Proposal for announcing seat under the Institute Internship Program

(separate form to be filled for seat under Institute funding and project funding)

1. Name of faculty member proposing: **Prof. M. M. Sharma**
2. Department/Centre: **Electronics and Communication Engineering**
3. Topic on which work is proposed:
   1. **Design Quad band antenna for satellite communication.**
   2. **Design of Microstrip antenna with AI and ML Techniques**

4. Preferred period of internship (after May 20th): Between May 2024 to July 2024

5. Qualification of student (branch/semester of study): CSE/ECE/ 6 th/ 4th semester

6. Brief description of work :

1. **Design Quad-Band Antenna for Satellite Communication**: This project involves designing a quad-band antenna system optimized for satellite communication applications. Quad-band antennas are capable of operating across multiple frequency bands, enabling communication with satellites in different orbits and frequency ranges. The design process includes conceptualization, simulation, prototyping, and experimental validation. Various antenna configurations and materials may be considered to achieve desired performance metrics such as gain, radiation pattern, bandwidth, and impedance matching. Advanced electromagnetic simulation tools are employed to model antenna characteristics, while experimental tests validate performance under real-world conditions. The project aims to develop a compact, efficient antenna system suitable for satellite communication systems, including LEO (Low Earth Orbit), MEO (Medium Earth Orbit), and GEO (Geostationary Orbit) satellites.
2. **Design of Microstrip Antenna with AI and ML Techniques**: This project focuses on the design optimization of microstrip antennas using Artificial Intelligence (AI) and Machine Learning (ML) techniques. Microstrip antennas are widely used in wireless communication systems due to their low profile, lightweight, and ease of integration. The project employs AI and ML algorithms to enhance the performance of microstrip antennas by automating the design optimization process. Data-driven approaches analyze large datasets of antenna parameters, simulation results, and performance metrics to identify patterns, correlations, and optimal design configurations. Genetic algorithms, neural networks, and reinforcement learning techniques may be utilized to explore the design space, optimize antenna geometry, and improve key performance parameters such as gain, bandwidth, and efficiency. The project aims to leverage AI and ML capabilities to accelerate the design iteration process, reduce time-to-market, and achieve superior performance compared to traditional manual design methods.

7. Expected learning of student: In an antenna research project, students can expect to gain a wide range of knowledge and skills across several domains. Here's a breakdown of the expected learning outcomes:
   - Understanding of Antenna Fundamentals
   - Research Methodologies
   - This includes proficiency in software packages such as MATLAB, CST Microwave Studio, HFSS (High-Frequency Structure Simulator), and Ansys.

- They will learn to operate equipment such as vector network analyzers (VNAs), spectrum analyzers, and anechoic chambers.
- Mathematical Modeling
- Through research challenges and design optimizations, students will enhance their critical thinking and problem-solving abilities.
- through engagement with industry professionals, conferences, and research communities, students will gain insights into the broader applications of antenna technology, emerging trends, and career pathways in the field.

8. Nature of work: (Experimental/simulation/mathematical modelling/data collection-analysis etc.):

    - Finite Element Method (FEM), Method of Moments (MoM), and Finite Difference Time Domain (FDTD) techniques are utilized to simulate antenna performance under various operating conditions.
    - Analytical formulations, including integral equations, differential equations, and boundary value problems, are employed to derive closed-form expressions for key antenna parameters such as impedance, radiation pattern, and gain.
    - Data collected from simulations, mathematical models, and experimental tests are systematically analyzed to extract insights into the performance characteristics of the antennas. Statistical techniques, numerical optimization algorithms, and machine learning approaches may be employed to identify trends, correlations, and design optimizations.

9. If the seat is under project sponsored category: **No**
    a) If yes, number of seats announced:
    b) Name and ID no. of project from which stipend is chargeable

Signature of faculty member

Name of department/Centre

Note:

a) Proposing faculty member needs to be available at the Institute during the period internship is offered
b) No extra space or funding than the stipend will be provided by the institute for this purpose