MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE GWALIOR
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute
Affiliated to RGPV, Bhopal)
Department of Mechanical Engineering
Academic session 2020-21 admitted

120615: Mechanical Vibration

Category	Title	Code	Credit - 4			Theory Paper
Departmental Core -DC	Mechanical Vibration	120615	L	T	P	Max.Marks-50 Duration-2 hrs.
			2	1	2	

Prerequisite: Engineering Mathematics, Engineering Mechanics

Course Objectives:

1. To impart basic knowledge and importance on Mechanical Vibration in Engineering Fields among the students.
2. To create the awareness on Mechanical Vibration in Research and Application area.

Syllabus

Unit-I:

Introduction: Importance and scope of vibrations, Definitions, Types of vibrations, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier transform and problems.

Undamped (Single Degree of Freedom) Free Vibrations: Derivations for spring mass systems, Methods of analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

Unit-II:

Damped free vibrations (1DOF): Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

Whirling of shafts: Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

Unit-III Forced Vibrations (1DOF)

Introduction, Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.

Unit-IV

Systems with two degrees of Freedom:

Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping), Torsional system, Semidefinite system

Multi Degree Freedom System: Free Vibration equation of motion. Stiffness influence coefficients, , flexibility influence coefficient, inertia influence coefficient

Unit V

Numerical Methods: Dunkerley's Methods, Rayleigh`s Method, Holzer`s Method, Methods of Matrix iterations, Jacobi's method

Vibration Control: Transducers and vibration pickup, Vibrometer, accelerometer, velometer, frequency measuring instrument, FFT analyser, vibration exciters.

Course Outcomes: After completing this course students are able to:

CO1: Able to **understand** basics concept of mechanical vibration.

CO2: Able to **define** the physical systems in to spring-mass-damper systems.

CO3: Able to **use** different methods and principles applicable to dynamic systems.

CO4: Able to **determine** responses of vibrating systems.
CO5: Able to **analyse** the behaviours of physical systems.
CO6: Able to **design** the mechanical systems by considering vibration.

Text Books:

1. Grover, G.K., " Mechanical Vibrations", 7th Ed., Nem Chand & Bros.
2. Rao, S.S., " Mechanical Vibrations", 5th Ed., Addison-Wesley Longman, Incorporated.

References Books:

1. Theory of Vibrations with Applications: W T Thomson CBS Publishers Delhi
2. Fundamentals of Vibration: Leonard Meirovitch , McGraw Hill International Edison.
3. Principles of Vibration Control: Asok Kumar Mallik, Affiliated East-West Press.
4. Mechanical Vibrations A H Church ,John Wiley & Sons Inc
5. Mechanical Vibrations J P Den Hartog ,McGraw Hill.
6. Mechanical Vibration Analysis: Srinivasan ,McGraw Hill.

List of Experiments

1. To verify the relation of simple pendulum.
2. To determine the radius of gyration of given compound pendulum.
3. To study undamped free vibration of equivalent spring mass system.
4. To study the torsional vibration of single rotor system
5. To study damped free vibration of equivalent spring mass system.
6. To study the damped torsional oscillation.
7. To study the forced vibration of spring mass system
8. To study the free vibration of Two rotor system.
9. To determine the whirling of shaft.
10. To verify the Dunkerley's rule.

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120617/190617: Artificial Intelligence & Machine Learning

Category	Title	Code	Credit - 4			Theory Paper
			L	T	P	
Mandatory Course (MC)	Artificial Intelligence & Machine Learning	120617/190617	3	-	2	Max.Marks-50 Duration-2 hrs.

COURSE OBJECTIVES:

1. To provide the fundamental knowledge of Artificial Intelligence, Neural Network and Machine Learning.
2. To present the basic representation and reasoning paradigms used in AI & ML.
3. To understand the working of techniques used in AI & ML.

Unit – I: Introducing Artificial Intelligence: Definition, Goals of AI, Task of AI, Computation, Psychology and Cognitive Science. Perception, Understanding, and Action. Artificial intelligence vs machine learning vs deep learning and other related fields. Applications of Artificial intelligence and Machine Learning in the real world.

Unit – II: Problem, Problem Space and Search:
Production System, Blind Search: BFS & DFS, Heuristic Search, Hill Climbing, Best First Search

Introduction to Neural Networks:

History, Biological Neuron, Artificial Neural Network, Neural Network Architectures, Classification, & Clustering

Unit – III: Introduction to Machine Learning: Traditional Programming vs Machine learning. Key Elements of Machine Learning: Representation, process (Data Collection, Data Preparation, Model selection, Model Training, Model Evaluation and Prediction), Evaluation and Optimization. Types of Learning: Supervised, Unsupervised and reinforcement learning. Regression vs classification problems.

Unit – IV: Supervised Machine Learning: Linear regression: implementation, applications & performance parameters. Decision tree classifier, terminology, classification vs regression trees, tree creation with Gini index and information gain, IDE3 algorithms, applications and performance parameters. Random forest classifier. Case study on regression and classification for solving real world problems.

Unit – V: Unsupervised Machine Learning: Introduction, types: Partitioning, density based, DBSCAN, distribution model-based, hierarchical, Agglomerative and Divisive, Common Distance measures, K-means clustering algorithm. Case study on clustering for solving real world problems.

RECOMMENDED BOOKS:

1. Artificial Intelligence: A Modern Approach by Stuart J. Russell and Peter Norvig, Prentice Hall.
2. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
3. Introduction to AI & Expert System: Dan W. Patterson, PHI.
4. Pattern Recognition and Machine Learning, Christopher M. Bishop
5. Introduction to Machine Learning using Python: Sarah Guido
6. Machine Learning in Action: Peter Harrington

COURSE OUTCOMES: After completing the course, the student will be able to:

CO1: Define basic concepts of Artificial Intelligence & Machine Learning.
CO2: Illustrate various techniques for search and processing.
CO3: Identify various types of machine learning problems and techniques.
CO4: Analysis various techniques in Artificial Intelligence, ANN & Machine Learning.
CO5: Apply AI and ML techniques to solve real world problems.
CO6: Build AI enabled intelligent systems for solving real world problems.