GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Diploma Engineering				Branch	Mechanical Engineering		
Semester	IV				Version	1.0.0.0		
Effective from Academic Year		2019-20			Effective for the batch Admitted in			June 2018
Subject code	1ME2403	Subject Name			THEORY OF MACHINES AND MECHANISMS			
Teaching scheme					Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	2	0	5	Theory	40	60	100
Hours	3	0	4	0	7	Practical	60	40	100

Pre-requisites:
Basic concepts of Engineering Mechanics and Strength of Material.

Course Learning Outcomes:

The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies and course learning outcomes:

CO1. To make the student conversant with commonly used mechanism for industrial application and Identify mechanisms in real life applications.

CO2. To develop competency in drawing velocity and acceleration diagram for simple mechanism and Perform kinematic analysis of simple mechanisms.

CO3. Be proficient in the use of mathematical methods to analyse the forces and motion of simple systems of linkages, gears and cams.

CO4. To develop analytical competency in solving problems related with friction in bearing, clutch, brakes etc. and power transmission.

CO5. Calculate balancing mass and its position and identify different types of vibration, their causes and remedies.

Course Content				
Name of Unit	Unit Content	Unit Learning Outcomes	Marks	Hrs
UNIT – 1 **Introduction**	1.1 Theory of machines: introduction, need, scope and importance in design and analysis. 1.2 Kinematics, kinetics and dynamics- concept and examples. 1.3 Basic terminology related to machines and mechanisms. 1.4 Development of different mechanisms and its inversions like four bar chain mechanism , slider crank mechanism, double slider crank mechanism, etc.	1a. Define link, pairs, mechanisms, inversion, structure and machines. 1b. Explain various terminology associated with theory of machine 1c. Draw inversions of different mechanisms	8	6
UNIT – 2 **Velocity and acceleration diagram**	2.1 Basic concept used in solving velocity and acceleration problems. 2.2 Approach to solve velocity and acceleration related to mechanisms using Relative velocity method for single slider crank mechanism and Four bar chain mechanism. 2.3 Klein's construction for single slider cranks mechanism.	2a.Draw velocity and acceleration diagram for a given mechanism. 2b.Calculate velocity and acceleration from a given mechanism.	8	6
UNIT – 3 **Cam and cam profile**	3.1 Introduction, functions and types of cams and cam followers. 3.2 Types of motions and displacement for different types of cam and cam followers. 3.3 Construct different types of cam profiles.	3a. Explain different types of cams and cam followers and their motions.	10	7

		3b.Construct different types of cam profile from given data.		
UNIT – 4 **Friction**	4.1 Concept and laws of friction. 4.2 Appreciate the role of friction in thrust bearing, pivot bearing and collars considering - Uniform pressure and Uniform wear condition. 4.3 Clutch: i. Functions. ii. Types with sketches and working.	4a.Explain laws of friction 4b. Calculate Power loss due to friction in bearings. 4c.Describe the working of different types of clutches,	10	8

		brakes and dynamometers.		
	4.4 Brakes: i. Functions. ii. Types with sketches and working. 4.5 Dynamometers- types and operational working principles.			
UNIT – 5 **Power transmission**	5.1 Introduction, need and modes of power transmission. 5.2 Types of power transmission. 5.3 Belt drive- types, terminology and standards/designation methods as per BIS/ISO. 5.4 Belt speed-co-efficient of friction, velocity ratios and slip.	5a.Explain the need and modes of power transmission. 5b.Solve problems on flat belt drive.	8	6

	5.5 Power transmitted by flat belt - tensions, centrifugal tensions, maximum tension, condition for transmitting maximum power and initial tension.(with derivations), numerical examples.			
	5.6 Merits and demerits of power transmission drives.			
	5.7 Gear trains-types, numerical examples and applications.			

		5c.Solve simple problems on gear trains.		
UNIT – 6 **Flywheel and governor**	6.1 Turning moment diagram: i. Concept. ii. Its use for different machines. iii. Fluctuations of energy.	6a.Construct Turning moment diagram.	8	6

	6.2 Co-efficient of fluctuation of speed and energy.			
	6.3 Method to construct turning moment diagram, numerical examples.			
	6.4 Flywheel: functions and types.			
	6.5 Moment of inertia and mass calculation of flywheel-numerical examples.			
	6.6 Governors: terminology, types & functions.	6b.Differentiate between flywheel and governor.		
		6c.Calculate mass of flywheel.		

UNIT – 7 **Balancing and vibrations**	7.1 Concepts and types of balancing. 7.2 Effects of unbalanced masses. 7.3 Balancing of revolving masses in same plane: i. Analytical and graphical methods to find balancing mass. ii. Numeric examples. 7.4 Balancing of reciprocating masses. (No numerical examples). 7.5 Vibration:	7a.Calculate balancing mass and its position for masses revolving in same plane. 7b.Identify different types	8	6

	i. Terminology. ii. Effects. iii. Causes. iv. Remedies.	of vibration, its causes and remedies.		

List of Practical		
The practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate course learning outcomes.		
No.	Unit	Name of Practical
1	ALL	**Preparatory Activity:** Interpret and write various course related SI units and their conversions. Recall and write scalar and vector quantities, area, volume, moment of inertia and section modulus for common shapes.
2	Unit 2	Prepare one sheet on velocity and acceleration diagram for given mechanisms by relative velocity method. This should include minimum two problems of four bar mechanism & two problems of single slider mechanism.
3	Unit 2	Prepare one sheet on velocity and acceleration diagram for single slider mechanisms by Klein's

		construction method.
4	Unit 3	Prepare one sheet on construction of cam profile for given data (without offset). This should include one problem of knife edge follower and another of roller follower.
5	Unit 7	Prepare one sheet on balancing using graphical and analytical method for a given data. Include minimum two problems.
6	Unit 4 Unit 5 Unit 6	**Tutorials:**
		A. Calculate power loss due to friction in bearings from given experimental data.
		B. Solve two problems of power transmission systems (one of belt drive and another of gear train) from given experimental data.
		C. Calculate and prepare turning moment diagram from given experimental data.
		D. Calculate mass of flywheel from given experimental data

7	Unit 4	**Demonstration of Clutch:** Identify different parts of a single plate disc clutch through disassembly, observe wear and tear due to friction and prepare report based on inspection criteria.
8	Unit 5	**Demonstration Of Power Transmission Systems:** Identify various power transmission systems by observing different machines and equipments used in mechanical engineering laboratory/workshop. For example- IC Engine test rig, Compressors, Machine tools, Elevators, etc. Sketch at least four mechanisms with labeling on each. Demonstrate working of each.

List of Instruments / Equipment / Trainer Board

1	Working Models / wooden/thermocol theoretical models of: a. Kinematic links and pairs. b. Single slider crank. c. Four bar chain.
2	Types of cams, followers and cam/follower arrangements.
3	Friction bearing- all types , Dynamometers - all types, Friction clutches - all types, Friction brakes - all types , Rope/belt – All types of flat and V. Gear trains - all types.(Simple, compound, reverted, epicyclical).
4	Balancing machines -Revolving masses, Reciprocating masses
5	Vibration -spring and mass model.
6	Governors - all types. Any machine having flywheel.

List of Reference Books			
No	Title of Reference Books	Authors	Publication
1	Theory of Machines	R.S.Khurmi	S.Chand, New Delhi.
2	Theory of Machines	Jagdishla	Metropolitan Book New Delhi.
3	Theory of Machines	S.S.Ratan	Tata McGraw Hill, New Delhi.
4	Theory of Machines	P.L.Bellaney	Khanna publication, New Delhi.

Link of Learning Web Resource	
1	http://nptel.iitm.ac.in/video.php?subjectId=112104121.
2	http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Kinematics%20of%20Machine/index.htm
3	http://kmoddl.library.cornell.edu/model.php?m=20
4	www.journals.elsevier.com/mechanism-and-machine-theory/
5	www.tecquipment.com/Theory_of_Machines.aspx
6	http://elearning.vtu.ac.in/12/enotes/Des_Mac-Ele2/Unit6-RK.pdf

CO'S AND PO'S MAPPING

PO'S/CO'S		CO1	CO2	CO3	CO4	CO5
PO1	Proficiently applies concepts, theories and techniques of the relevant natural, physical sciences and knowledge in mathematics.	**SUB**	**SUB**	**SUB**	**SUB**	**SUB**
PO2	Use basic principles of statics, dynamics, fluid mechanics, engineering materials, strength of materials engineering standards and manufacturing processes to aid in the design, characterization, analysis and troubleshooting of mechanical system.	**SUB**	**SUB**	**SUB**	**SUB**	**SUB**
PO3	Apply their engineering knowledge, critical thinking and problem solving skills in professional engineering practice or in nonengineering fields, such as law, medicine or business.	**SUB**	**SUB**	**SUB**	**SUB**	**SUB**
PO4	Continue their intellectual development, through, for example, graduate education or professional development courses	**SLI**	**SLI**	**SLI**	**SLI**	**SLI**
PO5	Use of appropriate computer languages, modern tool and application software that pertain to Mechanical engineering technology systems.	**MED.**	**MED.**	**MED.**	**MED.**	**MED.**
PO6	Ability to identify problems, conducts experiments, gather data, analyze data and produce results.	**MED.**	**MED.**	**MED.**	**MED.**	**MED.**
PO7	Retain the intellectual curiosity that motivates lifelong learning and allows for a flexible response to the rapidly evolving challenges of the 21st century	**NONE**	**NONE**	**NONE**	**NONE**	**NONE**
PO8	Design a system component or process to meet desired need within realistic constraints, such as economic, environmental and social.	**MED.**	**MED.**	**MED.**	**MED.**	**MED.**
PO9	Values the need for, and demonstrates, ethical conduct and professional accountability.	**NONE**	**NONE**	**NONE**	**NONE**	**NONE**
PO10	Demonstrates effective communication to professional and wider audiences.	**SLI**	**SLI**	**SLI**	**SLI**	**SLI**
PO11	Appreciates entrepreneurial approaches to engineering practice.	**NONE**	**NONE**	**NONE**	**NONE**	**NONE**
PO12	Apply commitment to quality, timeliness, and continuous improvement.	**SLI**	**SLI**	**SLI**	**SLI**	**SLI**