# Notice for the PhD Viva Voce Examination

Ms Srilakshmi Prabhu (Registration Number: 1881301), PhD scholar at the School Sciences, CHRIST (Deemed to be University) will defend her PhD thesis at the public viva-voce examination on Wednesday, 25 January 2023 at 3.00 pm in the Syndicate Room (Room No. 802), Ground Floor, Auditorium Block, CHRIST (Deemed to be University), Bengaluru - 560029.

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| **Title of the Thesis** | : | **Synthesis and Characterization of Light–Weight, Lead-Free Polymer Composites for X-Ray and Y-Ray Shielding** |
| **Discipline** | : | **Physics** |
| **External Examiner**<br>(Outside Karnataka) | : | **Dr Ramasubramanian V**<br>Professor<br>Department of Physics<br>VIT University<br>Vellore - 632014<br>Tamil Nadu |
| **External Examiner**<br>(Within Karnataka) | : | **Dr Manohara S R**<br>Associate Professor<br>Department of Physics<br>Siddaganga Institute of Technology<br>Tumkur<br>Karnataka - 572103 |
| **Supervisor** | : | **Dr Bubbly S G**<br>Professor<br>Department of Physics and Electronics<br>School of Sciences<br>CHRIST (Deemed to be University)<br>Bengaluru – 560029<br>Karnataka |

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.

**Registrar**

**Place:** Bengaluru
**Date:** 10 January 2023

# ABSTRACT

**Abstract:** The present study has focused on the development of technologically viable and efficient X-ray and γ-ray shielding materials to meet the safety requirements for use in medical radiation facilities, nuclear research laboratories, aerospace industry and so on. Light-weight and lead-free polymer composites have been synthesized by reinforcing high-Z metal oxide additives such as bismuth (III) oxide ($Bi_2O_3$), micro-/nano-tantalum (V) oxide ($Ta_2O_5$) and $Bi_2O_3$ decorated graphene oxide (GO) fillers (BGO) of varying loading into sodium alginate (SA) and epoxy resin polymers. The composites were characterized for their physical, microstructural, thermo-mechanical and viscoelastic properties using various techniques such as X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Raman spectroscopy, energy dispersive X-ray analysis coupled scanning electron microscopy (SEM-EDX), thermogravimetric analysis (TGA), universal tensile testing machine (UTM) and dynamic mechanical analysis (DMA). Shielding effectiveness of the developed composites were studied using CdTe and NaI(Tl) detector spectrometers in the energy range (30 – 1332 keV) of medical and industrial interest. Overall, the composites developed in this study are found to be human-safe and eco-friendly radioprotective materials.

***Keywords:*** *Sodium alginate, epoxy resin, bismuth oxide, tantalum oxide, graphene oxide, surface decoration, nanocomposites, thermo-mechanical, viscoelastic, X-/γ-ray shielding.*

**Journal Publications**

1. **Srilakshmi Prabhu**, Dhanya Y Bharadwaj, S G Bubbly and S B Gudennavar, Lead-free inorganic metal perovskites beyond photovoltaics: Photon, charged particles and neutron shielding applications, *Nuclear Engineering and Technology*, 2022. https://doi.org/10.1016/j.net.2022.11.025. (IF: 2.817)
2. **Srilakshmi Prabhu**, S G Bubbly and S B Gudennavar, Bismuth (III) oxide decorated graphene oxide filled epoxy nanocomposites: Thermo- mechanical and photon attenuation properties, Advanced Composite Materials, 1-27, 2022. https://doi.org/10.1080/09243046.2022.2128264. (IF: 2.870)
3. **Srilakshmi Prabhu**, S G Bubbly and S B Gudennavar, X-ray and γ-ray shielding efficiency of polymer composites: Choice of fillers, effect of loading and filler size, photon energy and multifunctionality, Polymer Reviews, 66, 2022. https://doi.org/10.1080/15583724.2022.2067867. (IF: 14.536)
4. **Srilakshmi Prabhu**, Sreehari Jayaram, S G Bubbly and S B Gudennavar, A simple software for swift computation of photon and charged particle interaction parameters: PAGEX, Applied Radiation and Isotopes, 176, 109903, 2021. https://doi.org/10.1016/j.apradiso.2021.109903. (IF: 1.787)
5. **Srilakshmi Prabhu**, Dhanya Y Bharadwaj, Rachaita Podder, S G Bubbly and S B Gudennavar, Natural polymer-based hydrogels as prospective tissue equivalent materials for radiation therapy and dosimetry, Physical and Engineering Sciences in Medicine, 44(4), 1107, 2021. https://doi.org/10.1007/s13246-021-01047-6. (IF: 7.099)
6. **Srilakshmi Prabhu**, S G Bubbly and S B Gudennavar, Thermal, mechanical and γ-ray shielding properties of micro-and nano-$Ta_2O_5$ loaded DGEBA epoxy resin composites, Journal of Applied Polymer Science, 138(44), 51289, 2021. https://doi.org/10.1002/app.51289. (IF: 3.057)
7. Muthamma M V, **Srilakshmi Prabhu**, S G Bubbly and S B Gudennavar, Micro and nano $Bi_2O_3$ filled epoxy composites: Thermal, mechanical and γ-ray attenuation properties, Applied Radiation and Isotopes, 174, 109780, 2021. https://doi.org/10.1016/j.apradiso.2021.109780. (IF: 1.787)
8. **Srilakshmi Prabhu**, S G Bubbly and S B Gudennavar, Sodium alginate/bismuth (III) oxide composites for γ-ray shielding applications, Journal of Applied Polymer Science, 138(19), 50369, 2021. https://doi.org/10.1002/app.50369. **(**IF: 3.057)
9. **Srilakshmi Prabhu**, S G Bubbly and S B Gudennavar, Synthetic polymer hydrogels as potential tissue phantoms in radiation therapy and dosimetry, Biomedical Physics & Engineering Express, 6(5), 055008, 2020. https://doi.org/10.1088/2057-1976/aba209. (IF: 1.463)
10. **Srilakshmi Prabhu**, Sneha A C, Pooja P Shetty, Arundati A Narkar, Bubbly S G and S B Gudennavar, Effective atomic number and electron density of some biologically important lipids for electron, proton, alpha particle and photon interactions, Applied Radiation and Isotopes, 160, 109137,2020. https://doi.org/10.1016/j.apradiso.2020.109137. (IF: 1.270)