C. U. SHAH UNIVERSITY
Wadhwan City

FACULTY OF: - Technology & Engineering
DEPARTMENT OF: - Mechanical Engineering
SEMESTER: - V
CODE: -4TE05DOM1
NAME – Dynamics of Machines

Teaching & Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
							Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
		Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE05DOM1	Dynamics of Machines	4	0	2	6	5	30	1.5	70	3	---	20	30	**150**

Objectives:-

1. Understand types of balancing and its need.
2. Application of theory of balancing to reciprocating and rotating masses in mechanical machines, locomotives, engines etc.
3. Understand the concept of vibratory systems, resonance and their analysis.
4. To acquaint with the principles of vibration measuring instruments

Prerequisites: - Basic Knowledge of mathematics and Applied mechanics.

Course outline:-

Sr. No.	Course Contents	Hours
1	**Balancing of rotating masses** Introduction, Need for Balancing, static and dynamic balancing, Balancing of several masses rotating in same plane, Balancing of several masses rotating in different planes, Balancing machines.	**06**
2	**Balancing of reciprocating masses** The effect of inertia force of the reciprocating mass on the engine. Partial primary balance. Partial balancing of Locomotives, Hammer blow, Variation of tractive effort, Swaying couple. Balancing of multi cylinder inline engines, v-engines, Radial engines, Concept of Direct and Reverse cranks	**09**
3	**Introduction of Vibration** Introduction, uses, effects and remedy, concept and term used, Degree of freedom, SHM, Elements of vibratory system, Types of vibrations, Equivalent stiffness of spring combinations.	**04**
4	**Undamped Free Vibration** Equations of motion, Natural frequency, Energy method, Equilibrium method, Rayleigh's method, Undamped free transverse and torsional vibrations.	**04**
5	**Damped Free Vibration** Types of damping, Free vibrations with viscous damping - over-damped system, critically damped system, under-damped system, Logarithmic decrement, viscous	**05**

	dampers, dry friction or coulomb damping – frequency and rate of decay oscillations.	
6	**Forced Vibration** Forced vibrations of longitudinal and torsional systems, Frequency Response Functions - Simple harmonic excitation, excitation due to reciprocating and rotating unbalance, base excitation, magnification factor, resonance phenomenon and phase difference, Vibration Isolation, Force and Motion transmissibility.	**10**
7	**Critical Speed of Shafts** Whirling of shaft with a single disc with and without damping, Dunkerley and Rayleigh method for transverse vibratory system.	**04**
8	**Torsional Vibrations** Torsionally equivalent system, torsional vibrations of two rotor, three rotor and geared system	**05**
9	**Vibration of Multirotor systems** Stodola Method, Holzer's Method, Numericals	**04**
10	**Vibration Measurements** Vibration measuring instruments, vibrometer, accelerometer and frequency measuring instruments, FFT Analyzer.	**03**
11	**Cam dynamics** Dynamics of high speed cam system, force analysis of cams, vibrations, jump, shock, spring surge criteria in high speed cams.	**06**

Learning Outcomes: Students will be able to…

1. Develop and apply the solutions of the equations of motion to problems for free and forced vibration under harmonic excitation.
2. Be able to perform static and dynamic balancing of rotating and reciprocating engines.
3. Develop mathematical model to represent dynamic system
4. Estimate natural frequency of mechanical element/system
5. Estimate the parameters of vibration isolation system

Text Books:

1. Mechanical Vibrations By **Shrikant Bhave**, Pearson Publication
2. Theory Of Machines by **S.S.Rattan** , Tata Mc-Graw Hill
3. Theory Of Machines by **R.S.Khurmi** , S.Chand Publication
4. Mechanical Vibrations by **V.P.Singh**, Dhanpatrai Pub., Delhi
5. Mechanical Vibrations by **G.K.Groover & A.K.Nigam**, Nemchand Bros., Roorkee

References Books:

1. Theory Of Machines And Mechanisms by **J.E.Shigley**, Tata Mcgraw Hill
2. Theory Of Machines & Mechanisms by **P.L.Ballaney** , Khanna Publishers, Delhi
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 **Schaum Series**, Mc-Graw Hill