

# DECLARATION

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I, hereby, declare that the thesis entitled “**Fabrication of sensitive SERS substrates on low-cost platform and their applications in chemical and biomolecular detection**”, submitted to the School of Sciences, Tezpur University, in partial fulfillment of the requirements for the award of the Doctor of Philosophy in Physics, has been carried out by me at the Department of Physics, Tezpur University, Assam, India-784028, under the supervision of **Prof. Pabitra Nath**. The contents of this work is original except where specific reference is made to the works of others, and has not been submitted in whole or in part for consideration for any other degree or qualification in this or any other university or institute.

**Date:** December 2, 2024

**Place:** Tezpur University

Sritam Biswas

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## TEZPUR UNIVERSITY

(A central University established by an Act of Parliament)

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## CERTIFICATE OF THE PRINCIPAL SUPERVISOR

This is to certify that the thesis entitled “**Fabrication of sensitive SERS substrates on low-cost platform and their applications in chemical and biomolecular detection**”, submitted to the School of Sciences, Tezpur University in partial fulfillment of the requirement for the award of the degree of Doctor of Philosophy in Physics, is a record of research work carried out by **Mr. Sritam Biswas** under my guidance and supervision.

All help received by him from various sources have been duly acknowledged. No part of this thesis has been submitted elsewhere for award of any other degree.

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### CERTIFICATE OF EXTERNAL EXAMINER AND ODEC

This is to certify that the thesis entitled “**Fabrication of sensitive SERS substrates on low-cost platform and their applications in chemical and biomolecular detection**”, submitted by **Mr. Sritam Biswas** to the School of Sciences, Tezpur University in partial fulfillment of the requirement for the award of the degree of Doctor of Philosophy in Physics, has been examined by us on ..... and found satisfactory.

The committee recommends for the award of the degree of Doctor of Philosophy.

**Principal Supervisor**

Date:

**External Examiner**

Date:



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*This thesis is dedicated to  
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## LIST OF ABBREVIATIONS

<b>Abbreviation</b>	<b>Meaning</b>
AgNP	Silver nanoparticle
AgNR	Silver nanorod
AuNP	Gold nanoparticle
AuNR	Gold nanorod
a.u.	Arbitrary unit
BPE	1,2-bis(4-pyridyl)ethylene
BR-DVD	Blu-ray digital versatile disc
CD	Compact disc
DI	Deionized
DNA	Deoxyribonucleic acid
dsRNA	Double-stranded ribonucleic acid
ELISA	Enzyme-linked immunosorbent assay
EF	Enhancement factor
$EF_{avg}$	Average enhancement factor
$EF_{max}$	Maximum enhancement factor
FEM	Finite element method
FESEM	Field emission scanning electron microscopy
GSM	Grams per square meter
GMR	Guided-mode resonance
ICA	Immunochemical assay
INR	Indian Rupee
$I_{Raman}$	Raman signal intensity
$I_{SERS}$	SERS signal intensity
LoD	Limit of detection
LSPR	Localized surface plasmon resonance
MG	Malachite green
NIR	Near infrared
$N_{Raman}$	Number of analyte molecules probed for normal Raman scattering measurement within the excitation area

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$N_{SERS}$	Number of molecules probed for SERS measurement within the excitation area on SERS substrate
PBS	Phosphate-buffered saline
PCR	Polymerase chain reaction
PET	Polyethylene terephthalate
PML	Perfectly matched layer
RNA	Ribonucleic acid
RSD	Relative standard deviation
rpm	Rotations per minute
R6G	Rhodamine 6G
SAED	Selected area electron diffraction
SEM	Scanning electron microscopy
SERS	Surface-enhanced Raman scattering
TEM	Transmission electron microscope
USD or \$	US Dollar
UV	Ultraviolet
WHO	World Health Organization