**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI**
**SHORT ABSTRACT OF THESIS**

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| Name of the Student | : Vijay Kumar Mishra |
| Roll Number | : 126103034 |
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| Thesis Title: | Simultaneous estimation of parameters in combined mode conduction-radiation heat transfer in porous medium |
| Name of Thesis Supervisor(s) | : Dr. Dipankar Narayan Basu |
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**SHORT ABSTRACT**

Development of thermal systems like a porous radiant burner, heat exchangers, insulations, etc., quantitative knowledge of heat and/or mass transfer, temperature field are essential. With geometric details, thermo-physical and optical properties, and initial and boundary conditions known, the desired results, viz., temperature and heat flux distributions are known by numerically solving a set of governing equations. However, when a thermal system is designed, a priori knowledge of some or all of the geometric parameters, and thermos-physical and optical properties of the material, and even initial and/or boundary conditions may not be known. Experimental route to optimize these parameters with trial and error approach for the desired outcome is not scientific. Recourse of an inverse analysis is the most preferred option by the scientific community. With thermo-physical properties and initial and boundary conditions known, calculations of the desired velocity field, temperature field or heat and mass flow rates, come under solving a direct problem. However, when either of the desired quantities (temperature, velocity fields, heat and mass transfer rates), and one or more of the properties or initial or boundary conditions are unknown, problem becomes an inverse one. In the direct problem, causes are known, and getting the outcomes are straightforward. On the contrary, in inverse problems, the outcome is known, but not the cause(s). Estimation of cause(s) is relatively, a difficult task. Mathematically, inverse problems are ill-posed. With even a slight variations in governing parameters, solution goes astray. Over the last five decades, many researchers have studied heat and mass transfer in porous media. They have considered different geometric and thermal configurations. However, study on estimation of parameters in a combined mode conduction and radiation heat transfer with or without combustion is scarce. With its application in porous radiant burners in mind, the present work, is aimed at heat transfer analysis as well as estimation of thermo-physical and optical properties in a combined mode conduction and radiation heat transfer in porous media. With aforementioned objective in mind, in the present work, different configurations like single stage, two stage are considered. Different geometries like 1D planar, 2D rectangular, 2D axisymmetric cylindrical are also considered. Also, different optimization algorithms in the inverse analysis are used, such as genetic algorithm, global search algorithm, pattern search algorithm, simulated annealing etc.