

FR. Conceicao Rodrigues College Of Engineering
 Father Agnel Ashram, Bandstand, Bandra-west, Mumbai-50
Department of Production Engineering

S.E. (Production) (semester IV) (2018-2019)

Lecture Plan

Subject: Dynamics of Machines (DOM-PEC402)

Credits-04

1. Syllabus.

Module	Contents	Hrs.
01	Basic Concepts: Links, kinematics pairs, kinematics pairs giving one, two and three degrees of freedom, kinematics chains, degree of freedom and mobility criterion. Constrained kinematics chains as mechanism. Inversions of four bar, single and double slider crank chains and their applications, Introduction to gyroscope (no numerical problems).	06
02	Motion Characteristics of Mechanisms: Velocity and acceleration analysis of mechanisms with single degree of freedom system with Coriolis component using graphical method. Instantaneous centre, Kennedy's theorem; analysis of velocities of mechanism using instantaneous centre method.	08
03	CAMS: Introduction to types of cams, types of followers. Follower motions. viz. simple harmonic motions, constant velocity, uniform and constant acceleration and retardation and cycloidal motion, layout of cam profile for specified displacement characteristics. Cams with oscillating follower systems.	08
04	GEARS: Introduction: Types of gears and applications, Gear terminology, condition for constant velocity ratio-conjugate profiles, profiles used in gears.	08
	Interference of involute teeth, methods of preventing interferences through undercutting, length of path of contact and contact ratio, no of teeth to avoid interference. Gear trains: Simple, compound, planetary and epicyclic gear trains (with numerical).	
05	5.1 Balancing: Introduction. Rotary masses: several masses in same plane, several masses in different planes. Balancing of reciprocating masses, primary balancing and secondary balancing. Balancing of locomotives- Variation of Tractive Effort, Swaying Couple and Hammer blow 5.2 Vibrations: Introduction-free vibrations; longitudinal, transverse and torsional vibrations. Dunkerly's equation, critical or whirling speed of shaft. Torsional vibrations of two rotor system-torsionally equivalent shaft.	10
06	Clutches Brakes and Dynamometers: Study and analysis of single plate clutch, multiple plate clutches and cone clutches. Types of brakes. viz. block and shoe brakes, band brake, band and block brakes, braking of vehicles. Types of dynamometers, classification, Prony brake, Rope brake belt transmission dynamometers	08

2. CO Statements.

Learner will be able to

PEC402.1: Understand the common mechanisms used in machines, correlate the concepts of kinematics with kinetics of rigid body dynamics and Design of four bar mechanisms, gyroscopic devices etc.

PEC402.2: Determine the velocity and acceleration of various links in motion.

PEC402.3: Illustrate different types of cams, followers with their different motions for their application and Develop profiles of cams for engineering applications.

PEC402.4: Illustrate various types of gears/ their terminology areas of application along with parameters pertaining to spur gears and gear trains.

PEC402.5: Develop basic concepts pertaining to balancing/vibrations in evaluation of simple machine components.

PEC402.6: Illustrate different types of clutches, brakes and dynamometers for evaluation of braking force.

3. CO-PO-PSO Mapping.

CO# / PO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEC402.1	3	2	-	-	-	-	-	-	-	-	-	-
PEC402.2	3	3	2	-	-	-	-	-	-	-	-	-
PEC402.3	3	3	-	-	-	-	-	-	-	-	-	-
PEC402.4	3	3	-	-	-	-	-	-	-	-	-	-
PEC402.5	3	3	-	-	-	-	-	-	-	-	-	-
PEC402.6	3	3	-									

CO# / PSO#	PSO1	PSO2
PEC402.1	-	-
PEC402.2	-	-
PEC402.3	-	-
PEC402.4	-	-
PEC402.5	-	-
PEC402.6	-	-

4. CO Assessment tools with target.

Co Statement #	Target for Assessment Tools
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	Unit Test	End Semester Exam	Course Exit Survey
PEC402.1	50%	40%	60%
PEC402.2	50%	40%	60%
PEC402.3	50%	40%	60%
PEC402.4	-	40%	60%
PEC402.5	-	40%	60%
PEC402.6	40%	40%	60%

5. Curriculum Gap/Content beyond syllabus (if any).

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6. Lecture/Lab/Mini Project/Assignment Plan.

Week No.	Topics	Module	Hours
Week 1 (01/01/19 – 04/01/19)	Links, kinematics pairs, kinematics pairs giving one, two and three degrees of freedom, kinematics chains, degree of freedom and mobility criterion. Constrained kinematics chains as mechanism.	1	4
Week 2 (07/01/19 – 11/01/19)	Inversions of four bar, single and double slider crank chains and their applications, Introduction to gyroscope (no numerical problems).	1	4
	Types of brakes. viz. block and shoe brakes, band brake Band and block brakes , braking of vehicles. Study and analysis of single plate clutch, multiple plate clutches.	6	
Week 3 (14/01/19 – 18/01/19)	Study and analysis of cone clutches. Types of dynamometers, classification, Prony brake, Rope brake belt transmission dynamometers.	6	4
Week 4 (21/01/19 – 25/01/19)	Introduction to types of cams, types of followers. Follower motions. viz. simple harmonic motions, constant velocity, uniform and constant acceleration and retardation and cycloidal motion	3	4
Week 5 (28/01/19 – 01/02/19)	Layout of cam profile for specified displacement characteristics. Cams with oscillating follower systems.	3	4
Week 6 (04/02/19 – 08/02/19)	Unit Test 1 (Feb 12, 14 and 15) – FE, SE, TE.	-	-

Week 7 (11/02/19 – 15/02/19)	Instantaneous centre, Kennedy’s theorem; analysis of velocities of mechanism using instantaneous centre method. Velocity analysis of mechanisms with single degree of freedom system using graphical method	2	4
Week 8 (18/02/19 – 22/02/19)	Analysis of mechanisms with single degree of freedom system using graphical method with Coriollis component using graphical method.	2	3
Week 9 (25/02/19 – 1/03/19)	Introduction: Types of gears and applications, Gear terminology, condition for constant velocity ratio–conjugate profiles, profiles used in gears. length of path of contact and contact ratio	4	4
Week 10 (4/03/19 – 08/03/19)	Interference of involute teeth, methods of preventing interferences through undercutting, no of teeth to avoid Interference. Numericals on Gears	4	3
Week 11 (11/03/19 – 15/03/19)	Gear trains: Simple, compound, planetary and epicyclic gear trains (with numerical)	5	4
Week 12 (18/03/19 – 22/03/19)	Introduction–free vibrations; longitudinal, transverse and torsional vibrations. Dunkerly’s equation, critical or whirling speed of shaft. Torsional vibrations of two rotor system-torsionally equivalent shaft.	5	3
Week 13 (25/03/19 – 29/03/19)	Introduction. Rotary masses: several masses in same plane, several masses in different planes. Balancing of reciprocating masses, primary balancing and secondary balancing	5	4
Week 14 (1/04/19 – 05/04/19)	. Balancing of locomotives– Variation of Tractive Effort, Swaying Couple and Hammer blow	5	3
Week 15 (08/04/18 – 12/04/18)	Unit Test 2 (April 2, 3 and 4) – SE, TE.	--	--
Week 16 (15/04/19 – 19/04/19)	Term End (April 15)	--	--

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Lecture Plan

Subject: Dynamics of Machines Laboratory (DOM-PEL401)

Credits-01

1. Syllabus.

Exp. No.	List of Experiments (Any 6)
01	Gyroscope
02	Longitudinal Vibrations of Helical Spring
03	Torsional Vibrations of Shaft
04	Torsional Vibrations of Single Rotor System
05	Torsional Vibrations of Two Rotors System
06	Compound Pendulum
07	Transverse Vibrations - Whirling Speed of Shaft
08	Cam Analysis
09	Coriollic Component of Acceleration
10	Interference and Undercutting in Gears
	(Any 2 Assignments)
01	Velocity and Acceleration Analysis
02	Cam and Follower
03	Balancing of Rotary and Reciprocating Masses

2. CO Statements.

Learner will be able to

PEL401.1: Compute the natural frequencies of 1 DOF system.

PEL401.2: Apply the working principles of gyroscope and Cam.

PEL401.3: Demonstrate the understanding of static and dynamic balancing.

PEL401.4: Compute velocity and acceleration in mechanisms.

PEL401.5: Carryout Cam analysis.

PEL401.6: Demonstrate the practical significance of interference and undercutting in gears.

3. CO-PO-PSO Mapping.

Laboratory

CO# / PO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEL401.1	3	3	-	-	-	-	-	-	-	-	-	-
PEL401.2	3	3	-	-	-	-	-	-	-	-	-	-
PEL401.3	3	3	-	-	-	-	-	-	-	-	-	-
PEL401.4	3	3	-	-	-	-	-	-	-	-	-	-
PEL401.5	3	3	5	-	-	-	-	-	-	-	-	-
PEL401.6	3	3	-									

CO# / PSO#	PSO1	PSO2
PEL401.1	-	-
PEL401.2	-	-
PEL401.3	-	-
PEL401.4	-	-
PEL401.5	-	-
PEL401.6	-	-

4. **CO Assessment tools with target.**

Co Statement #	Target for Assessment Tools			
	Assignments	Experiments	Oral Exam	Course Exit Survey
PEL401.1	-	70%	60%	60%
PEL401.2	-	70%	60%	60%
PEL401.3	-	-	60%	60%
PEL401.4	70%	-	60%	60%
PEL401.5	70%	70%	60%	60%
PEL401.6	-	-	60%	60%

5. **Curriculum Gap/Content beyond syllabus (if any).**

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6. **Lab Plan.**

Week No.	Topics	Hours (Per Batch)
Week 3 (14/01/19 – 18/01/19)	Compound Pendulum	2

<u>Week 4</u> (21/01/19 – 25/01/19)	Gyroscope	2
<u>Week 5</u> (28/01/19 – 01/02/19)	Cam and Follower	2
<u>Week 6</u> (04/02/19 – 08/02/19)	Unit Test 1 (Feb 12, 14 and 15) – FE, SE, TE.	-
<u>Week 7</u> (11/02/19 – 15/02/19)	Whirling Speed of Shaft	2
<u>Week 8</u> (18/02/19 – 22/02/19)	Coriolis Component of Acceleration	2
<u>Week 9</u> (25/02/19 – 1/03/19)	Velocity and Acceleration Analysis Assignment	2
<u>Week 10</u> (4/03/19 – 08/03/19)	Velocity and Acceleration Analysis Assignment	2
<u>Week 11</u> (11/03/19 – 15/03/19)	Velocity and Acceleration Analysis Assignment	2
<u>Week 12</u> (18/03/19 – 22/03/19)	Cam and Follower Profile Assignment	2
<u>Week 13</u> (25/03/19 – 29/03/19)	Cam and Follower Profile Assignment	2
<u>Week 14</u> (1/04/19 – 05/04/19)	Cam and Follower Profile Assignment	2
<u>Week 15</u> (08/04/18 – 12/04/18)	Unit Test 2 (April 2, 3 and 4) – SE, TE.	--

<u>Week 16</u> (15/04/19 – 19/04/19)	Term End (April 15)	--
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