Faculty of Engineering & Technology, SRM University, Kattankulathur – 603203
School of Mechanical Engineering

Department of Mechanical Engineering

Course plan

Course code : ME1012 Date :28.11. 2014
Course title : MACHINES AND MECHANISMS
Semester : FOURTH
Academic year / Semester : 2014-15 / Even (January – April 2015)

Section details:

Branch	Section	Class Room No.	Details of Faculty member				
			Name	Room No.	Inter com No.	e-mail id	Student contact time
~~Mechanical~~ Aero Space			D. Raja	MEC 302	1844	raja.d@ktr.srmuniv.ac.in	Mon 1.00 – 1.30 pm
~~Mechanical~~ Aero Space			P.V. Jeyakarthikeyan	MEH 101	-	jeyakarthik.p@ktr.srmuniv.ac.in	Wed 1.00 – 1.30 pm

Direct assessment details:

Name of assessment	Marks	Topics	Tentative date	Duration
Cycle test – I	10	Unit I	09.02.2015	100 minutes
Surprise test	05	Unit I & Unit II	Last week of Feb 2015	10 – 15 min
Cycle test – II	10	UNIT II	09.03.15	100 minutes
Model examination	20	Full syllabus	15.04.15	3 hours
End semester examination	50	Full syllabus		3 hours
Attendance	05			

Expected learning outcome of the course:

		L	T	P	C
ME1012	MACHINES AND MECHANISMS	2	2	0	3
	Prerequisite				
	Nil				

Student outcomes	Program Educational Objectives			
	The main objective of the B.Tech in Mechanical Engineering Program is to provide a periodically-updated curriculum so that, following the completion of the program and with a few years of experience, our alumni will have the expertise to:			
	1. Practice mechanical engineering in different disciplines towards system design, realization, and manufacturing.	2. Enhance professional practice to meet the global standards with ethical and social responsibility.	3. Solve industrial, social, and environmental problems with appropriate techniques and tools. tools.	4. Work in large cross-functional teams and pursue life-long learning.
(a) an ability to apply knowledge of mathematics, science, and engineering	X		X	
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	X	X	X	
(e) an ability to identify, formulate, and solve engineering problems	X		X	
(j) a knowledge of contemporary issues		X	X	X

Course designed by		Department of Mechanical Engineering									
1	Student outcome	a	b	c	d	e	f	g	h	i	j	K
		×		×		×					×	
2	Mapping of instructional objectives with student outcome	1-4		1-5		1-5					1-5	

3	Category	GENERAL (G)	BASIC SCIENCES (B)	ENGINEERING SCIENCES AND TECHNICAL ART (E)	PROFESSIONAL SUBJECTS (P)
					X

4	Broad area (for professional courses only, i.e 'under P' category)	Manufacturing	Design	Thermal	Genaral
			X		

5	Course Coordinator	D.RAJA

Syllabus

ME1012 - MACHINES AND MECHANISMS Total Contact Hours-60

PURPOSE

To expose the students to learn the fundamentals of various laws governing rigid bodies and its motions.

INSTRUCTIONAL OBJECTIVES

1. Basic mechanisms, velocity and acceleration of simple mechanisms
2. Drawing the profile of cams and its analysis
3. Gear train calculations , Gyroscopes
4. Inertia force analysis and flywheels
5. Balancing of rotating and reciprocating masses

UNIT I- MECHANISMS (14 hours)

Introduction - Links - Pairs - Chain - Mechanism - Machine structure - Degrees of freedom - Fodur bar chains - Terminology and definition - Planer, Spherical and Spatial Mechanisms - Grashoff's law - Kutzback criterion - Grubler's criterion for plane mechanism. Inversion of mechanisms - Four bar, single slider crank and double slider crank mechanisms - Simple problems - Instantaneous centre - Kennedy's theorem - Velocity and Acceleration of Four bar and single slider crank mechanisms by relative velocity Method.

UNIT II - CAMS (10 hours)

Types of cams and followers - Follower motion - Uniform, Parabolic, SHM and cycloidal. Cam terminology - Cam profiles construction for roller, flat faced and knife edge follower types - pressure angle - Derivatives of Follower motion – High speed cams - circular arc and tangent cams – Standard cam motion – Pressure angle and undercutting.

UNIT III - GEAR TRAINS AND CONTROL MECHANISMS (12 hours)

Spur gear terminology and definition - Gear trains: simple, compound, reverted and epicyclic - Velocity ratio and torque calculation in gear trains – Automobile differential. Gyroscopes: Gyroscopic forces and couple - Forces on bearing due to gyroscopic action - Gyroscopic effect in ship, motor cycle, car and aircraft.

UNIT IV - FORCE ANALYSIS (12 hours)

Inertia force and inertia torque calculations – D'Alembert's principle – The principle of super position – Dynamic analysis in reciprocating engines – Gas forces – Equivalent masses – Bearing loads – crank shaft torque. Turning moment diagrams: Fly wheels - Application of flywheel - Punching presses.

UNIT V - BALANCING (12 hours)

Static and dynamic Balancing: Balancing of rotating masses - Balancing of single cylinder engine - Balancing of multi cylinder engine –partial balancing in locomotive engines – Hammer blow – Swaying couple – Tractive force - Balancing machines.

TEXT BOOKS

1. Ratan, S.S.,"*Theory of Machines*", Tata McGraw Hill Publishing company Ltd., 2nd Edition, 2005.
2. Thomas Bevan,"*Theory of Machines*", CBS Publishers and Distributors, 3rd Edition, 1984.

REFERENCES

1. Shigley, J. E., and Uicker, J. J.,"*Theory of Machines and Mechanisms*", McGraw Hill, 1995.
2. Ghosh, A., and Mallick, A. K.,"*Theory of Mechanisms and Machines*", Affiliated East-West Pvt Ltd., New Delhi, 1988.
3. Rao, J. S., and Dukkipati, R.V.,"*Mechanism and Machine Theory*", Wiley- Eastern Ltd., New Delhi, 1995.

Lesson Plan:

COURSE CODE: ME1012
COURSE TITLE: MACHINES AND MECHANISMS
YEAR / SEM: II Year – IV Sem
COURSE TIME – SEMESTER: ODD / EVEN

S. No.	Date	PERIOD	TITLE	BOOK	Chapter No.
MECHANISMS					
1		1	Overview about the course, Introduction to mechanism, its elements - pairs and its types, links & chains	T-1	C-1
2		2	Degrees of freedom and its application in planar, spherical and spatial mechanism - Grashofs law and its application -Kutz-back relationship, Inversion of mechanisms – Four Bar Chain		
3		1	Velocity analysis of Four bar, single slider crank and double slider crank mechanisms using relative velocity method	T-1	C-2 :- 3
4		2	Practice of Problems in velocity analysis like Four bar, single slider crank and double slider crank mechanisms in Relative Velocity method		
5		1	Acceleration analysis of Four bar, single slider crank and double slider crank mechanisms using relative velocity method.		
6		2	Practice of Problems in acceleration analysis like Four bar, single slider crank and double slider crank mechanisms in Relative Velocity method	R-2	C-2
7		1	Instantaneous centre method - Theory		
8		1	Velocity analysis of Four bar, single slider crank and double slider crank mechanisms using Instantaneous centre method – Simple Problems		
9		1	Kennedy's theorem		
10		2	Practice of Problems in velocity analysis like Four bar, single slider crank and double slider crank mechanisms in Instantaneous centre method		
ADVANCED MECHANISMS AND CAMS					
11		1	Types of cams and Folower motion - Uniform, Parabolic, SHM and cycloidal	T-1	C-7
12		1	Derivatives of Folower motion		
13		1	Displacement, velocity and acceleration diagrams for various follower motions		
14		1	Cam profile construction - Radial Follower – Same Axis		
15		1	Cam profile construction –Knife edgeFollower – Offset follower	T-1	C-7
16		1	Cam profile construction – flat faced – Same Axis		
17		1	Practice problems in cam construction		
18		1	Highspeed cams - circular arc and tangent cams	T-1	C-8
19		1	Problems in circular arc and tangent cams		
20		1	Standard cam motion -Undercutting, Interference, Pressure angle in cams		
GEAR TRAINS AND CONTROL MECHANISMS					
21		1	Gears and its basics - classification of gears - Nomenclature of gears - Law of gearing - Undercutting and interference of gears	T-1	C-10
22		1	Interference in gears and some basics problems involving the calculation of module, contact ratio..	R-2	C-9
23		1	Gear trains & its applications - Types, calculation of speed ratio, gear speeds in simple gear train and compound gear train	T-1	C-11
24		1	Train value calculation in epicyclic gear train and determination of number of tooth in driver and driven, sun and planet gear system	R-2	C-9

25		1	Torque calculation of gear trains		
26		1	Definition of gyroscope and introduction about gyroscopic couple and moment with precision axis of spin	T-1	C-17
27		1	Forces on bearing due to gyroscopic action		
28		1	Gyroscopic action and its effect in aeroplane	R-2	C-10
29		1	Gyroscopic action and its effect in Ships		
30		1	Gyroscopic action and its effect in two wheelers		
31		1	Gyroscopic action and its effect in four wheelers		
32		1	Tutorial Class		
FORCE ANALYSIS					
33		1	D'Alembert's Principle	T-1	C-13
34		1	Derivation of velocity and acceleration of piston		
35		1	Engine force analysis		
36		1	Problems in turning moment of crankshaft		
37		1	Dynamically equivalent system		
38		1	Simple problems		
39		1	Turning moment diagram in Flywheel – Problem 1– Intercepted areas	T-1	C-13
40		1	Turning moment diagram in Flywheel – Problem 2 – Curve equation	T-1	C-13
41		1	Turning moment diagram in Flywheel – Problem 3 –IC engine application		
42		1	Punching press		
43		1	Problems on Flywheel & punching Press		
44		1	Tutorial class		
BALANCING					
45		1	Balancing – Conditions & Balancing of several masses in same plane – Analytical & Graphical method	T-1	C-14
46		1	Balancing of several rotating masses in different planes - Theory		
47		1	Balancing of several rotating masses in different planes - Problems		
48		1	Problems on Balancing of Rotating masses		
49		1	Balancing of locomotives		
50		1	Effects of partial balancing in locomotives		
51		1	Hammer blow, Swaying couple	T-1	C-14
52		1	Tractive force		
53		1	Problems in partial balancing		C-14
54		1	Problems in partial balancing		
55		1	Balancing machines		
56		1	Tutorial class		

TEXT BOOKS

1. Ratan, S.S., *Theory of Machines*, Tata McGraw Hill Publishing company Ltd., 2 nd Edition, 2005.

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3. Rao, J. S., and Dukkipati, R.V., *Mechanism and Machine Theory*, Wiley–Eastern Ltd., New Delhi, 1995

Staff Signature

1. **D. Raja** -
2. **P.V. Jeyakarthikeyan** -

29/11/14

HOD Sign

for 4/12/14