INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : **Ph.D**.

Thesis Title: **Deep Eutectic Mixtures with Graphene and MWCNT Functionalized Nanofluids for Indirect Solar Desalination using Multistage Flash Approach**

Name of Thesis Supervisor(s) : **Prof. Tamal Banerjee**

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Key words for description of Thesis Work : **Deep Eutectic Solvent, DFT, NADES, Nanofluid, Heat transfer fluid**

SHORT ABSTRACT

The thesis addresses the growing global water crisis and presents nanofluid-based thermal technologies as a sustainable solution, particularly in solar-assisted desalination. It focuses on developing eco-friendly and efficient heat transfer fluids using bio-based solvents such as Cyrene, deep eutectic solvents (DES), and natural deep eutectic solvents (NADES). These solvents were enhanced with nanoparticles like multi-walled carbon nanotubes (MWCNT), carboxyl-functionalized MWCNT (MWCNT-COOH), and amine-functionalized graphene oxide (GO-NH_2) to improve thermal conductivity and heat transfer efficiency. Experimental studies, supported by density functional theory (DFT) and non-equilibrium molecular dynamics (NEMD) simulations, demonstrated that Cyrene-based nanofluids exhibited superior heat transfer performance and stability. DES-MWCNT nanofluids showed improved thermal behavior and stability, with thermogravimetric analysis (TGA) confirming their resistance to high temperatures. DES-based GO-NH_2 nanofluids enhanced thermal properties and were successfully applied in a multistage flash desalination model using ASPEN simulations. NADES-based nanofluids, incorporating lauric acid and DL-menthol, achieved up to 108% enhancement in thermal conductivity, with MWCNT-COOH nanofluids showing exceptional performance under forced convection conditions. The combined experimental and theoretical results highlight the potential of these green nanofluids for efficient thermal energy storage and water desalination systems.