

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.

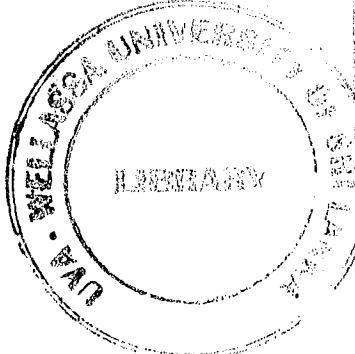
Answer all questions

- 1.
- a. Let $A = \begin{pmatrix} 3 & 2 \\ 1 & -6 \end{pmatrix}$, $B = \begin{pmatrix} 5 & 3 \\ 2 & -1 \end{pmatrix}$ and $C = (1 \quad -2 \quad -3)$, find;
- i. $3A + 2B$ (04 mark)
 - ii. C^T (03 mark)
 - iii. determinant of matrix A (03 mark)
 - iv. inverse of matrix B (04 mark)
- b. If $\begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix} \begin{pmatrix} x & 2 \\ 7 & y \end{pmatrix} = \begin{pmatrix} 25 & b \\ a & 13 \end{pmatrix}$, find the values of x, y, a and b . (06 mark)
- c. Use **Gauss-Jordan method** to solve the following system of linear equations.
- $$\begin{aligned} x + 3y - 4z &= 9 \\ 2x - y + z &= 3 \\ x + 2y - 5z &= 16 \end{aligned} \quad (10 \text{ mark})$$

2. A firm makes two types of containers, A and B. Each of which requires cutting, assembling and finishing. The maximum available machine capacity in hours per week for each process is: cutting 50, assembly 84 and finishing 72.
 The process times for one unit of each type are as follows:

Process	Time in hours	
	A	B
Cutting	2	5
Assembly	4	8
Finishing	4	5

The profit margin is Rs. 600 per unit A and Rs. 1000 per unit B:



- a. Formulate the mathematical model to find the maximum profit of product mix. (05 mark)
b. Determine the optimum weekly output of containers and maximum profit using **graphical method**. (10 mark)

3.

a. Find the general solution of the equation $\frac{dy}{dx} = 3x^2 - 4x + 5$. (05 mark)

b. Solve $x \frac{dy}{dx} = y + xy$, by separating the variables. (08 mark)

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

i. $x \frac{dy}{dx} + y = x^3$ (07 mark)

ii. $\frac{dy}{dx} + \cot xy = \cos x$ (10 mark)

4. Solve the following ordinary differential equations (ODEs).

a. $\frac{d^2 y}{dx^2} + 5 \frac{dy}{dx} + 6y = 0$ (04 mark)

b. $\frac{d^2 y}{dx^2} + 6 \frac{dy}{dx} + 9y = 0$ (06 mark)

c. $\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + 10y = 0$ (07 mark)

d. $\frac{d^2 y}{dx^2} - 5 \frac{dy}{dx} + 6y = 24$ (08 mark)