RKUNIVERSITY

SYLLABUS

| Course Title | DYNAMICS OF MECHANICAL SYSTEMS |
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| Course Code | MD121 |
| Course Credit | Lecture : 03 |
| | Practical : 01 |
| | Tutorial : 00 |
| | Total : 04 |

## Course Objective

The objective of the course is to -

- Understand the fundamentals of vibration theory and how to apply theory of vibration to engineering problems.
- Understand the kinematics and dynamics of mechanical elements such as linkages, gears and cams and learn to design such elements to accomplish desired motions or tasks.

## Detailed Syllabus

| Sr. No. | Name of chapter & Details | Hours Allotted |
|---|---|---|
| | **SECTION - I** | |
| 1 | **Vibrations**<br>Forced vibration – Single DOF, 2DOF, Multi DOF vibration – Matrix method, Dunkerely's method, Rayleigh's method, Holzer's method, Stodola Method, Eigenvalues and eigenvectors; Vibrations of continuous systems – bars, beams and plates; Flexural and torsional vibrations, classical and approximate methods of vibration analysis. Vibration isolation of single degree and multi DOF systems. | **14** |
| 2 | **Gears and Gyroscopes:**<br>Elements of different secondary space curves, conjugate action, general mechanism, noncircular sensors, dynamics of gears, Gyrodynamics, gyroscopic actions in machines. | **07** |
| | **Total** | **21** |
| | **SECTION – II** | |
| 3 | **Analysis and Synthesis of Mechanism**<br>Basic concepts of kinematics and mechanisms-type, number and dimensions, kinematic pairs, chains and inversions, accuracy point and error analysis, velocity and acceleration analysis of different complex mechanism (I, II & III ), gross motion in the 4-bar mechanisms, static and dynamic force analysis of mechanisms. ; Synthesis of coordinated positions, synthesis of mechanism to trace a curve or path generation, synthesis for function generation. ; Dimensional synthesis, method of | **14** |

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| | approach and optimization of a solution. ; Equivalent and conjugate linkages, four bar chains, copular curves, Robert's Law chebycheve's polynomials, path curvature Euler –Savary equation, Polode curvature. ; Planer and spatial problems, graphical and analytical methods, finite displacements, analytical design of 4-bar mechanisms for coordinated motion | |
| **4** | **Cam Dynamics:** Forces in rigid systems, Mathematical models, Response of a uniform motion undamped cam mechanism, Analytical method, Position error, Follower response by phase plane method, Jump and cross over shock, Johnson's numerical analysis, Unstable spring surge and wind up. | **07** |
| | **Total** | **21** |

## Instructional Method and Pedagogy:

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

## Students Learning Outcomes:

At the end of the course the students will be able to:

- The basic mathematical modeling of vibration of mechanical systems and Cam mechanism.
- Understand the concept of Mechanisms – their structures, analysis and dynamics.

## Reference Books:

1. Mechanical Vibrations by S.S. Rao – Wesley Publication Co.
2. Theory of Mechanism And Machines by A. Ghosh& A.K. Mallik, Affiliated East-West Press
1. Dynamics of Machinery By HaideriFarazdak - NiraliPrakashan
2. Mechanical Vibrations by S.S. Rao – Wesley Publication Co.
3. Vibration Problems in Engineering by S. Timoshenko - Wiley Estern
4. Shock and Vibration Handbook by C.M. Harris and C.E. Grede (Ed.) – McG Hill
5. Theory of Vibration and Applications by Thomson W.T. - Prentice Hall
6. Theory of Machines by S.S. Ratan, Tata McGraw Hill

## Additional Resources

- www.nptel.iitm.ac.in