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Notice for the PhD Viva Voce Examination

Ms Seema, Registration Number: 2270143, PhD Scholar at the Department of Mathematics, School of Sciences, CHRIST (Deemed to be University) will defend her PhD thesis at the public viva-voce examination on Friday, 08 May 2026 at 11.00 am in Discussion Room, 2nd Floor, A Block, CHRIST (Deemed to be University), Delhi NCR Off-Campus, Ghaziabad - 201003, Uttar Pradesh, India.

Title of the Thesis	:	**Transference Characteristics of Seismic Surface Waves in Peizo-Composite Layered Structures with Distinct Interfacial Conditions Using Analytical and Computational AI Methods**
Discipline	:	**Mathematics**
External Examiner - I	:	**Dr Sachin Kumar** Associate Professor and Head Department of Mathematics and Statistics Central University of Punjab VPO-Ghudda, Bhatinda - 151401 Punjab
External Examiner - II	:	**Dr Dharmendra Tripathi** Associate Professor Department of Mathematics National Institute of Technology Uttarakhand Srinagar - 246174 Uttarakhand
Supervisor	:	**Dr Abhinav Singhal** Assistant Professor School of Sciences CHRIST (Deemed to be University) Delhi NCR Off-Campus Ghaziabad - 201003 Uttar Pradesh

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva–voce examination.

Registrar (Academics)

Place: Bengaluru
Date: 27 April 2026

ABSTRACT

This research presents a comprehensive theoretical and computational investigation of surface wave propagation in advanced smart and functional materials, with particular emphasis on piezoelectric, piezo-flexoelectric, thermoelastic, viscoelastic, and biological media at micro- and nanoscale dimensions. Generalized dynamic models are developed to analyse Love-type, Rayleigh-type surface waves in layered and composite structures, including piezoelectric quasicrystals, piezo-thermoelastic half-spaces, multiferroic cylindrical shells, visco-piezo composites, and orthotropic biological structures such as long bones. Surface and interfacial effects, namely surface elasticity, surface piezoelectricity, surface permittivity, flexoelectricity, and imperfect bonding are rigorously incorporated through spring-type and interface models to capture size-dependent wave behaviour. Analytical formulations based on separable variable methods, and generalized thermoelastic theories (Green–Naghdi type III and Three-Phase-Lag) are employed to derive dispersion relations, secular equations, phase velocities, attenuation coefficients, and energy loss characteristics under electrically and magnetically open/shorted and thermally constrained boundary conditions. Numerical investigations identify critical thickness effects, anisotropy ratios, bonding parameters, initial stress, and magnetic field as key factors governing wave dispersion and damping. To overcome the high computational cost of solving complex transcendental equations, the physics-informed and data-driven machine-learning technique Physics-informed neural network (PINN) is integrated as an efficient surrogate solver, enabling rapid parametric exploration with high accuracy. The outcomes provide unified physical insight into electromechanical, magneto-electro-elastic, flexoelectric, and thermoelastic coupling mechanisms across engineered and biological media. The developed framework offers practical mathematical and computational tools for the design and optimisation of surface acoustic wave devices, and non-invasive biomedical diagnostic technologies, while remaining adaptable to a wide class of wave phenomena and material systems.

Keywords: Piezoelectric materials; Surface waves; Imperfect interfaces; Surface Acoustic Waves devices.

Publications:

1. Seema and Abhinav Singhal. (2025). Investigating wave propagation across loosely bonded interfaces in visco-piezo composites with flexoelectricity in LiNbo3 and AlN. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *481*(2311). *https://doi.org/10.1098/rspa.2024.0661*
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