CHRIST
(DEEMED TO BE UNIVERSITY)
BANGALORE | DELHI NCR | PUNE

Notice for the PhD Viva Voce Examination

Ms Nirosha James, Registration Number: 2090192, PhD Scholar at the Department of Chemistry, School of Sciences, CHRIST (Deemed to be University) will defend her PhD thesis at the public viva-voce examination on Friday, 19 December 2025 at 9.00 am in Room No. 044, Ground Floor, R&D Block, CHRIST (Deemed to be University), Bengaluru - 560029, Karnataka, India.

Title of the Thesis : **Two-Dimensional Carbon-Based Ternary Composites as Supercapacitor Electrodes**

Discipline : **Chemistry**

External Examiner - I : **Dr Sreekumar K**
Chief Scientist
Physical and Materials Chemistry Division
CSIR-National Chemical Laboratory
Pune - 411008
Maharashtra

External Examiner - II : **Dr Asha A S**
Assistant Professor
Department of Physics
Cochin University of Science and Technology
Kochi - 682022
Kerala

Supervisor : **Dr Sreeja P B**
Associate Professor
Department of Chemistry
School of Sciences
CHRIST (Deemed to be University)
Bengaluru - 560029
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 – voce examination.

Registrar

Place: Bengaluru
Date: 11 December 2025

ABSTRACT

The global surge in energy demand, fuelled by the rapid expansion of portable electronics, electric vehicles, and renewable energy systems, has positioned energy storage as a pivotal challenge for achieving grid stability and advancing decarbonization to combat climate change. Supercapacitors, owing to their rapid energy transfer, high-power characteristics, operational longevity, and environmental benignity, are instrumental in meeting these challenges. This research explores the potential of 2D carbon-based materials, specifically rGO and g-C3N4, as advanced electrode materials for high-performance supercapacitors. This study focuses on the strategic synthesis of ternary composites by integrating these 2D materials with other carbonaceous materials and pseudocapacitive materials to enhance the overall electrochemical performance. Material characterization was performed using an integrated analytical approach combining crystallographic (XRD), spectroscopic (Raman, FTIR, XPS), and microscopic (SEM, TEM) techniques, complemented by surface area quantification (BET). Electrochemical evaluations, encompassing cyclic voltammetry, galvanostatic charge-discharge, electrochemical impedance spectroscopy, and stability testing, demonstrated substantial performance gains in energy storage capacity, operational lifespan, and power delivery metrics relative to conventional alternatives. These enhancements stem from the synergistic interactions and optimized spatial configurations within the ternary composites, which facilitate optimized charge storage sites and efficient ion/electron transport pathways. The asymmetric supercapacitors developed using these 2D carbon-based ternary composites showcase a remarkable enhancement in their electrochemical attributes. This work highlights the potential of 2D carbon-based hybrid materials in next-generation energy storage systems, offering a sustainable pathway toward reducing fossil fuel dependence and accelerating the adoption of renewable energy technologies.

Keywords: *Reduced graphene oxide, Graphitic carbon nitride, Metal oxides, Conducting polymers, Asymmetric supercapacitors.*

Publications:

1. **Nirosha James**, Shilpa Simon, Sreelakshmi Rajeevan, Soney C George, and Sreeja P B, "Symmetric Supercapacitors based on Reduced Graphene Oxide/Multi-walled Carbon Nanotubes/Cobalt Oxide Ternary Composites," J. Macromol. Sci. Part B Phys., vol. 0, no. 0, pp. 1–22, 2023, doi: 10.1080/00222348.2023.2285656.
2. **Nirosha James**, Shilpa Simon, and Sreeja P B, "Materials Today: Proceedings Electrochemical performance of rGO/MWCNT/CoS ternary composite for supercapacitor applications," Mater., Proc., no. November 2023, 2024, doi: 10.1016/j.matpr.2023.11.076.
3. **Nirosha James** and Sreeja P B, "Indium oxide decorated graphitic carbon nitride/multiwalled carbon nanotubes ternary composite for supercapacitor applications," Electrochim. Acta, vol. 507, no. June, p. 145192, 2024, doi: 10.1016/j.electacta.2024.145192.
4. **Nirosha James**, Shilpa Simon, and Sreeja P. B, "Graphene–Metal Oxide Composite Materials for Supercapacitor Applications," in Graphene–Metal Oxide Composites: Synthesis, Properties, and Applications, S. Moharana, S. K. Satpathy, T. A. Nguyen, and T. Maharana, Eds., Royal Society of Chemistry, 2025, p. 0.
   Doi: 10.1039/9781837673391-00734.