(OR)

8. *(a)* A company producing three items has a limited inventories of averagely 750 items of all types. Determine the optimal production quantities for each item separately, when holding cost per unit per unit time are ₹0.05, 0.02 and 0.04 respectively. Ordering cost per order are ₹50, 40 and 60 respectively and respective demands are 100, 120 and 75 units per unit time.

(b) Draw the graph of inventory carrying cost and ordering cost with respect to inventory for purchasing inventory model without shortage. Also indicate optimal order quantity graphically. (6+3) **(CO4)**

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Bachelor of Arts Examination, 2025

(2nd Year, 1st Semester)

MATHEMATICS – III

Paper : MATH/UG/MINOR/TH/21/201

Time : *Two Hours* *Full Marks* : 30

The figures in the margin indicate full marks.

Symbols / Notations have their usual meanings.

1. *(a)* Formulate partial differential equation by eliminating arbitrary function 'f' from $f(x^2+y^2-z^2, x+y+z)=0$.

(b) Solve $\dfrac{\partial^2 z}{\partial y^2}=z$ where $\dfrac{\partial z}{\partial y}=e^{-x}$ for $y=0$ and $z=e^x$ for $y=0$.

(c) Classify the partial differential equation (elliptic, parabolic or hyperbolic) : $z_{xx}-yz_{yy}=0$. (3+3+2) **(CO1)**

(OR)

2. *(a)* Solve the partial differential equation : $(D^3-4D^2D'+5DD'^2-2D'^3)z=e^{2x+y}$ where $D=\dfrac{\partial}{\partial x}$ and $D'=\dfrac{\partial}{\partial y}$.

(b) Solve $(x^2 - y^2 - z^2)\dfrac{\partial z}{\partial x} + 2xy\dfrac{\partial z}{\partial y} = 2xz$. (4+4) **(CO1)**

3. Solve the following system of equation by Gauss elimination method using partial pivoting :

$$3x + 2y + z = 10$$

$$3y + 2x + 2z = 14$$

$$x + 2y + 3z = 14. \qquad (4)\ \textbf{(CO2)}$$

4. *(a)* Find a root of the equation $(\cos x - 5x + 5 = 0)$ corrected up to two decimal places, lying between 0.5 and 1.5 using fixed point iteration method.

(OR)

(b) Solve the following system of equation by Gauss-Seidel iteration method corrected up to one decimal place :

$$20x + 2y + z = 30$$

$$2x - y + 10z = 30$$

$$x - 40y + 3z = -75. \qquad (3)\ \textbf{(CO2)}$$

5. *(a)* Compute $\int_0^1 \dfrac{1}{1+x^2}dx$ by Simpson's one-third rule by taking $h = 0.25$.

(b) Compute $y = (0.2)$ from

$$\frac{\partial y}{dx} = x + y,\ y(0) = 1$$

taking step length $h = 0.1$ by 4th order Runge-Kutta method corrected up to 2 decimal places.(3+3) **(CO3)**

(OR)

6. *(a)* Compute $\int_0^{0.6} \dfrac{1}{\sqrt{1+x}}dx$ by Trapezoidal rule with number of sub-intervals (n) = 6.

(b) Solve by Euler's modified method for the following ODE for $x = 0.02$, by taking step length, $h = 0.01$, (corrected up to two decimal places)

$$\frac{dy}{dx} = x^2 + y,\ \ y(0) = 1. \qquad (3+3)\ \textbf{(CO3)}$$

7. *(a)* Write down the required assumptions and notations and derive the formula for the optimum production quantity per cycle of a single product so as to minimize total average cost for manufacturing inventory model without shortage with production rate P units per unit time and deterministic demand.

(b) The demand for an item in a company is 18000 units per year. The company can produce the item at a rate of 3000 per month. The cost of ten set-up is ₹5,000 and the holding cost of one unit per month is ₹0.15. The shortage cost of one unit is ₹20 per month. Determine the optimum manufacturing quantity and the shortage quantity. Also, determine the manufacturing time and the time between setups. (6+3) **(CO4)**