
Registration Seminar

Seminar Title	: Development of a High-Performance Workwear Material for Extreme Environmental Conditions
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Venue	: ME Seminar Hall Room No.: 001 (Offline mode)
Date and Time	: 30 Apr 2025 (04:30 PM)
Abstract	: Ensuring thermal comfort for individuals working in extreme environmental conditions is a critical challenge, especially where conventional clothing fails to offer sufficient heat dissipation and moisture management. This study investigates the development of high-performance workwear utilizing advanced hygroscopic and thermoregulatory textile technologies. The research focuses on selecting appropriate fabric polymers integrated with sorption materials such as silica gel, zeolites, and hydrogel composites to enhance moisture absorption and evaporative cooling. A structured review of literature highlights recent advances in passive and active cooling textiles, including Janus materials, phase change materials (PCMs), super hygroscopic polymer films, and multilayered 3D spacer fabrics. The experimental framework involves the design of a controlled thermal manikin-based setup to simulate extreme heat and assess thermophysical properties, breathability, and cooling efficiency of the developed fabrics. Complementary numerical simulations and data-driven predictive modeling using Physics-Informed Neural Networks (PINNs) are employed to evaluate heat transfer and optimize performance. The study addresses key gaps related to long-term durability, scalability, and applicability under real-world conditions such as mining, military, and industrial work zones. The outcome of this research aims to contribute a novel, sustainable, and scalable fabric solution that enhances thermal comfort, reduces heat stress, and promotes productivity in demanding occupational environments.