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 : 1×4=4

তলৰ প্ৰশ্নবোৰৰ 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 প্ৰামাণিক 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 ফ্ৰেমৰ 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 : 2×3=6

তলৰ প্ৰশ্নবোৰৰ 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 ফ্ৰেম সৃষ্টি কৰা। স্তম্ভবোৰৰ নাম "Name" আৰু "Age" হব।

3. Answer ***any two*** questions from the following : 5×2=10

তলৰ *যিকোনো দুটা* প্ৰশ্নৰ 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 a R program to check if the input number is odd or even.

Input সংখ্যাটো যুগ্ম বা অযুগ্ম পৰীক্ষা কৰিবলৈ এটা R প্ৰগেম 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 : 10×3=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 :

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

তলৰ শ্ৰেণীটোৰ যোগফল নিৰ্ণয় কৰিবলৈ এটা R-program লিখা ঃ

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

(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 ফিবোনাকি 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। ফলনটোয়ে 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 :

× × sin mu1

× 1 add 2 exp 1 × 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.

 This is bold and italics.

3. Answer ***any two*** questions : 5×2=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 : 10×3=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 $\mathbf{x}=(x_1,\ldots,x_n)$, where the $x_i$ are nonnegative real numbers. Set
\begin{equation*}
M_r(\mathbf{x})=\left(\frac{x_1^r+x_2^r+\cdots+x_n^r}{n}\right)^{1/r},
\; \; r \in \mathbf{R} \setminus \{0\},
\end{equation*}
and
\begin{equation*}
M_0(\mathbf{x})=\left( x_1 x_2 \ldots x_n \right)^{1/n}.
\end{equation*}
We call $M_r(\mathbf{x})$ the \emph{$r$th power mean} of $\mathbf{x}$.
```

(b) Plot $y = \sin x$ and $y = \cos x$ on the same coordinate system, for $0 \le x \le 2\pi$. 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{Differ entiability}
\begin{document}
\begin{frame}
\titlepage
\begin{frame}
Let $f$ be a function defined in a neighbourhood of a point x_{θ}. Then $f$ is differentiable at x_{θ} if the following limit exists :
\begin{equation*}
\lim_{x\rightarrow x_{θ}}frac{f(x)-f(x_θ)}{x-x_θ}
\end{frame}
\end{equation}
```

(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.
