B.E Semester: VI

Automobile Engineering

Subject Name: Dynamics of Machinery (common with mechanical) **(AE601)**

Course Objective:

- To present a problem oriented in depth knowledge of dynamics of machinery.
- To address the underlying concepts and methods behind dynamics of machinery.

Teaching / Examination Scheme:

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
AE601	Dynamics of Machinery	4	0	2	6	5	3	70	30	20	30	150

Detailed Syllabus:

Topic no	Details
1	**Alignment and Balancing**: Concepts of alignment and various alignment techniques and equipments, Static and dynamic balance, rotating masses in different planes, balancing of reciprocating masses, Balancing of locomotives: Balancing of multi cylinder in line engines, direct and reverse crank concept, balancing of V and radial engines, balancing machines. Field balancing of balancing machines for reciprocating and rotating machine elements
2	**Mechanical Vibrations:** Introduction, Degree of freedom, Types of vibrations; Uses, effects and remedy; free natural vibrations, Newton method and energy method for single degree of freedom. -Damped vibrations; under damped, critically damped and over damped systems, response curves for single degree of freedom system. -Forced vibrations with and without damping in single degree of freedom, rotating and reciprocating unbalance, base excitations, transmissibility, motion and power transmissibility. -Longitudinal and Transverse Vibrations, whirling of shaft with a single disc with and without damping, Dunkerley's method for simply supported beams. -Torsional vibrations, torsionally equivalent system, stepped shafts and tapered shafts, two rotor, three rotor and geared systems, Holzer's method for multi rotor systems -Two degree and Multi degree Vibrations, wave equation, boundary conditions in beams, solution of wave equation, Rayleigh's method. -Vibration measuring instruments, vibrometer, accelerometer and frequency measuring instruments, -Causes, effects and remedies of vibrations in machine tools.
3	**Cam Dynamics:** Analysis of circular arc cam and tangent cam, dynamics of high speed cam systems,

	poly dyne cams, force analysis of cams, vibrations, jump, shock, spring surge criteria in high speed cams.

Lesson Planning:

Sr.No.	Date/Week	Unit No.	% Weightage	Topic No:
1	1^{st} ,2^{ed} ,3^{ed}	Unit 1	20 % .	1
2	4^{th} ,5^{th} ,6^{th}	Unit 2	20 %	2
3	7^{th} ,8^{th} ,9^{th}	Unit 3	20 %	2
4	10^{th} ,11^{th} ,12^{th}	Unit 4	20 %	3
5	13^{th} ,14^{th} ,15^{th}	Unit 5	20 %	3

Instructional Method & Pedagogy:

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- Term Work should be as per below:
    - To verify the relation of simple pendulum.
    - To demonstrate the longitudinal vibration of helical spring mass system.
    - To demonstrate the Torsional vibration of single rotor system.
    - Static and Dynamic Balancing of a Single Rotating Mass System.
    - To demonstrate the Damped torsional Oscillation & to determine the damping co-efficient Ct.
    - To demonstrate the forced vibration of the beam for different damping.
    - To demonstrate the Free Vibration of Two Rotor System and to determine the Natural Frequency of Vibration Theoretically & Experimentally.
    - To verify the Dunkerley's Rule.
    - To determine the radius of gyration 'k' of a given compound pendulum.
    - To demonstrate the modes of vibration and to measure the frequency of each case.
    - To demonstrate Jump Phenomena in cam systems.

Students Learning Outcomes

- The student can identify different areas of dynamics of machinery.
- Can find the applications of all the areas in day to day life.

Recommended Study Materials

- **Text & Reference Books:**

1. Mechanical Vibrations by G.K.Groover & A.K.Nigam, Nemchand Bros., Roorkee
2. Theory Of Machines by S.S.Rattan , Tata Mc-Graw Hill
3. Dynamics Of Machines by F. Haidery , Nirali Prakashan, Pune
4. Theory Of Machines by V.P.Singh, Dhanpatrai Pub., Delhi
5. Mechanical Vibration by Tse, Morse & Hankle
6. Mechanical Vibration by Schaum Series, Mc-Graw Hill
7. Theory Of Machines And Mechanisms by J.E.Shigley, Tata Mcgraw Hill
8. Theory Of Machines & Mechanisms by P.L.Ballaney , Khanna Publishers, Delhi