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Notice for the PhD Viva Voce Examination

Mr Puneeth V (Registration Number: 1942071), PhD scholar at the School of Sciences, CHRIST (Deemed to be University), Bangalore will defend his PhD thesis at the public viva-voce examination on Friday, 19 May 2023 at 10.00 am in the Council Room, Ground Floor, Central Block, CHRIST (Deemed to be University), Bengaluru - 560029.

Title of the Thesis	:	**Heat and Mass Transfer Analysis of Newtonian and Non-Newtonian Nanofluids in the Presence of Motile Microorganisms**
Discipline	:	**Mathematics**
External Examiner (Outside Karnataka)	:	**Dr Rushi Kumar** Professor Department of Mathematics School of Advanced Sciences Vellore Institute of Technology Vellore - 632014, Tamil Nadu
External Examiner (Within Karnataka)	:	**Dr G Jayalatha** Associate Professor Department of Mathematics R V College of Engineering Mysore Road, R V Vidyaniketan Post Bengaluru – 560059 Karnataka
Supervisor	:	**Dr Manjunatha S** Assistant Professor Department of Sciences and Humanities School of Engineering and Technology CHRIST (Deemed to be University) Bangalore Kengeri Campus Bengaluru-560074 Karnataka

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

Place: Bengaluru
Date: 15 May 2023

Registrar

ABSTRACT

This dissertation deals with the analysis of heat and mass transfer in Newtonian and non-Newtonian nanofluid in the presence of motile microorganisms. The major application of the fluids in heat and mass transfer process is its capability to conduct heat. Hence, the fluids act as a source that conducts heat and cools down the temperature of the appliance. Whereas, the capacity of heat conductance is low in case of regular fluids, hence the concept of nanofluids was introduced whose thermal conductivity is more when compared to regular fluids. The high thermal conductivity of nanoparticles helps in conducting more heat and the property of fluid to flow helps the nanoparticles to flow all over the desired surface and conduct heat. During the process of nanofluid flow, the nanoparticles undergo random motion that is termed as Brownian motion and they also experience the thermophoretic force that causes the nanoparticles to move from hotter region to colder region. Further, the presence of nanoparticles would either result in sedimentation or formation a layer of nanoparticles over the surface.

This layer of nanoparticles adhered to the surface creates corrosion. Hence, it is important to prevent the nanoparticles from forming its layer over the surface and also the sedimentation of nanoparticles must be avoided to have no blockages in the system. Hence to avoid sedimentation, self–propelled microorganisms are made to swim in the nanofluid which in turn constitutes bioconvection. Considering these assumptions, problems in this dissertation are modelled such that it deals with the analysis of bioconvection caused due to the swimming of microorganisms in the flow of nanofluid. The mathematical models of the flow, heat and mass transfer of Newtonian and non–Newtonian nanofluids are designed using the partial differential equations with various assumptions to achieve realistic results. This system of partial differential equations are then converted to non–linear ordinary differential equations with the help of similarity variables and the resulting system of equations is solved using numerical methods such as DTM–Pade approximant, Chebyshev Collocation method and RKF–45 method. The study is performed for various geometries such as needle, parallel walls, non–parallel walls, Riga plate and stretching sheet. Further, the flow, heat and mass transfer of nanofluid between non–parallel walls is observed through simulation. The outcomes are discussed through plotted graphs and tables.

Keywords: Gyrotactic microorganisms, nanofluid, thermophoresis, Brownian motion, numerical methods, bioconvection, heat transfer, mass transfer, radiation, Buongiorno's model

Publications:

1. **V. Puneeth**, S. Manjunatha, and B.J. Gireesha, "Bioconvection in Buoyancy Induced flow ofWilliamson Nanofluid over a Riga Plate-DTM-Pade Approach", Journal of Nanofluids, vol.9(4), pp.269–281, 2020.
2. **V. Puneeth**, S. Manjunatha, and B.J. Gireesha, "Quartic Autocatalysis of Homogeneous and Heterogeneous Reactions in the Bioconvective Flow of Radiating Micropolar Fluid between Parallel Plates", Heat Transfer – Wiley, vol.50(6), pp.5925– 5950, 2021.
3. **V. Puneeth**, S.S. Narayan, S. Manjunatha, and O.D. Makinde, "Numerical Simulation of Jeffrey-Hamel flow of nanofluid in the presence of microorganisms", International Journal of Ambient Energy, vol.43, no.1, pp.6095–6107, 2022.
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5. **V. Puneeth**, S. Manjunatha, and B.J. Gireesha, "Implementation of Modified Buongiorno's Model for the Investigation of Chemically Reacting rGO − Fe3O4 − TiO2 − H2O Ternary Nanofluid Jet flow in the Presence of Bio-Active Mixers", Chemical Physics Letters, vol.786, p.139194, 2022.
6. **V. Puneeth**, S. Manjunatha, B.J. Gireesha, and S.A. Shehzad, "Three-dimensional Bio-Convective Flow of Sisko Nanofluid under Robin's Conditions", Heat Transfer – Wiley, vol.50(8), pp.7632–7653, 2021.
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