GUJARAT TECHNOLOGICAL UNIVERSITY

PRODUCTION ENGINEERING
MACHINE DYNAMICS
SUBJECT CODE: 2152509
B.E. 5th SEMESTER

Type of course: Under Graduate

Prerequisite: Theory of Machine

Rationale: The course is designed to give fundamental knowledge of behavior of machines under dynamic condition.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	2	0	6	70	20	10	30	0	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Dynamic Force analysis of mechanisms:** Introduction, D'alembert's principle, equivalent offset inertia force, dynamic analysis of four link mechanism, dynamic analysis of slider crank mechanism, velocity & acceleration of piston, angular velocity & angular acceleration of connecting rod, engine force analysis, turning moment on crank shaft, dynamically equivalent system inertia of the connecting rod, inertia force in reciprocating engines.	**06**	10
2	**Balancing:** Introduction, static balancing, dynamic balancing, transference of force from one plane to another plane, balancing of several masses in different planes, force balancing of linkages, balancing of reciprocating mass, balancing of locomotives, Effects of partial balancing in locomotives, secondary balancing, balancing of inline engines, balancing of v-engines, balancing of radial engines, balancing machines.	**10**	15
3	**Longitudinal Vibrations:** Free longitudinal vibration, displacement, velocity & acceleration. Inertia, effect of the mass of spring, damped vibration, logarithmic decrement, forced vibration, forced damped vibration, magnification factor, vibration isolation and transmissibility.	**08**	15
4	**Transverse Vibration:** Transverse vibration, single concentrated load, uniformly loaded shaft, shaft caring several load, whirling of shafts without damping effect.	07	10
5	**Torsional Vibration:-** Torsional vibration, free Torsional vibration (single rotor), inertia effect of mass of shaft, multifilar system, free Torsional vibration (two rotor system, three rotor system), torsionally equivalent shaft, free Torsional	08	12

	vibration of geared system.		
6.	**Governors:** Introduction, Types of Governors, Watt Governor (Simple Conical Governor), Porter Governor, Proell Governor, Hartnell Governor, Hartnug Governor, Wilson-Hartnell Governor (Radial-Spring Governor), Pickering Governor, Spring-Controlled Gravity Governor, Inertia Governor, Sensitiveness of a Governor, Hunting, Isochronisms, Stability, Effort of a Governor, Power of a Governor, Controlling Force.	14	18

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	**21**	**14**	**14**	**14**	**--**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Theory of Machines by S.S. Ratan, Tata McGraw Hill Companies
2. Theory of Machine by R.S.Khurmi, S.Chand Publications.
3. Theory of Machines by Singh V.P., Dhanpat Rai & Sons
4. Theory of Machines by R. K. Bansal, Laxmi Publication

Course Outcome:

After learning the course the students should be able to:

1. Understand the basic concept of Dynamic Force Analysis.
2. Understand static and dynamic balancing of rotary and reciprocating systems.
3. Understand fundamentals of l vibrations.
4. Understand basics of governors
5. Correlate the fundamentals of dynamics with various machinery.

List of Tutorials:

1. To solve Problems on engine force analysis analytically and graphically.
2. To solve problems on balancing of rotating masses.
3. To solve problems on balancing of reciprocating masses.
4. To study longitudinal vibrations and problems based on it.
5. To study transverse vibrations and problems based on it.
6. To study Torsional vibrations and problem based on it.
7. To study governors and problems based on it.

Major Equipment:

1. Balancing Machine
2. Vibration test ring

List of Open Source Software/learning website:

http://nptel.ac.in

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.