GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering (Part Time)
Subject Code: 2941902
Semester – IV
DYNAMICS OF MACHINERY

Type of course: Professional Core

Prerequisite: Kinematics and theory of machines

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
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
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, dynamically equivalent system inertia of the connecting rod, inertia force in reciprocating engines.	04
2	**Turning moment diagrams and flywheel** Turning moment diagram for various type of engines, fluctuation of energy, fluctuation of speed, flywheel, energy stored in flywheel, dimensions of flywheel rims, flywheel in punching presses	04
3	**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.	11
4	**Gyroscope:** Angular velocity, angular acceleration, gyroscopic torque, gyroscopic effect on naval ships, aero plane, stability of an automobile, stability of two wheel vehicle	05
5	**Free vibrations and damped free vibrations:** Types of vibrations, elements constituting vibration, spring mass system, free undamped vibrations, equation of motion, equivalent spring stiffness, free damped vibrations, equation of motion for viscous damper, damping factor, under damped system, critically damped system, over damped system, logarithmic decrement, free torsional vibration of a two and three rotor system, torsionally equivalent shaft, torsional vibration of a geared	12

	system.	
6	**Forced damped vibrations:** Analytical solution of forced damped vibration, vector representation of forced vibrations, Magnification factor, force transmissibility, forced vibration with rotating and reciprocating unbalance, forced vibration due to excitation of support, vibration frequency measurement.	08
7	**Critical speeds of shafts:** Critical speed of shaft carrying single rotor and having no damping, Critical speed of shaft carrying single rotor and having damping, secondary critical speeds in horizontal shafts, critical speed of shaft having multiple rotors.	05

Reference Books:

1. Theory of Machines, S.S.Rattan , Tata Mc-Graw Hill.
2. Mechanical Vibrations and Noise Engineering, A. G. Ambekar, Prentice Hall of India.
3. Dynamics of Machinery, Farazdak Haideri, Nirali Prakashan.
4. Dynamics of Machines, S. Balaguru, Cengage Learning India Pvt. Ltd.
5. Kinematics and Dynamics of Machinery, Norton R L, McGraw-Hill
6. Theory of Machines : Kinematics and Dynamics, Sadhu Singh, Pearson

Distribution of marks weightage for cognitive level

Bloom's Taxonomy for Cognitive Domain	Marks % weightage
Recall	10
Comprehension	10
Application	30
Analysis	40
Evaluate	10
Create	05

Course Outcome:

After learning the course the students will able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Summarize dynamic forces and turning moments in mechanisms.	15
CO-2	Minimize unbalance in mechanical systems by means of static and dynamic balancing.	20
CO-3	Analyze gyroscopic effect in aeroplane, ships and automobiles.	10
CO-4	Demonstrate longitudinal vibrations, transverse vibrations and torsional vibrations in single degree of freedom systems .	40
CO-5	Determine critical speed of the shaft.	15

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List of Experiments:

Practical should be designed to include followings experiments:

1. Static and dynamic balancing of rotating masses.
2. Understanding of gyroscopic effect using motorized gyroscope.
3. Longitudinal free vibration of spring mass system.
4. Study of torsional vibration in shaft (single rotor and two rotor system)
5. Study of free damped vibration and logarithmic decrement.
6. Study of forced damped vibration.
7. Critical speed of the shaft.
8. Study of dynamic forces and turning moments in mechanisms.

Major Equipment:

1. Universal vibration apparatus.
2. Motorised gyroscope.

List of Open Source Software/learning website:

1. http://nptel.ac.in