S.No.	Topic	No. of Practicals
3.	Analysis and design problems of gear trains	5
4.	Cam profile design	3
	Total	**16**

X. Suggested Reading

- Erdman A, Sandor G and Kota S. 2001. *Mechanism Design: Analysis and Synthesis* Pearson India Pvt Ltd, New Delhi.
- Sandor GI, Erdman AG. 1984. *Advanced Mechanism Design: Analysis and Synthesis* Pearson. Facsimile edition.
- Ballaney PL. 2003. *Theory of Machines*. - Khanna Publishers, New Delhi.
- Rattan. SS. 2014. *Theory of Machines*, McGraw Hill Pvt Ltd, New Delhi.
- Khurmi RS and Gupta 2020. *Theory of Machines*. Eurasia Publishing House (P) Ltd, New Delhi.

I. Course Title : Vibrations

II. Course Code : ME 504

III. Credit Hours : 3+0

IV. Aim of the course

To enable the students to design vibration control sytem,and balancing of rotating and reciprocating masses.

V. Theory

Unit I

Vibration motion and its terminology. Undamped free vibrations, equations of motion- natural frequency. Energy method, Rayleigh method; effective mass principle of Virtual work. Equivalent spring stiffness in parallel and in series. Harmonic analysis and Fourier Series

Unit II

Damping - viscous, solid, coulomb equivalent dampers. Viscosity damped free vibrations, Logarithmic decrement. Forced vibrations with harmonic excitation and rotating unbalance. Energy dissipated by damping

Unit III

Forced vibration with damping, Vibration isolation and force and motion transmissibility. Two degree of freedom systems. Principal modes of vibration, co-ordinate coupling. Vibration absorbers

Unit IV

Free vibration equation of motion for multi-degree of freedom systems. Influence coefficients and Maxwell's reciprocal theorem, stiffness coefficients. Numerical methods for finding natural frequencies for multi-degree of freedom systems.

Unit V

Vibration of lumped parameter systems and continuous systems. Lagrange equations. Vibration measuring instruments, Vibrometers, velocity pickups, Accelerometer and frequency measuring instruments. Applications of vibrations. Vibration control, balancing of rotating and reciprocating machines, design of vibration isolators.

VI. Learning outcome

The student will be able to understand the concept of vibrations, analyze the mathematical modeling of the multidegree freedom systems and able to design vibration isolators.

VII. Lecture Schedule

S.No.	Topic	No. of Lectures
1.	Vibration motion and its terminology.	2
2.	Undamped free vibrations, equations of motion- natural frequency.	2
3.	Energy method, Rayleigh method; effective mass principle of Virtual work.	2
4.	Equivalent spring stiffness in parallel and in series.	1
5.	Harmonic analysis and Fourier Series.	2
6.	Damping - viscous, solid, coulomb equivalent dampers.	3
7.	Viscosity damped free vibrations, Logarithmic decrement	3
8.	Forced vibrations with harmonic excitation and rotating unbalance	2
9.	Energy dissipated by damping. Forced vibration with damping,	3
10.	Vibration isolation and force and motion transmissibility.	2
11.	Two degree of freedom systems. Principal modes of vibration co-ordinate coupling	3
12.	Vibration absorbers,	2
13.	Free vibration equation of motion for multi-degree of freedom systems.	2
14.	Influence coefficients and Maxwell's reciprocal theorem, stiffness coefficients.	3
15.	Numerical methods for finding natural frequencies for multi-degree of freedom systems.	3
16.	Vibration of lumped parameter systems and continuous systems.	3
17.	Lagrange equations. Vibration measuring instruments, Vibrometers, velocity pickups	3
18.	Accelerometer and frequency measuring instruments.	2
19.	Applications of vibrations. Vibration control, balancing of rotating and reciprocating machines	3
20.	Design of vibration isolators.	2
	Total	**48**

VIII. Suggested Reading

- V.P. Singh.2014. *Mechanical Vibrations*. Dhanpat Rai and Comopany, New Delhi
- Rao S S. 2010.*Mechanical Vibrations*. Pearson Education, Delhi
- Srinivas P.1983. *Mechanical Vibration Analysis*. Tata McGraw Hill Company
- Limited, New Delhi
- Daniel J Inman.2013. *Engineering Vibration*. Prentice Hall, New Jersey

I. Course Title : Fatigue Design

II. Course Code : ME 507

III. Credit Hours : 2+1

IV. Aim of the course

The course provides an understanding on fatigue design considerations of mechanical components. The causes of fatigue in brittle and ductile materials are taught with focus on crack initiation, propagation and fracture.