

Proposal for announcing seat under the Institute Internship Program

1. **Name of faculty member proposing:** Dr. Naresh Kumar Raghuwanshi
2. **Department/Centre:** Mechanical Engineering
3. **Topic on which work is proposed:** Machine learning and Vibration based gearbox fault diagnosis.
4. **Preferred period of internship (after May 20<sup>th</sup>):** Between May 20<sup>st</sup>, 2024, to July 16<sup>th</sup>, 2024.
5. **Qualification of student (branch/semester of study):** Pursuing **B.Tech.** in Mechanical or Automobile or Computer Science and Engineering having completed IV semester or Pursuing **M.Tech.** in Mechanical or Automobile or Computer Science and Engineering department having completed II semester.

6. **Brief description of work (300-500 words):** Most failures in rotating machinery are related to the mechanical transmission system, which contributes 30% of the machine's total maintenance cost. The gearbox is a vital transmission system composed of gears, bearings, and drive shafts that form a complex system. Gears contribute to 60% of gearbox failures. The breakdown of a gearbox causes a halt in the operation of the machine, followed by a lengthy maintenance process to identify, and resolve the problem. Traditionally, fault diagnosis systems based on time and frequency domain analysis of vibrations involve mainly three main steps: data/signal acquisition, data/signal preprocessing, and fault diagnosis. In the current research, automated fault diagnosis is playing a main role in the research. The fault diagnosis based on machine learning involves data/signal acquisition, data/signal preprocessing, feature extraction, feature reduction/selection, and fault diagnosis.

The vibration data acquisition of gearbox has already been done and need to be explored for analysis based on some signal processing and machine learning techniques. The vibration signals generally acceleration signals of gearbox with healthy and faulty condition will be used for fault diagnosis. There are three faulty cases such as cracked tooth, missing tooth, and chipped tooth along with healthy condition. The fault is introduced artificially in the gear. Healthy condition means no fault is present in the gearbox. ANN, Deep learning, SVM etc. algorithms will be explored in detail along with some advanced signal processing techniques or automated feature extraction techniques for fault classification. The present work also involves improving the classification accuracy of different machine learning algorithms for fault diagnosis. The flow diagram is shown in below figure that shows the work that to be done is fault feature extraction using machine learning and classification of the faults. The acceleration signal analysis will be done using MATLAB. All the machine learning based analysis will be done using Python.



Fig. Machine learning based fault diagnosis.

7. **Expected learning of student (upto 100 words):** After completion of internship training, the student will be able to diagnose the gearbox faults such as crack, missing tooth, chipping etc. using different machine learning algorithms. The python will be used for implementation of machine learning. Before applying machine learning, the students will be involved in analysing the vibration signals based on different advanced signal processing techniques using MATLAB.



Thus, they will learn two software such as Python and MATLAB for vibration analysis and machine learning.

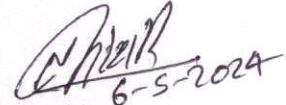
**8. Nature of work: (Experimental/simulation/mathematical modelling/data collection-analysis etc.): upto 50 words**

The nature of work during the internship training will be based on modelling/simulation and data analysis.

**9. If the seat is under project sponsored category: Yes/No: No**

a) If yes, number of seats announced: NA

b) Name and ID no. of project from which stipend is chargeable: NA



Signature of faculty member

Name of department/Centre

Mechanical Engineering

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