McEng 3161 – Mechanical Vibration

Course Number: McEng 3161	**Credit Hours:** 3
Course Title: Mechanical Vibration	**Contact Hours**: 2 Lecture hrs and 3 Tutorial hrs

Course Objectives:

At the end of the course, students would be able to:

- Make vibration analysis,
- Know the different causes of vibration,
- Know the three types of vibrations (transversal, axial and torsional),
- Develop a model for vibration analysis,
- Make transient and steady state vibration analysis of single and multi degree of freedom systems, and
- Develop the necessary skills required to control vibrations.

Course Description:

Introduction to mechanical vibration; Modeling of dynamic systems; Single-degree of freedom system; Multi-degree of freedom system; Whirling of shafts; Torsional vibrations; Causes of vibrations; Introduction to vibration control and measurements.

Course Outline:

1. **Introduction:** Why we study vibration?; Kinematics of vibrations
2. **Introduction to Modeling:** Mechanical modeling; Mechanical elements; Continuous system elements
3. **Single Degree of Freedom System:** Undamped free vibration; Damped free vibration: Viscous damping; Columb damping; Hysterisis damping (optional)
4. **Forced Vibration of Single Degree of Freedom System:** Mechanical models and equations of motion; General solution of the equation of motion; Application of SDOF system
5. **Two Degree of Freedom System:** Free undamped vibration; Free vibration with damping; Forced vibration
6. **Multi-Degree of Freedom System:** Generalized coordinates; Derivation of the equations of motion; Free undamped vibration; Forced vibration; Approximate methods: Rayleigh method, Dunkerly's method, Holzer's method, Matrix iteration method(Optional), Jacobi's method (optional)
7. **Whirling of Shafts**
8. **Torsional Vibration**
9. **Causes of Vibration and Control:** Causes of vibration; Vibration control

Pre-requisites: Math 2071 - Applied Mathematics III , McEng-3071 Mechanisms of Machinery

Co-requisite:

Textbook: Leul, F., ***Introduction to Mechanical Vibrations***, Addis Ababa University Press

References:

1. Dimoragonas, A.D., ***Vibration for Engineers***, Prentice-Hall, Inc., 1992
2. Rao, S.S, ***Mechanical Vibration***, 3rd Edition, Addison-Wesley Publishing Company, 1995
3. Seto. W.W., ***Mechanical Vibrations***, Schaum's Outline Series, McGraw-Hill Book Company, 1964
4. Thomson, E.S., ***Theory of Vibrations with Applications***, UNWIN Hyman, Sydney/ Wellington, 1989

Teaching Methods:

- Lectures supported by exercises,
- Assignments, and
- Project work.

Project work: A project work will be arranged on vibration measurements and analysis.
Attendance Requirement: • Minimum of 75% attendance during lecture hours; and • 100% attendance during project work sessions, except for some unprecedented mishaps.
Evaluation: Evaluation: • Assignments 5%, • Project Work 15%, • Mid-semester Examination 20%, and Final Examination 60%.
Hours per-semester: 80 hrs