

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

## Department of Mechanical Engineering

### Course plan

Course code : ME1012  
Course title : MACHINES AND MECHANISMS  
Semester : 3  
Academic year : 2014-2015

#### Section details:

Details of Faculty member					
Section	Name	Room No.	Intercom no.	e-mail id	Student contact time
A	Mr.J.Santhakumar	MEC101	-	santhakumar.j@ktr.srmuniv.ac.in	1.15 to 1.30 pm
B	Mr.M.Sachidhanandam	MEB305A	-	sachidhanandam.m@ktr.srmuniv.ac.in	
C	Mr.B.Ramprasath	MEC202A	-	ramprasath.b@ktr.srmuniv.ac.in	
D	Mr.Vamsikrishna	MEH101C	-	vamsikrishna.d@ktr.srmuniv.ac.in	
E	Mr.M.Seramaraj	MEB405	-	sermaraj.m@ktr.srmuniv.ac.in	
F	Mr.S.Arokya Agustin	MED101A	-	arokyaagustin.s@ktr.srmuniv.ac.in	
G	Mr.N.C.Sasidharan	MEB305	-	sasidharan.nc@ktr.srmuniv.ac.in	
H	Mr.V.Raghavendra Rao	MEB305	-	raghavendra.v@ktr.srmuniv.ac.in	
I	Mr.Shubrajit Baumik	MEM12D	-	shubrajit.b@ktr.srmuniv.ac.in	
J	Mr.C.Balasuthagar	MEB104C	-	balasuthagar.c@ktr.srmuniv.ac.in	
K	Mr.M.Rajendra	MEB104G	-	rajendramachavaram.r@ktr.srmuniv.ac.in	
L	Mr.Sampathkumar	MEB208F	-	Sampathkumar.s@ktr.srmuniv.ac.in	

#### Direct assessment details:

Name of assessment	Marks	Topics	Tentative date	Duration
Cycle test - I	10	Upto velocity and acceleration diagram	30.07.2014	100 minutes
Surprise test	05	Mechanisms	11.08.2014	10 – 15 min
Cycle test - II	10	Upto Cams	25.08.2014	100 minutes
Model examination	20	Full Syllabus	20.10.2014	3 hours
End semester examination	50	Full Syllabus	14.11.2014	3 hours
Attendance	05	-	-	-

		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.	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
		x		x		x					x	
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		General			
					X							
5	Course Coordinator	M.SERMARAJ										

ME1012

**MACHINES AND MECHANISMS**

L	T	P	C
2	2	0	3

**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 - Kutzbach 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.

TOTAL : 60

**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, 3<sup>rd</sup> 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 Dukkupati.R.V, "Mechanism and Machine Theory", Wiley- Eastern Ltd., New Delhi, 1995.

S. No	TITLE	BOOK	Chapter No.
<b>MECHANISMS</b>			
1	Overview about the course, Introduction to mechanism, its elements - pairs and its types, links & chains	T-1 & R-2	C-1
2	Degrees of freedom and its application in planar, spherical and spatial mechanism		
3	Simple Problems in Quick return mechanisms		
4	Grashofs law and its application -Grublers criteria and Kutz-batch relationship		
5	Inversion of mechanisms-Four bar mechanism,Single Slider and Double slider mechanism		
6	Velocity analysis of Four bar, single slider crank,Toggle mechanism, and double slider crank mechanisms using relative velocity method	T-1	C-2, C-3
7	Tutorial: Velocity analysis like Four bar, single slider crank and double slider crank mechanisms using Relative Velocity method		
8	Acceleration analysis of Four bar and single slider crank using relative acceleration method.		
9	Tutorial:Acceleration analysis like Four bar, single slider crank mechanism,Toggle Mechanism using Relative acceleration method	R-2	C-2
10	Overview of Instantaneous centre method and Kennedys theorem		
11	Velocity analysis of Four bar, single slider crank mechanisms using Instantaneous centre method		
12	Velocity analysis of double slider crank mechanisms using Instantaneous centre method		
13	Tutorial:Velocity analysis of Four bar, single slider crank mechanisms using Instantaneous centre method		
14	Tutorial:Velocity analysis of double slider crank mechanisms using Instantaneous centre method		
<b>CAMS</b>			
13	Fundamentals of cam and its Nomenclature - Classification of cam and its follower with its different types of motion	T-1	C-7
14	Undercutting, Interference, Pressure angle in cams – Displacement, velocity and acceleration diagrams for various follower motions		
15	Velocity and acceleration analysis – various follower motions		
16	Cam profile construction - Radial Follower – Same Axis	R-2	C-8
17	Cam profile construction –Knife edgeFollower – Offset follower		
18	Pressure angle – derivatives of follower motions		
19	High speed cam-circular arc	T-1	C-7
20	High speed cam- tangent cam		

21	Standard cam motion – pressure angle		
22	Tutorial: Problems in High speed cam		
23	Tutorial: Problems in cam construction		
24	Tutorial: Problems in cam construction	T-1	C-7

### GEAR TRAINS AND CONTROL MECHANISMS

25	Gears and its basics – spur gear terminology and definition.	T-1	C-10
26	Gear trains & its applications - Types, calculation of speed ratio, gear speeds in simple gear train and compound gear train	T-1	C-11
27	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
28	Torque calculation of gear trains and reverted gear train		
29	Automobile differential	T1	C11
30	Definition of gyroscope and introduction about gyroscopic couple and moment with precision axis of spin	T-1	C-17
31	Forces on bearing due to gyroscopic action		
32	Gyroscopic action and its effect in Aeroplanes, ships		
33	Tutorial: Gyroscopic action and its effect in aeroplanes, ships		
34	Gyroscopic action and its effect in two wheelers	R-2	C-10
35	Tutorial: Gyroscopic action and its effect in two wheelers		
36	Gyroscopic action and its effect in four wheelers		

### FORCE ANALYSIS

37	Introduction to inertia force and inertia torque calculations	T-1	C-13
38	D’ALEMBERT’S principle and principle of super position	T-1	C-13, C12
39	Dynamic analysis of four bar mechanism	T-1	C-13
40	Dynamic analysis of slider crank mechanism	T-1	C-13
41	Gas forces, equivalent masses, Bearing loads.	T-1	C-13
42	Determination of Crank shaft torque	T-1	C-13
43	Turning moment diagram in Flywheel - Theory	T-1	C-13
44	Turning moment diagram in Flywheel - Problem 1- Intercepted areas		
45	Turning moment diagram in Flywheel - Problem 2 - Curve equation		
46	Turning moment diagram in Flywheel - Problem 3 -IC engine application	T-1	C-13
47	Problems on Flywheel in punching press design		
48	Applications of fly wheel.		

### BALANCING

49	Static and dynamic balancing	T-1	C-14
50	Balancing - Conditions & Balancing of several masses in same plane - Analytical & Graphical method	T-1	C-14
51	Balancing of several rotating masses in different planes - Theory	R-2	C-7
52	Balancing of several rotating masses in different planes - Problems		

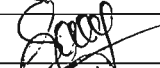
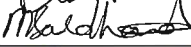


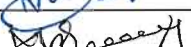
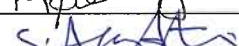
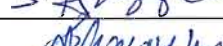
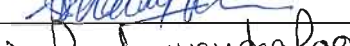


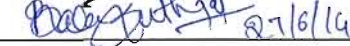

53	Problems on Balancing of Rotating masses	R-2	C-7
54	Balancing of single cylinder engine	T-1	C-14
55	Balancing of multi cylinder engine		
56	Problems on single and multi-cylinder engines		
57	Partial balancing in locomotive engines	T-1	C-14
58	Hammer blow, swaying couple		
59	Tractive force		
60	Balancing 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.

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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 Dukkupati.R.V, "Mechanism and Machine Theory", Wiley- Eastern Ltd., New Delhi, 1995.

Name of the Faculties:	Signatures:
Mr.J.Santhakumar	
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Mr.N.C.Sasidharan	
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Mr.Shubrajit Baumik	 27/6/14
Mr.C.Balasuthagar	 27/6/14
Mr.M.Rajendra	 27.06.14.
Mr.Sampathkumar	 27.06.14

  
Course Coordinator

  
HOD / Mechanical

