

Uva Wellassa University, Sri Lanka
Faculty of Science and Technology
Science and Technology Degree program
1st Semester Examination – March/April 2018



SCT 201-2 Mathematics II

Instructions to candidates

Answer all Four (04) questions

Index Number:

Time allocation: Two (02) hours

Total marks allocated: 100

1.

- a. State elementary row operations for Matrices
- b. An intelligent agent knows that 60 aircraft consisting of fighter planes and bombers are stationed at a certain secret airfield. The agent wishes to determine how many of the 60 are fighter planes and how many are bombers. There is a type of rocket carried by both types of planes; the fighter carries six of these rockets, the bomber only two. The agent learns that 250 rockets are required to arm every plane at this airfield. Furthermore, the agent overhears a remark that there are twice as many fighter planes as bombers at the base. Calculate the number of fighter planes and bombers at the airfield or show that the agent's information must be incorrect because it is inconsistent.

(25 marks)

2. A farmer can use two types of fertilizer on his crops, "Best Crops" and "Fert Fertilizer". Each bag of Best Crops contains 2 pounds of chlorine, 4 pounds of phosphoric acid and 8 pounds of nitrogen. Each bag of Fert Fertilizer contains 1 pound of chlorine, 4 pounds of phosphoric acid and 3 pounds of nitrogen. Tests indicate that the crops need at most 400 pounds of chlorine and at least 1,000 pounds of phosphoric acid. The farmer wants to minimize the amount of nitrogen added to his crops.
- Defining variables clearly, formulate the linear programming model.
 - Graphically or by any method find the optimal solution.

(25 marks)

3. Let the matrices $A = \begin{pmatrix} 3 & 2 & 1 \\ 4 & 3 & 3 \\ 6 & 5 & 4 \end{pmatrix}_{3 \times 3}$ and $B = \begin{pmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 0 \end{pmatrix}_{3 \times 2}$. Find the following,

- $A + 2I$
- AB
- $|A|$
- Deduce whether the inverse of A exists. If so, find A^{-1} .

(25 marks)

4.

a. Identify and state the following ordinary differential equations (ODEs) as linear or homogeneous. If linear, what are the kinds of coefficients? Write the order of each ODEs.

i. $y \frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 3y = 0$

ii. $\frac{dy}{dx} + y = \sin x$

iii. $x^2 \frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 3xy = 0$

iv. $7 \frac{d^2y}{dx^2} - 16 \frac{dy}{dx} + 3y = x^2 + \cos x$

v. $9 \frac{d^4y}{dx^4} + 4 \frac{d^3y}{dx^3} - \frac{dy}{dx} + 3y = e^x$

b. Solve following ODEs.

i. $\frac{dy}{dx} + 2y = 2xe^{-2x}$

ii. $\frac{d^2y}{dx^2} - 5 \frac{dy}{dx} + 4y = 0$



(25 marks)