules for round-off the number to significant figure.

ii) Derive the formula for $\frac{dy}{dx}$ at $x = x_0$ in terms of Δ.

b) **Attempt any ONE of the following :** **[5]**

i) Find $\sqrt[4]{74}$ by Newton-Raphson method. Perform two iterations.

ii) Find y when $x = 0.1$ by Runge-Kutta fourth order formula given $\frac{dy}{dx} = x + y$ with $y(0) = 1$.

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