



BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus

INSTRUCTION DIVISION
SECOND SEMESTER 2015-16
Course Handout (Part II)

Date: 08/01/2016

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : ME / MF F 244
Course Name : Kinematics and Dynamics of Machines
Instructor-in-charge : J S Rathore
Tutorial Instructors : T-1 Arun Jalan
T-2 J S Rathore
T-3 Sharad Shrivastava
T-4 Amol Marathe

- 1. Course Description:** Kinematic analysis of Plane Mechanisms, Velocity and Acceleration diagrams, Kinematics of Cam & Synthesis of Cam profile and Gear trains, Static and Dynamics force analysis (planar), Dynamics of reciprocating engines, Balancing, Flywheels, Governors and Gyroscopes.
- 2. Scope and Objective of the Course:** The first part deals with kinematics of simple mechanisms and motion generation, which lays foundation for further study in Dynamics and Vibration. The second part introduces some of basic concepts in the analysis of dynamic systems, kinetics of machine parts and vibration theory.
- 3. Text Books:**

- T1: Theory of Machines and Mechanisms by Uicker J.J., Pennock G.R., Shigley J.E., Oxford Univ. Press, NY, 3rd Ed., 2003.
T2: Theory of Mechanisms and Machines, Amitabh Ghosh and Ashok K. Malik, Allied East West Press Pvt. Ltd., 3rd Ed.

Reference Books:

- R1: Mechanism Design: Analysis and Synthesis, A. Erdman and G. Sandor, Prentice-Hall, 1984.
R2: Kinematics, Dynamics and Design of Machinery, Kenneth J. Waldron and Gary L. Kinzel, Wiley India Pvt. Ltd., 2nd Ed.
R3: Theory of Vibration with Application, Thomson W. T., Dahleh M. D., Pearson Education, 5th Ed.





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4. Course Plan:

Lecture	Objectives	Topics to be covered	Chapter
1- 2	Degree of Freedom, Types of Kinematic Joints, Inversions, Grashof's law	Introduction to Kinematics	CH 1: T1
3-7	Velocity and Acceleration Diagram of Kinematic Chain	Vector Polygon Method for Velocity and Acceleration	CH 3 and 4: T1
8-10	Different types of Cams, Motion Analysis and Motion Synthesis of Cam, Cam Profile drawing	Cam and Follower Systems	CH 5: T1
11-14	Direction of Rotation, Speed and Torque determination of Simple, Compound and Planetary gear systems	Gear Trains	CH 10: T1
15-17	Analytical and Position Vector Method of determination of Velocity and Acceleration	Analytical solutions of Velocity & Acceleration	CH 2, 3 and 4 (T2)
18-21	Dynamic Force Analysis	D'Alemberts Principle, Graphical Method, Vector Method, Complex Algebra Method	CH 4 (T2)
22-25	Dynamics of Reciprocating Engines	Introduction, Gas Forces, Dynamic Analysis, Equivalent Masses, Inertia Forces, Crank Shaft, Torque Analysis	CH 5 (T2)
26-27	Flywheels	Introduction, Dynamic Theory	CH 5 (T2)
28-30	Gyroscopes	Motion of Gyroscopes, Euler's Equation	CH 4 (T2)
31-34	Balancing	Dynamic Unbalance, Single Plane, Multi-plane Balancing, Multi-cylinder Balancing	CH 7 (T2)
	Governors	Self-Study	CH 6
35	Introduction to Oscillatory Motion	Basic Terminology	CH 1 (R3)
36-38	Free Vibrations	Vibration Models, Natural Frequency, Energy Methods, Damped Free Vibrations, Logarithmic Decrement, Coulomb Damping	CH 3 (R3)

5. Evaluation Scheme:

Evaluation Components	Duration	Weightage (%)	Date and time	Remarks
Mid Sem Test	1.5 Hrs	30	15/3 9:00 - 10:30 AM	CB
Tutorials + Quiz	---	30	--	OB
Compre. Exam	3 Hrs	40	5/5 FN	CB+OB





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6. **Tutorial + Quiz** : Out of six evaluative best three will be considered for final evaluation.
7. **Chamber Consultation Hour** : Will be announced by instructors individually in the class.
8. **Make up Policy** : Make-up will be granted only to genuine cases. For cases related to illness, proper documentary evidence is essential. Prior permission is necessary if student is out of station on the test date. **No make-up for tutorial tests.**
9. **Notices** : Notice, if any, concerning the course will be displayed on the Notice Board of Mechanical Engineering Department as well on Nalanda.

Instructor-In-Charge
ME/MF F 244

