

Academic Course Description

BHARATH UNIVERSITY
 Faculty of Engineering and Technology
 Department of Mechanical Engineering
BME 301- KINEMATICS OF MACHINES
Third Semester, 2015-16 (odd Semester)

Course (catalog) description

To understand the concept of machines, mechanisms and related terminologies. To analyse a mechanism for displacement, velocity and acceleration at any point in a moving link.

Compulsory/Elective course : Compulsory

Credit & contact hours : 4 & 60

Course Coordinator : Mr.R.Karthikeyan

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in)	Consultation
Mr. R. J. Golden Renjith Nimal	2 nd Year Mech, Sec 'A', 'B'	SK 001, SK 002	9994351938	goldenrenjith.mech@bharathuniv.ac.in	9.00 to 9.50 am
Mr. R. Karthikeyan	2 nd Year Mech, Sec 'C'	SK 003	9884918458	Karthikeyan.mech@bharathuniv.ac.in	10.50 to 11.40

Relationship to other courses:

Pre –requisites : Engineering Mechanics

Assumed knowledge : By understanding the concept of machines, mechanisms and related terminologies.

Following courses : Dynamics of Machines ,Mechanical Vibration, Vibration control & Monitoring

Syllabus Contents**UNIT I INTRODUCTION TO MECHANISMS****12**

Introduction-Science of mechanisms-Terms and definitions-Planar, Spherical and spatial mechanisms, Mobility-Classification of mechanisms-Indexing mechanisms, reciprocating mechanism etc. Straight line generators- kinematic inversion- Slider crank chain inversions- Four bar chain inversions- Grashof's law.

Determination of velocities and acceleration in mechanisms- Relative motion method (Graphical) for Mechanisms having turning, sliding and rolling pair.

UNIT II SYNTHESIS OF MECHANISMS**16**

Classification of kinematics- Synthesis problems- Chebyshev's spacing, Two point synthesis- Freudenstein method- Four bar mechanism and slider crank mechanism. Types of cams and followers- Follower motions- Uniform, parabolic, SHM, Cycloidal and polynomial- Synthesis of cam profiles for different followers. Cams with specified contours

UNIT III FRICTION 10

Friction-Types-Application-Inclined plane, Screw jack, Clutch, Brakes Bearings, Journal bearing, Flat pivot bearing, multi collar bearings, Belt & Rope drives.

UNIT IV THEORY OF GEARING 12

Classification of gears, Law of gearing, nomenclature-Forms of teeth, Cycloidal teeth, Involute teeth- Length of path of contact- Length of arc of contact- Contact ratio- Interference and undercutting- Minimum number of teeth to avoid interference- Internal gears- Extended center distance system- Long and short addendum system- Gear trains- Types- Epicyclical gear trains- Automobile differential unit.

UNIT V CONTROL MECHANISMS 10

Governors- Gravity controlled governors- Spring control governors, Hartnell governor, and Hartung governor- Governor characteristics- Governor effort and power.

Gyroscopes- Gyroscopic forces and couple- Forces on bearing due to gyroscopic action- Gyroscopic effects on the movement of aero plans and ships, stability of two wheel drive and four wheel drive.

Total: 60 hours

TEXT BOOKS:

1. S.S. Rattan-Theory of Machines- Tata McGraw Hill, 2005.
2. Rao J.S. & Duggipati R.V. Mechanisms and Machine Theory, 2nd Edition- Wiley Eastern Ltd-1992.

REFERENCES:

1. Bansal- Theory of Machines, 2006.
2. Shigley. J.E- Theory of Machines and Mechanisms, 2nd Edition- McGraw Hill Inc, 1995
3. V.P. Singh- Theory of Machines, 2001
4. royalmechanicalbuzz.blogspot.com/.../theory-of-machines-by-rs-khurmi.

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area: Dynamics, Effects of vibration, Couples

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 2 nd week	Session 1 to 14	2 Periods
2	Cycle Test-2	September 2 nd week	Session 15 to 28	2 Periods
3	Model Test	October 3 rd week	Session 1 to 45	3 Hrs
4	University Examination	November	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To understand the concept of machines, mechanisms and related terminologies. To analyse a mechanism for displacement, velocity and acceleration at any point in a moving link.	Correlates to program outcome		
	H	M	L
1. Upon completion of this course, the students can understand mechanism and its applications in various field of work	a, b, c, f, i	k, l	h
2. Students will be able to draw velocity and acceleration diagrams graphically and analytically.	f	k	h
3. Understand the analysis method for optimum design.	f	k, l	h
4. Understand the importance of friction in machine elements.	f	k, l	h
5. Understand control mechanism	f	k, l	h
6. Study of gears and its applications	f	k	h

H: high correlation, M: medium correlation, L: low correlation

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
Unit 1 INTRODUCTION TO MECHANISMS			
1.	Introduction-Science of mechanisms-Terms and definitions	No	[T1] chapter - 2, [R3] chapter -1
2.	Planar, Spherical and spatial mechanisms	No	
3.	Mobility-Classification of mechanisms	No	
4.	Indexing mechanisms	No	
5.	Reciprocating mechanism etc.	No	
6.	Straight line generators	No	
7.	kinematic inversion	No	
8.	Slider crank chain inversions	No	
9.	Four bar chain inversions	No	
10.	Grashof's law	No	
11.	Determination of velocities and acceleration in mechanisms	Yes	
12.	Relative motion method (Graphical) for Mechanisms having turning, sliding and rolling pair.	Yes	
UNIT II SYNTHESIS OF MECHANISMS			
13.	Classification of kinematics	No	[T1] chapter - 6, [T3] chapter - 4
14.	Synthesis problems	Yes	
15.	Chebyshev's spacing	No	
16.	Two point synthesis	No	
17.	Freudenstein method	Yes	
18.	Four bar mechanism and slider crank mechanism	Yes	
19.	Types of cams and followers	No	
20.	Follower motions	Yes	
21.	Uniform velocity	Yes	
22.	parabolic, SHM, Cycloidal and polynomial	Yes	
23.	Synthesis of cam profiles for different followers	Yes	
24.	Cams with specified contours	Yes	
UNIT III FRICTION			
25.	Friction	No	[T1] chapter - 10, [R2] chapter - 6
26.	Types-Application	No	
27.	Inclined plane	Yes	
28.	Screw jack	Yes	
29.	Clutch	Yes	
30.	Brakes	Yes	
31.	Bearings	Yes	
32.	Flat pivot bearing	Yes	
33.	Journal bearing	Yes	
34.	multi collar bearings	Yes	
35.	Belt	Yes	
36.	Rope drives.	Yes	

UNIT IV		THEORY OF GEARING	
37.	Classification of gears	No	[T1] chapter - 12, [R2] chapter - 9
38.	Law of gearing, Nomenclature	No	
39.	Forms of teeth	No	
40.	Involute teeth	Yes	
41.	Cycloidal teeth	Yes	
42.	Length of arc of contact, Contact ratio	Yes	
43.	Length of path of contact	Yes	
44.	Internal gears- Extended center distance system	No	
45.	Long and short addendum system- Gear trains-Types	Yes	
46.	Interference and undercutting	Yes	
47.	Minimum number of teeth to avoid interference	Yes	
48.	Epicyclical gear trains-Automobile differential unit.	Yes	
UNIT V		CONTROL MECHANISMS	
49.	Governors	No	[T2] chapter - 19, [R3] chapter - 13 [R4]
50.	Gravity controlled governors	Yes	
51.	Spring control governors, Hartnell governor	Yes	
52.	Hartung governor	Yes	
53.	Governor characteristics	No	
54.	Governor effort and power.	Yes	
55.	Gyroscopes	No	
56.	Gyroscopic forces and couple	Yes	
57.	Forces on bearing due to gyroscopic action	Yes	
58.	Gyroscopic effects on the movement of aero planes	Yes	
59.	Gyroscopic effects on the movement of ships	Yes	
60	Stability of two wheel drive and four wheel drive.	Yes	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignment / Seminar / Online		
Test / Quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Addendum

ABET Outcomes expected of graduates of B.Tech / MECH / program by the time that they graduate:

- a) The ability to apply knowledge of mathematics, science, and engineering fundamentals.
- b) The ability to identify, formulate and solve engineering problems.
- c) The ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- d) The ability to design and conduct experiments, as well as to analyze and interpret data
- e) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- f) The ability to apply reasoning informed by the knowledge of contemporary issues.
- g) The ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- h) The ability to understand professional and ethical responsibility and apply them in engineering practices.
- i) The ability to function on multidisciplinary teams.
- j) The ability to communicate effectively with the engineering community and with society at large.
- k) The ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.
- l) The ability to recognize the need for, and an ability to engage in life-long learning.

Program Educational Objectives

PEO1: PREPARATION:

Mechanical Engineering graduates are enthusiastic to provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the field of Mechanical Engineering.

PEO2: CORE COMPETENCE:

Mechanical Engineering graduates have competence to enhance the skills and experience in defining problems in the field of Mechanical Engineering and Technology design and implement, analyzing the experimental evaluations, and finally making appropriate decisions.

PEO3: PROFESSIONALISM:

Mechanical Engineering graduates made competence to enhance their skills and embrace new thrust areas through self-directed professional development and post-graduate training or education.

PEO4: PROFICIENCY:

Mechanical Engineering graduates became skilled to afford training for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS:

Mechanical Engineering graduates are morally merged to apply the ethical and social aspects of modern Engineering and Technology innovations to the design, development, and usage of new products, machines, gadgets, devices, etc.

Course Teacher	Signature
Mr. R. J. Golden Renjith Nimal Mr. R. Karthikeyan	

Course Coordinator
Mr.R.Karthikeyan

HOD/MECH