Strathmore
UNIVERSITY

STRATHMORE INSTITUTE OF MANAGEMENT AND TECHNOLOGY
DIPLOMA IN BUSINESS INFORMATION TECHNOLOGY
END OF SEMESTER EXAMINATION
DBT 1106: MATHEMATICS FOR BUSINESS COMPUTING

DATE: 15th December, 2023 Time:15:30-17:30 Hours

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.
3. Do not write on the question paper.

QUESTION ONE [30 MARKS]

a) Prove by contradiction that $\sqrt{7}$ is not rational. **[3 Marks]**

b) Use truth table to show that $(p \wedge q) \leftrightarrow (\neg p \vee \neg q)$ is a tautology or not. **[3 Marks]**

c) A hockey team containing 6 men and 7 women is to be chosen from 8 men and 10 women. In how many ways can this be done. **[3 Marks]**

d) Let $A = \{1,2,3,4,5,6\}$, $B = \{x : x \in Z \text{ and } x \text{ is divisible by } 6\}$, $C = \{x : x \in \Re \text{ and } x^2 = 3 \text{ or } x^3 = 1\}$. Mark the following true or false.

i. $4 \in (A \cup B)$ **[1 Mark]**

ii. $6 \in (A \cap B)$ **[1 Mark]**

iii. $1 \in (A \cap B)$ **[1 Mark]**

iv. $\sqrt{3} \in (B \cup C)$ **[1 Mark]**

e) Test the validity of the following argument:

If the given figure is a square, then it is a rectangle.
The given figure is a square.
Therefore, it is a rectangle.

[3 Marks]

f) Evaluate the following limits

i. $\lim_{x \to -2} \left(4x^2 - \frac{5}{x} - 10\right)$ **[1 Mark]**

ii. $\lim_{x \to 2} \frac{2x^2 - 7x + 6}{5x^2 - 11x + 2}$ **[3 Marks]**

iii. $\lim_{x \to 5} \frac{\sqrt{2x-1} - 3}{x - 5}$ **[3 Marks]**

g) Differentiate the following

i. $y = \dfrac{1-x^2}{1+x^2}$ **[2 Mark]**

ii. $y = \left(x^4 + 2x - 10\right)^{-2/3}$ **[2 Marks]**

h) Evaluate the integral

$$\int_2^3 \left(2x^3 + 7x - 5\right)dx$$ **[3 Marks]**

QUESTION TWO [15 MARKS]

a) Determine the maximum area of a rectangular piece of land that is enclosed by 1200 metres of fence. **[4 Marks]**

b) Given the following matrices $A = \begin{pmatrix} 2 & -1 \\ 4 & 3 \end{pmatrix}$, $B = \begin{pmatrix} 0 & 1 \\ -1 & 2 \end{pmatrix}$, $C = \begin{pmatrix} 1 \\ 5 \\ 3 \end{pmatrix}$, $D = \begin{pmatrix} 3 & 1 & 2 \\ 0 & 1 & 1 \end{pmatrix}$.

I. Show that $AB \neq BA$. **[4 Marks]**

II. Determine the following if possible:

i. AC **[1 Mark]**

ii. AD **[2 Marks]**

iii. DC **[2 Marks]**

iv. DCC^T **[2 Marks]**

QUESTION THREE [15 MARKS]

a) Determine the integral of the following:

i. $\int \left(\dfrac{e^{4x} + 2}{e^{-x}}\right)dx$ **[2 Marks]**

ii. $\int_0^1 \dfrac{2x+3}{\sqrt{x^2 + 3x + 2}}\,dx$ **[4 Marks]**

b) At a school open day there are 12 special people for whom the cateress has prepared supper. Unfortunately, she can only fit 9 people into the dining room, and of these the Headmaster, the Board Chairman and the Guest of Honour must be included. In how many ways can the six remaining guests be chosen, if Mr. and Mrs. A must both be included or both excluded, and if Miss X and Miss Y have recently quarrelled and must not both be invited? **[9 Marks]**

QUESTION FOUR [15 MARKS]

a) Are the following statements true or false?

i. $2 \in \{1, 2, 3, 4\}$ **[1 Mark]**

ii. $8 \in \{2, 4, 6, ...\}$ **[1 Mark]**

iii. $\{x, y, w, z\} = \{z, x, w, y\}$ **[1 Mark]**

iv. $\{1, 2, 3\}$ is equivalent to $\{4, 5, 6\}$ **[1 Mark]**

v. $\sqrt{3} \notin \{x : x \text{ is a counting number}\}$ **[1 Mark]**

vi. $0 \in \{\ \}$ **[1 Mark]**

b) A company makes three types of automobile transmissions ($4-$ gear manual (type X), $4-$ gear automatic (type Y), $5-$ gear automatic (type Z)). In one day, it produces 40 of type X , 50 of type Y and 80 of type Z . Required for production are 4 units of parts (some preassembled) and 1 worker-hour for type X , 5 units of parts and 2 worker-hours for type Y , and 3 units of parts and 2 worker-hours for type Z .Letting matrix A represent the number of each type produced, and matrix B represents the parts and time requirements .

(i) Write down matrix A in one row. **[2 Marks]**

(ii) Write down matrix B in two-column. **[3 Marks]**

(iii) Using matrix A and B determine the total number of units of parts and the total number of worker-hours needed for the day's production . **[4 Marks]**

QUESTION FIVE [15 MARKS]

a) Test the validity of the following argument:

If I like Mathematics, then I will study.
Either I study or I fail.
If I fail, then I do not like Mathematics. **[5 Marks]**

b) In a survey of 1000 households, 275 owned a home computer, 455 a video, 405 two cars, and 265 households neither owned a home computer, nor a video, nor two cars. Given that 145 households owned both a home computer and a video, 195 both a video and two cars, and 110 both two cars and a home computer , find the number of households surveyed which owned

i. a home computer, a video and two cars. **[2 Marks]**

ii. present the information on a Venn diagram. **[3 Marks]**

iii. two cars and a video but not a home computer**.** **[1 Mark]**

iv. a home computer or two cars but not a video. **[1 Mark]**

v. exactly one of the three items. **[1 Mark]**

vi. exactly two of the three items. **[1 Mark]**

vii. at least one of the three items. **[1 Mark]**

END