

Instructions to candidates

Duration: Two(02) hours

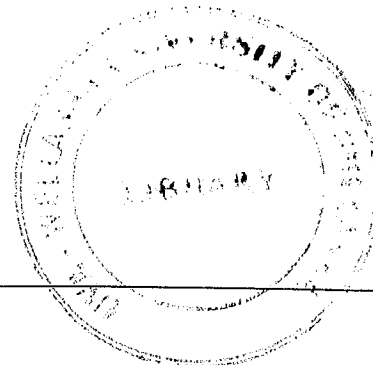
Number of questions: Four(04) Essay Questions

Mark allocation: 100 mark

Use standard symbols without definition.

Scientific calculators are allowed.

Answer all questions



1.

a. Let $A = \begin{pmatrix} 5 & -2 \\ 0 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 6 & 9 \\ 5 & 3 \end{pmatrix}$ and $C = (1 \quad -2)$, find;

- i. $2A + B$ (04 mark)
- ii. C^T (03 mark)
- iii. determinant of matrix A (03 mark)
- iv. inverse of matrix B (04 mark)

b. Find x such that $\begin{vmatrix} x & x+1 \\ 2 & x+2 \end{vmatrix} = 0$. (06 mark)

c. Use **Gauss-Jordan method** to solve the following system of linear equations.

$$\begin{aligned} 2x + y + z &= 10 \\ 3x + 2y + 3z &= 18 \\ x + 4y + 9z &= 16 \end{aligned} \quad (10 \text{ mark})$$

2. Food X contains 6 units of vitamin A per gram and 7 units of vitamin B per gram and cost is Rs. 12 per gram. Food Y contains 8 units of vitamin A per gram and 12 units of vitamin B per gram and cost is Rs. 20 per gram. The daily minimum requirements of vitamin A and vitamin B are 100 units and 120 units respectively.

- a. Formulate a mathematical model to find the minimum cost of product mix. (05 mark)
- b. What is the total estimated cost? Use the graphical method to solve this model. (10 mark)

3.

a. Find the particular solution of the equation $e^x \frac{dy}{dx} = 4$, given that $y = 3$ when $x = 0$. (08 mark)

b. Solve $\frac{dy}{dx} = (1+x)(1+y)$, by separating the variables. (05 mark)

c. Solve the following differential equations by using integrating factor.

i. $\frac{dy}{dx} + \frac{1}{x}y = x^2$ (07 mark)

ii. $x \frac{dy}{dx} = x^2 + 3y$ (10 mark)

4. Solve the following Ordinary Differential Equations (ODEs).

a. $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 12y = 0$ (07 mark)

b. $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 0$ (08 mark)

c. $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 8$ (10 mark)