Departmental Seminar

Seminar Title	: Dynamic Modelling and Stability Analysis of Fluid-Conveying Pipelines Immersed in an Incompressible Fluid with Simplified Boundary Conditions
Speaker	: Bala Murugan S (518me3031)
Supervisor	: Prof. Saurav Datta (2524), PIC Departmental Seminar
Venue	: ME Seminar Hall (ME-001)
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Abstract	: The study investigates the dynamic behavior and stability of a slender, uniform pipe with simple supports conveying fluid, immersed in an incompressible medium. Key parameters, including pipe length, diameter, flexural rigidity, and fluid properties, are analyzed. The influence of the surrounding fluid is altered using an axial added mass coefficient to refine the forces acting on the system. The Galerkin approach is employed to derive the equations of motion under these new boundary conditions. Numerical simulations explore the system's response to varying internal fluid velocities and support configurations, focusing on stability and vibration characteristics. Additionally, the expressions of the natural frequency are simplified when different boundary conditions are considered because of this. By way of illustration, the natural frequency of a straight pipe that is simply supported at both ends is investigated. This is done while taking into consideration the Coriolis forcing. In a particular boundary condition, the natural frequency of a pipeline transporting fluid is analyzed in depth, and the findings show that the influence of Coriolis force on natural frequency is negligible. The natural frequency equation frame makes it straightforward to follow the Galerkin formulation that describes the pipeline conveying fluid vibration equation. Then, the relationship between the Euler beam's natural frequency and the pipeline's conveying fluid is examined. The findings reveal critical insights into divergence and flutter instabilities and how system parameters like internal fluid velocity, pipe slenderness, and initial tension affect stability transitions. This study provides an extensive investigation of pipe behavior under simple supports, offering significant guidance for the design and operation of fluid-conveying pipelines in engineering applications.