15MH208	Kinematics and Dynamics of Rigid Bodies and Mechanisms	L	T	P	C
		3	0	0	3
Co-requisite:	Nil				
Prerequisite:	15MH202J				
Data Book / Codes/Standards	Nil				
Course Category	P Professional Core	Mechanical Engineering			
Course designed by	Department of Mechatronics Engineering				
Approval	32nd Academic Council Meeting held on 23.07.2016.				

Purpose	To provide an overview on fundamentals of various laws governing rigid body motions, vibration characteristics and balancing of mechanical machines.							
Instructional Objectives		**Student Outcomes**						
At the end of the course, student will be able to								
1.	Comprehend the concept of machines, mechanisms and flywheel.	a	e					
2.	Analyze the performance of cams, gyroscope, gears and gear trains.	a	e					
3.	Explore the undesirable effects of unbalanced force in engines and its remedies.	a	e					
4.	Interpret and solve problems in vibratory systems and analyze the effects.	a	e					

Session	Description of Topics	Contact hours	C-D-I-O	IOs	Reference
	Unit I : Basic Elements of Mechanisms	**9**			
1.	Introduction to kinematic links, pairs, chain, machine and structure, degrees of freedom.	2	C	1	1,7
2.	Grashoff's law, Kutzback criterion.	2	C	1	1, 6
3.	Kinematic inversions of four-bar and slider crank chain.	2	C	1	1, 6
4.	Turning moment diagram of multi cylinder engine.	1	C	1	1, 6
5.	Energy stored in flywheel, dimensions of the flywheel.	2	C	1	1, 6
	Unit II : Cams and Gyroscope	**8**			
6.	Classification of cam and follower, displacement diagrams.	2	C	2	1,3
7.	Construction of cam profile for uniform velocity, uniform acceleration of follower.	2	C	2	1,3
8.	Construction of cam profile for Simple Harmonic Motion (SHM) and cycloidal motion of follower.	2	C	2	1,3
9.	Gyroscope: Forces and couples, effect of gyroscopic couple in aeroplanes and ships, stability of two-wheel and four- wheel vehicle.	2	C	2	1,3
	Unit III : Gears and Gear Trains	**7**			
10.	Fundamentals of toothed gearing, spur gear terminology.	1	C	2	2,5
11.	Involute gear tooth profile.	1	C,D	2	1,2
12.	Gear meshing, contact ratio.	1	C,D	2	1,2
13.	Gear trains, simple and compound gear trains.	2	C	2	1,5
14.	Velocity ratio and torque calculations in epicyclic gear train.	2	C,D	2	1,2
	Unit IV: Balancing of Masses	**9**			
15.	Balancing: Introduction, static and dynamic.	1	C	3	1,3
16.	Balancing of single mass rotating in single plane.	1	C,D	3	1,3
17.	Balancing of several masses rotating in single plane.	1	C,D	3	1,3
18.	Balancing of several masses rotating in different planes.	1	C,D	3	1,3
19.	Balancing of reciprocating masses.	1	C,D	3	1,3
20.	Balancing of single cylinder engine.	1	C,D	3	1,3
21.	Balancing of multi cylinder inline engine.	1	C,D	3	1,3
22.	Hammer blow, swaying couple, tractive force.	2	C	3	1,3
	Unit V : Vibrations	**8**			
23.	Types of vibration, longitudinal, transverse and	2	C,D	4	1,4

Session	Description of Topics	Contact hours	C-D-I-O	IOs	Reference
	torsional, transverse vibration: Dunkerley's method.				
24.	Critical speed of shafts, frequency of undamped system.	1	C,D	4	1,6
25.	Viscous damping: Introduction, damping factor.	1	C	4	1,6
26.	Damped free vibration: Torsional vibrations.	2	C,D	4	1,6
27.	Two rotor, three rotor and geared systems.	2	C,D	4	1,4
	Assessment	**4**			
28.	Cycle test - I	1			
29.	Cycle test - II	2			
30.	Surprise test/Assignment and Quiz	1			
	Total contact hours	**45**			

Learning Resources	
Sl. No.	**Text Books**
1.	Ratan.S.S, "*Theory of Machines*", Tata McGraw Hill Publishing company Ltd., 2nd edition, 2005.
2.	R.L. Norton, "*Kinematics and Dynamics of Machinery*", Tata McGraw Hill Publishing Company Ltd., 2014.
3.	R.K. Bansal, "*Theory of Machines*", Lakshmi publications pvt.ltd., 2011.
4.	Singiresu S.Rao, "*Mechanical Vibrations*", Nem Chand and Bros, 1998.
5.	Thomas Beven, "*Theory of Machines*", CBS Publishers and Distributors, 3rd edition, 2013.
	Reference Books/Other Reading Materials
6.	Sing.V.P, "*Mechanical Vibrations*", Dhanpat Rai and Co., 1998.
7.	Rao.J.S and Dukkipati.R.V, "*Mechanism and Machine Theory*", Wiley Eastern Ltd., New Delhi, 2006.
8.	John Hannah and Stephens.R.C, "*Mechanics of Machines"*, Viva Low Price student edition, 1999.
9.	Shigley .J.E, "*Theory of Machines and Mechanisms*", McGraw Hill 2009.
10.	Ghosh .A and Mallick.A.K, *"Theory of Mechanisms and Machines*", Affiliated East - West Pvt. Ltd. New Delhi, 2006.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination weightage:							**50%**