National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: Existence results for a class of elliptic equations with singular nonlinearities
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Venue	: Seminar Room, Department of Mathematics
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Abstract	: The central theme of this thesis is to explore the existence and regularity of solutions to certain classes of elliptic equations that involve singularities. These problems lie at the intersection of nonlinear analysis, functional analysis and partial differential equations &mdash fields that are deeply connected. Elliptic partial differential equations play a key role in various areas such as mechanics, electrostatics, quantum physics, and finance. There has been growing interest in nonlinear elliptic equations with singularities in recent years. These problems appear in many real-world situations, including chemical reactions, heat transfer in special materials, fluid flow, glacial movement, and industrial transport systems. Our physical motivation for studying such equations comes from thermo-conductivity and models in signal transmission, boundary layers, and non-Newtonian fluid flow. Some problems also involve the Hardy potential, which is important in quantum physics, especially in studying the Schrödinger equation. Our objective is to prove the existence, multiplicity and regularity of positive solutions, focusing on the impact of singular and other critical and supercritical nonlinearities. Additionally, different types of homogeneous and nonhomogeneous operators are considered in the study. To demonstrate the existence of a weak solution, we used various methods like the weak convergence method, Schauder&rsquos fixed point theorem, variational method, method of sub and supersolutions, etc. In some problems, we also proved the non-existence of a solution for sufficiently large parameters. We also prove the regularity of solutions with the help of the standard Moser iteration method.