Title of the Project	Analysis of effect of Lorentz force on attitude dynamics of a charged spacecraft
Commencement Date	12th May 2024
Completion Date	12th July 2024
Project Supervisor	Prof. Dipak K. Giri
Organization/Institution where the Project was accomplished	SDFCL Lab-IIT KANPUR

Project Description (You can use extra A4 sheets in case you run out of space however the extra sheets should also have the seal & signature of the Project Supervisor or the relevant authority)

Approach
• Conducted a literature review and documentation of an 'to be published' research paper on satellite dynamics and kinematics equations, including the effects of Lorentz force.
• Modelling a hypothetical small satellite with charge q and derived its dynamic equations in body frame and kinematics equation using quaternions on circular orbits.
• Developed and implemented code for numerical simulations using MATLAB, employing the ode15 solver to find accurate solutions for the satellite's quaternion and angular velocity (omega) dynamics.
• Designed and analysed quaternion plots on MATLAB and angular velocity profiles to understand the satellite's attitude behaviour over time for varying charge and orbit inclination i.

Outcomes
• Observed uncontrolled i.e. diverging behaviour of angular velocities and perturbations on quaternions tested on various q=[1C,,0.1C,0.01C,0.001C,0.0001C] and i=[0,30,60,90,105] degrees for 5 orbits around earth.
• As the charge value increases from 0.0001C to 1C, quaternion oscillations decrease in frequency but increase in amplitude, while angular velocity components increase in magnitude and variability.
• Higher charge values enhance the Lorentz force's impact on the satellite, significantly altering its attitude and reducing rotational stability.

By appending your signatures to this form you acknowledge and agree that:

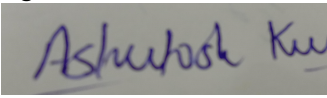- This form along with the certificate would serve as the official document between the project supervisor and Students Placement Office, IIT Kanpur regarding verification of the student's project work
- The student will provide additional information and documentation relevant to his/her project upon request by the Students' Placement Office
- The student has clearly defined his/her individual role in projects done in cooperation with other students, faculty, groups or company personnel.
- Incorrectly over-stating the reach, impact and/or quantitative/qualitative results of a project is unethical.
- In case of violation of any of the above rules, Students' Placement Office, IIT Kanpur reserves the right to take necessary action including de-registering the student from the placement season and reporting the misconduct to the Institute Authorities.

Submitted by:-	Project Supervisor Details:-SDFCL Lab
Name: **Ashutosh Kumar**	Name: Prof. Dipak K. Giri
Roll No:220241	Designation: Assistant Professor, IIT KANPUR
Signature:	Signature: