CLASS: TE (Mechanical/Automobile)			Semester:-VI
-- SUBJECT: MECHANICAL VIBRATION			
Periods per week. 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
	Theory Examination	03	100
	Practical	--	
	Oral Examination	--	25
	Term Work	--	25
	TOTAL	--	150

Sr. no.	Details	Hrs
Module 01	1.1 Basic Concepts Of Vibration: Vibration and oscillation, causes and effects of vibrations, Vibration parameters - spring, mass, damper, Damper models, Motion - periodic, non periodic, harmonic, non - harmonic, Degree of freedom, static equilibrium position, Vibration classification, Steps involved in vibration analysis. 1. 2 Free Undamped Single Degree Of Freedom Vibration System: Longitudinal, transverse, tensioned system, Methods for formulation of differential equations' by Newton, Energy, Lagrangian (Rayleigh's method), Effect of springs mass and shaft inertia on natural frequency, Effect of flexible bearings on natural frequency.	08
Module 02	2.1 Free Damped Single Degree Of Freedom Vibration System: Viscous damped system - under damped, critically damped, over damped Logarithmic decrement. Coulomb's damping Combined viscous and coulomb's damping 2.2 Equivalent Single Degree Of Freedom Vibration System: Conversion of multi-springs, multi masses, multi - dampers into a single spring and damper with linear or rotational co-ordinate system	08

Module 03	3.1 Free Undamped Multi Degree Of Freedom Vibration Systems: Eigen values and Eigen vectors for linear system and torsional two degree of freedom Holzer method for linear and torsional unbranched system Two rotors, Three rotors and geared system. Dunkerley and Rayleigh method for transverse vibratory system 3.2 Forced Single Degree Of Freedom Vibratory System: Analysis of linear and torsional systems subjected to harmonic force excitation and harmonic motion excitation (excluding elastic damper)	08
Module 04	4.1 Vibration Measuring Instruments: Principle of seismic instruments, vibrometer, accelerometer - undamped, damped. 4.2 Vibrational Isolation: I Force isolation, motion isolation. isolators	08
Module 05	5.1 Rotor Dynamics: Critical speed of single rotor, undamped and damped 52 Carn Dynamics: Cam Dynamics: Mathematical Model, Differential Equation, Response Follower Jump Phenomenon	08
Module 06	6. Balancing: Static and dynamic balancing of multi rotor system, Balancing of reciprocating masses In - line engines, V - engines (excluding radial engines)	08

List of Experiments:: (Minimum 8 experiments)

1. Experimental prediction of natural frequency of compound pendulum, prediction of equivalent simple pendulum system.
2. Experimental prediction of natural frequency for longitudinal vibrations of helical springs, and springs in series and parallel
3. Experimental prediction of natural frequencies, and nodal points for single rotor and two-rotor vibratory system, and comparison with theoretical results
4. Experimental and theoretical investigation of whirling of shaft (i.e. . comparison of experimental and theoretical natural frequency and justification of discrepancy between experiment and theory)
5. Experimental investi8ation of viscous and coulomb damping, prediction of system parameter (spring stiffness, damping coefficient) from damped oscillations
6. Experimental and theoretical investigation of frequency response of mechanical system, and comparing both and justification of discrepancy between theory and experiments
7. Experiments ')n distributed parameter system: Transverse vibrations of beam (Dunkerley's Ru]e Expt.)
8. Experimental balancing of single and multi-rotor system
9. Introduction to FFT analyzer, and prediction of spectral response of vibrating

machine from workshop

10. Experiments on vibration isolation system and prediction of force transmissibility, :notion transmissibility of system
11. Vibration analysis of mechanical system using MATLAB.

Theory Examination:

I. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compu1sory and based on maximum part of syllabus.
3. Remaining questions will_ be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.
5.

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of syllabus.

Term Work:

Term work shall consist of minimum 08 experiments, assignments and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): ..... (15) Marks
- Test (at least one): ..... (10) Marks.

TOTAL:..... (25) Marks.

Text Books:

1. Mechanical Vibrations 4th ed- S. S. Rao - *Pearson Education*
2. Mechanical Vibrations - G. K. Grover
3.. Fundamentals of Mechanical Vibration - S.Graham Kelly - *Tata McGraw Hill* 4. Mechanical Vibration Analysis - P. Srineevasan - Tata McGraw Hill
5. Mechanical Vibrations - Schaum's outline series - S.Graham Kelly- *McGraw Hill*
6. Mechanical Vibrations - Schaum's outline series - William W. Seto- *McGrmv Hill*
7. Theory and Practice of mechanical vibrations - J. S. Rao, K. Gupta - *New Age International Publications.*
8. Mechanical Vibrations - Den; Chambil, Hinckle
9. Mechanical Vibrations, J.P. Den Hartog, McGrawhill Book Company Inc.

References:

1. Leonard Meirovitch, Introduction to Dynamics and Conti'oJ. *Wiley, New York,*
2. Leonard Meirovitch, Elements of Vibration Analysis. *McGrmv-Hill, New York,*
3. Leonard Meirovitch, Dynamics and Control of Structures. *Wiley, New York.* 4. Antony J. Petto frezzo,
Matrices and Transformations. Dover, New York.
5. Benson H. Tongue, Principles of Vibration. *Oxford University Press.*
6. W. Thomson, Theory of Vibrations with Applications, Second Edition,
Pearson Education
7. Vibrations-Balakumar Balachandan, Edward Magrab, *CENGAGAE*
Learning.