

Total number of printed pages-12

3 (Sem-4/CBCS) MAT SE 1/2

2025

MATHEMATICS

(Skill Enhancement Course)

Answer the Questions from any one Option.

OPTION - A

Paper : MAT-SE-4014

(R-Programming)

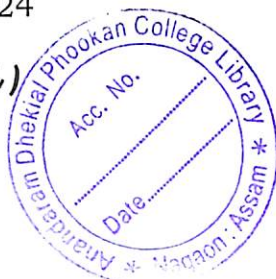
OPTION - B

Paper : MAT-SE-4024

(LaTeX and HTML)

Full Marks : 50

Time : Two hours



The figures in the margin indicate full marks for the questions.

Answer **either** in English **or** in Assamese.

OPTION - A

Paper : MAT-SE-4014

(R-Programming)

1. Answer the following questions : $1 \times 4 = 4$

তলৰ প্রশ্নবোৰৰ উত্তৰ লিখা :

(a) How do you load a package in R?

R ত কেনেকৈ এটা পেকেইজ লোড কৰিব পাৰি?

(b) What is the function to calculate standard deviation in R?

R ত প্রামাণিক বিচ্যুতি গণনা কৰিবলৈ ব্যৱহাৰ হোৱা ফলনটো কি?

(c) How do you view the summary statistics of a data frame in R?

R ত এটা ডাটা ফ্রেমৰ সাৰাংশ পৰিসংখ্যা কেনেকৈ চাবা?

(d) How do you create a boxplot in R?

R ত বক্সপ্লট কেনেকৈ তৈয়াৰ কৰিব পাৰি?

2. Answer the following questions : $2 \times 3 = 6$

তলৰ প্রশ্নবোৰৰ উত্তৰ লিখা :

(a) Write a function in R to calculate the Sum of squares of a given vector.

কোনো এটা ভেক্টৰৰ বৰ্গৰ যোগফল গণনা কৰিবলৈ R ত এটা ফলন লিখা।

(b) What is the use of seq() function in R?

R ত seq() ফলনৰ ব্যৱহাৰ কি?

(c) Create a data frame in R with 3 rows and 2 columns. The columns should be named "Name" and "Age".

3টা শাৰী আৰু 2টা স্তম্ভৰ সৈতে R ত এটা ডাটা ফ্রেম সৃষ্টি কৰা। স্তম্ভবোৰৰ নাম "Name" আৰু "Age" হব।

3. Answer **any two** questions from the following : $5 \times 2 = 10$

তলৰ যিকোনো দুটা প্রশ্নৰ উত্তৰ লিখা :

(a) What is a factor in R? How would you create a factor in R?

R ৰ ক্ষেত্ৰত ফেক্টৰ কি? R ত ফেক্টৰ কি ধৰণে তৈয়াৰ কৰা হয়?

- (b) Write an R program to check if the input number is odd or even.

Input সংখ্যাটো যুগ্ম বা অযুগ্ম পৰীক্ষা কৰিবলৈ এটা R প্ৰগ্ৰাম লিখা।

- (c) Create a scatter plot in R with a title, x -axis label, and y -axis label. The plot should display the relationship between two variables: "Height" and "Weight". The plot should also include a regression line.

এটা শিৰোনাম, x -অক্ষ লেবেল, আৰু y -অক্ষ লেবেলৰ সৈতে R ত এটা স্কেটাৰ প্লট সৃষ্টি কৰা। প্লটত দুটা চলকৰ মাজৰ সম্পৰ্ক প্ৰদৰ্শন কৰিব লাগে : "Height" আৰু "Weight"। প্লটটোত এটা ৰিগ্ৰেছন লাইনো থাকিব লাগে।

- (d) Create a bar chart in R with a title, x -axis label, and y -axis label. The chart should display the frequency of different categories. The chart should also include a legend.

এটা শিৰোনাম, x -অক্ষ লেবেল, আৰু y -অক্ষ লেবেলৰ সৈতে R ত এটা বাৰ চাৰ্ট সৃষ্টি কৰা। চাৰ্টত বিভিন্ন শ্ৰেণীৰ frequency প্ৰদৰ্শন কৰিব লাগে। চাৰ্টত এটা legend ও থাকিব লাগে।

4. Answer **any three** questions from the following : $10 \times 3 = 30$

তলৰ যিকোনো তিনিটা প্ৰশ্নৰ উত্তৰ লিখা :

- (a) Discuss about the components of R-studio.

R-studio ৰ উপাদানৰ বিষয়ে আলোচনা কৰা।

- (b) Write an R-program to find the sum of the following series :

$$1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n}$$

তলৰ শ্ৰেণীটোৰ যোগফল নিৰ্ণয় কৰিবলৈ এটা R-program লিখা :

$$1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n}$$

- (c) Write an R-program to find all primes smaller than 1000.

1000 তকৈ সৰু মৌলিক সংখ্যাবোৰ উলিওৱাৰ বাবে R-programটো লিখা।

- (d) Write a program to display the Fibonacci sequence upto n -th term using recursive function.

Recursive ফলন ব্যৱহাৰ কৰি এটা ফিবোনাৰ্চি অনুক্ৰমৰ n -তম পদলৈ প্ৰদৰ্শন কৰা Program-টো লিখা।

- (e) Write a recursive function in R to calculate the binomial co-efficients for given values of n and k .

n আৰু k ৰ প্ৰদত্ত মানৰ বাবে দ্বিপদ সহগ গণনা কৰিবলৈ R ত এটা পুনৰাবৃত্তিমূলক ফলন লিখা।

- (f) Write a function in R to calculate the correlation co-efficient between two variables. The function should take two arguments: x (the 1st variable) and y (the 2nd variable). The function should return the correlation co-efficient and the P-value.

দুটা চলকৰ মাজৰ correlation co-efficient গণনা কৰিবলৈ R ত এটা ফলন লিখা। ফলনটোৱে দুটা লব : x (প্ৰথম চলক) আৰু y (দ্বিতীয় চলক)। ফলনটোৱে correlation co-efficient আৰু P-মান দিব লাগিব।

OPTION - B

Paper : MAT-SE-4024

(*LaTeX and HTML*)

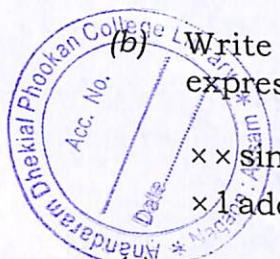
1. Answer **any four** questions: 1×4=4

- (a) What do you mean by LaTeX ?
(b) What do you mean by preamble in a LaTeX document ?
(c) What are the LaTeX commands for the Greek letters ε and γ ?
(d) Write the LaTeX command for $A \cap B$.
(e) What is beamer ?
(f) Which document class do we use in the preamble of a beamer document ?
(g) What does HTTP stand for ?
(h) What does the `<body>... </body>` section of a web page contain ?

2. Answer **any two** questions: 3×2=6

- (a) Make the following equation in LaTeX :

$$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$$



- (b) Write each of the following postfix expressions in standard form :

$\times \times \sin \text{ mul}$

$\times 1 \text{ add } 2 \text{ exp } 1 \times \text{ sub div}$

- (c) What is wrong with the following input ?
What is the right way to do it ?
If $\$theta = \pi$, then $\$cos \theta = -1$

- (d) Write a simple LaTeX program to create a file containing an itemized list.

- (e) Write a simple LaTeX program to create a presentation with a title page and a second page containing a 3×3 matrix.

- (f) Is the following HTML construction correct ? Justify.

`<p> This is bold and italics.</p>`

3. Answer **any two** questions : $5 \times 2 = 10$

- (a) Write the LaTeX command for the following :

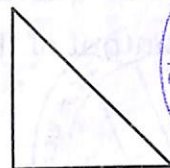
$$1 + 2 = 3$$

$$4 + 5 + 6 = 7 + 8$$

$$9 + 10 + 11 + 12 = 13 + 14 + 15$$

$$16 + 17 + 18 + 19 + 20 = 21 + 22 + 23 + 24$$

- (b) Use LaTeX picture environment to make a picture of a Pythagorean triangle of sides 3,4,5 as shown below and put the inscribed triangle



- (c) What is PSTricks in LaTeX ? Write the use of the following commands :

`\psset`, `\psline`, `\pscircle`, `\psclip`

- (d) Write the output of the following LaTeX code :

```
\begin{pspicture}(4,4)
\pscircle(2,2){1.5}
\pswedge[fillstyle=solid,fillcolor=lightgray](2,2){1.5}{0}{60}
\put(2.75,1.7){\${r\$}}
\put(2.3,2.1){\${\theta\$}}
\put(3.25,3){\${A=r\theta\$}}
\end{pspicture}
```

- (e) Write a simple program in LaTeX to create a presentation containing the title page and a second page containing a PSTricks picture of a square.

- (f) What are the basic elements of HTML ?
Write the uses of these basic elements.

4. Answer **any three** questions : $10 \times 3 = 30$

- (a) Write the output of the following LaTeX code.

```
\documentclass{article}
\title{My Document}
\author{A. Student}
\begin{document}
\maketitle
\begin{enumerate}
\item Let  $\mathbf{x} = (x_1, \dots, x_n)$ , where the  $x_i$  are nonnegative real numbers. Set
\begin{equation*}
M_r(\mathbf{x}) = \left( \frac{x_1^r + x_2^r + \dots + x_n^r}{n} \right)^{1/r},
\end{equation*}
; ;  $r \in \mathbf{R} \setminus \{0\}$ ,
\end{equation*}
and
\begin{equation*}
M_\theta(\mathbf{x}) = \left( x_1 x_2 \dots x_n \right)^{1/n}.
\end{equation*}
We call  $M_r(\mathbf{x})$  the  $r$ th power mean
of  $\mathbf{x}$ .
```

- (b) Plot $y = \sin x$ and $y = \cos x$ on the same coordinate system, for $0 \leq x \leq 2\pi$. Show the sine function as a solid curve and the cosine function as a dotted curve.

- (c) How to create arrays and multiline expressions in LaTeX ? Give examples of each in LaTeX code as well as the corresponding outputs.
- (d) Draw a graph consisting of two sets of three nodes and all nine possible line connections between the two sets.
- (e) Check for mistakes in the following LaTeX codes and correct them and produce the final output.

```
\documentclass{article}
\title{Differentiability}
\begin{document}
\begin{frame}
\titlepage
\begin{frame}
Let  $f$  be a function defined in a neighbourhood of a point  $x_0$ . Then  $f$  is differentiable at  $x_0$  if the following limit exists :
\begin{equation*}
\lim_{x \rightarrow x_0} \frac{f(x) - f(x_0)}{x - x_0}
\end{equation*}
\end{frame}
\end{document}
```

- (f) Describe how to put an image in a web page with the image aligned at the center. Give an example. How to use an image as a link ? Give an example.

- (g) What does HTML stand for ? Write HTML code to construct the following web page:

Here are the mathematical subjects offered :

- Differential equation
- LaTeX and HTML

The syllabus of each paper can be found at Gauhati University.

(Note : Here Gauhati University should be a link to an external website)

- (h) Make a web page showcasing some of your mathematical interests.
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