

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 86
(For candidates admitted from the academic year 2023 – 2024 and thereafter)

M.Sc. DEGREE EXAMINATION, NOVEMBER 2024
BRANCH I - MATHEMATICS
THIRD SEMESTER

COURSE : **MAJOR CORE**
PAPER : **RESEARCH METHODS AND TOOLS**
SUBJECT CODE : **23MT/PC/RT34**
TIME : **3 HOURS**

MAX. MARKS: 100

THEORY

Q. No.	SECTION A (10 × 1 = 10) Answer ALL questions	CO	KL
1	Which of the following is a key element that motivates researchers? a) Financial incentives b) Curiosity and knowledge creation c) Professional criticism d) Leisure and entertainment	1	1
2	The main purpose of research is to: a) Promote business b) Generate new knowledge c) Prove a theory d) Strengthen personal opinions	1	1
3	Which of the following is NOT a characteristic of a well-formulated research problem? a) It should be specific b) It should be feasible c) It should lead to a general conclusion d) It should be researchable	1	1
4	In research, data analysis refers to: a) The process of drawing conclusions b) Collecting and recording data c) Classifying and organizing data d) Interpreting and making sense of data	1	1
5	What is the main purpose of the 'Suggestions and Recommendations' section in a research report? a) To criticize previous research b) To propose future actions based on the findings c) To list personal opinions of the researcher d) To present the raw data	1	1
6	Research ethics primarily focuses on: a) Financial management of research projects b) Integrity and honesty in the research process c) Writing research papers d) Managing intellectual property	1	1
7	What is the key environment that promotes research integrity? a) Competitive research funding b) Pressure to publish c) Open and collaborative work culture d) Strict legal regulations	1	1

8	Which of the following is an example of scientific misconduct? a) Careless record-keeping b) Ignoring peer reviewers' suggestions c) Fabrication of data d) Minor calculation errors	1	1
9	Which of the following organizations provides guidelines on publication ethics? a) WHO b) COPE c) UNESCO d) NIH	1	1
10	Which of the following databases provides a journal impact factor? a) Scopus b) Google Scholar c) Web of Science d) PubMed	1	1

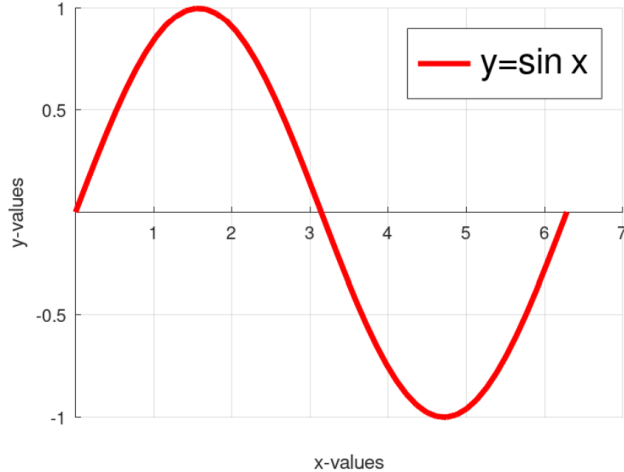
Q. No.	SECTION B (2 × 5 = 10) Answer ANY TWO questions	CO	KL
11	Distinguish between research methods and research methodology.	1	2
12	Give your understanding of a good research design. Is single research design suitable in all research studies? If not, why?	1	2
13	What is a conflict of interest? Which interests may collide rather than cooperate? What is the proper first interest of a scientist?	1	2
14	What is the basic difference between intellectual honesty and research integrity?	1	2

Q. No.	SECTION C (1 × 10 = 10) Answer ANY ONE question	CO	KL
15	Enumerate the different methods of collecting data. Explain their merits and demerits.	2	3
16	Explain the terms fabrication, falsification, and plagiarism with illustrations.	2	3

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PRACTICAL

Q. No.	SECTION A (25 × 1 = 25) Answer ANY ONE question	CO	KL																																
1.	(a) Create a simple LaTeX document that uses the article document class. The document should have a title, two authors, and date. Divide the document into sections and subsections, and customize the page numbering style (Roman numerals for the first few pages and Arabic numerals for the rest). (b) Write a MATLAB script to create a basic area calculator with at least 3 shapes. The user should choose the operation to perform from a menu and then the parameters accordingly. <p style="text-align: right;">(10+15)</p>	3	4																																
2.	(a) Recreate the following table in LaTeX: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Matrix</th> <th>Property</th> <th>Dimension</th> <th>Operation</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td rowspan="3"> $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ </td> <td><i>Determinant</i></td> <td>2×2</td> <td>$\det(A)$</td> <td>-2</td> </tr> <tr> <td><i>Transpose</i></td> <td>2×2</td> <td>A^T</td> <td> $\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$ </td> </tr> <tr> <td>Sum of Matrix A and Identity Matrix</td> <td>2×2</td> <td>$A + I_2$</td> <td> $\begin{bmatrix} 2 & 2 \\ 3 & 5 \end{bmatrix}$ </td> </tr> <tr> <td rowspan="2"> $B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ </td> <td><i>Determinant</i></td> <td>2×2</td> <td>$\det(B)$</td> <td>-1</td> </tr> <tr> <td><i>Inverse</i></td> <td>2×2</td> <td>B^{-1}</td> <td> $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ </td> </tr> <tr> <td colspan="4">Trace of Matrix A</td> <td>5</td> </tr> </tbody> </table> (b) Write MATLAB script to recreate the following graph: <p style="text-align: center;">Graph of a Sine Curve</p>  <p style="text-align: right;">(15+10)</p>	Matrix	Property	Dimension	Operation	Result	$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$	<i>Determinant</i>	2×2	$\det(A)$	-2	<i>Transpose</i>	2×2	A^T	$\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$	Sum of Matrix A and Identity Matrix	2×2	$A + I_2$	$\begin{bmatrix} 2 & 2 \\ 3 & 5 \end{bmatrix}$	$B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$	<i>Determinant</i>	2×2	$\det(B)$	-1	<i>Inverse</i>	2×2	B^{-1}	$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$	Trace of Matrix A				5	3	4
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3.	<p>(a) Create a simple grid using the tikzpicture environment and draw the coordinate axes and label them using looping. Also draw a filled rectangle and a filled circle in this grid, add a dashed border for the circle.</p> <p>(b) In MATLAB, create a 4×4 matrix and perform each of the following:</p> <ol style="list-style-type: none"> Maximum value in each column Minimum value in each row Sum of all the elements Characteristic polynomial Eigen values and Eigen vectors Elements greater than 5 using logical indexing Extract a submatrix Replace the third row with all 1's <p style="text-align: right;">(10+15)</p>	4	5														
4.	<p>(a) Write a LaTeX document that includes footnotes, cross-references between sections, and a bibliography at the end. The document should contain mathematical expressions, and each section must have at least one citation and one footnote.</p> <p>(b) Represent the following data by using pie diagram emphasizing the region for 'Asia':</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>Africa</td> <td>30.33</td> </tr> <tr> <td>Antarctica</td> <td>13.23</td> </tr> <tr> <td>Asia</td> <td>42.24</td> </tr> <tr> <td>Australia</td> <td>8.42</td> </tr> <tr> <td>Europe</td> <td>10.57</td> </tr> <tr> <td>North America</td> <td>24.35</td> </tr> <tr> <td>South America</td> <td>17.64</td> </tr> </tbody> </table> <p style="text-align: right;">(15+10)</p>	Africa	30.33	Antarctica	13.23	Asia	42.24	Australia	8.42	Europe	10.57	North America	24.35	South America	17.64	4	5
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Q. No.	SECTION C (20 × 1 = 20) Answer ANY ONE question	CO	KL
5.	<p>Typeset a LaTeX document to create a simple project report. The report should have the following:</p> <ul style="list-style-type: none"> Title page A table of contents Two sections: one with a detailed table and another section with at least three mathematical equations Include at least two images with appropriate captions, and references to the images within the text. Bibliography 	5	6
6.	<p>Plot and format in MATLAB, the torus $x = \cos t(R + r \cos u)$, $y = \sin t(R + r \cos u)$, $z = r \sin u$, where R, r are constants and t, u both vary between 0 and 2π.</p>	5	6
