

GANPAT UNIVERSITY				
FACULTY OF DIPLOMA ENGINEERING				
Programme	Diploma in Mechanical/Mechatronics/Agriculture Engineering			
Semester	IV	Version	1.0.0.0	
Effective from Academic Year	2026-27	Effective for the batch Admitted in	JULY 2025	
Course code	1ME4103	Course Name	Theory of Machine and Mechanisms	

I. TEACHING-LEARNING AND ASSESSMENT SCHEME																			
Course Type	Course code	Course Title	Teaching & Learning Scheme								Examination Scheme								
			Credit				Actual Contact Hrs/week			SLH	Total Learning Hrs/Week	TH			PR			SLA	Total
			CL	TL	LL	Total	CL	TL	LL			CE	SEE	Total	CE	SEE	Total		
DSC	1ME4103	Theory of Machine and Mechanisms	3	0	1	4	3	0	2	3	8	40	60	100	30	20	50	20	170

Abbreviation:	CL- Classroom Learning	TL - Tutorial Learning	LL - Laboratory Learning
	SLH - Self Learning Hours	SLA - Self Learning Assessment	CE – Continuous Evaluation
	SEE – Semester End Examination		

II. PRE-REQUISITES
Basic concepts of Engineering Mechanics and Strength of Material.
III. INDUSTRY / EMPLOYER EXPECTED OUTCOMES
Theory of Machines and Mechanisms equips diploma engineering students with essential knowledge of mechanical motion and force transmission. It builds foundational skills for analysing and designing machine elements like gears, cams, and linkages, enabling students to work effectively in maintenance, manufacturing, and mechanical design roles across various industries.
IV. COURSE LEARNING OUTCOMES
At the end of the course, students will be able to achieve the following course learning outcomes: CO1. Understand Kinematics and Dynamics of different machines and mechanisms. CO2. To develop competency in drawing velocity and acceleration diagram for simple mechanism. CO3. Understand different types of Cams and their motions along with the drawing ability of Cam profiles. CO4. Justify the role of Flywheel, Governor, Brakes, Bearings and Clutches along with selection of suitable drives in Mechanical applications. CO5. Appreciate concept of balancing and vibrations.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:				
Name of Unit	Theory Learning outcomes (TLO's) aligned to CO's	Learning Content mapped with Theory Learning outcomes (TLO's) & CO's	Marks	Hours
Unit-1 Motions and Mechanisms	TLO 1.1 Define various terms related to mechanisms.	1.1 Theory of machines: Introduction, need, scope and importance in design and analysis, basic terminology that has already been studied in Engineering Mechanics.	12	08

	TLO 1.2 Explain different Inversions of Mechanism. TLO 1.3 Explain the construction and working of various mechanisms. TLO 1.4 Understand various terms and methods related to velocity and acceleration diagrams.	1.2 Kinematics of Machines: Definition of Kinematics, Dynamics, Statics, Kinetics, Kinematic link, Kinematic pair, and its types, degree of freedom, constrained motion and its types, Kinematic chain and its types, Mechanism, inversion, machine, and structure. 1.3 Inversions of four-bar chain, Single Slider Crank chain and Double Slider Crank Chain. 1.4 Concept of velocity and acceleration of a point on link by relative velocity method in four-bar chain and single slider crank mechanism with numerical.		
Unit-2 Cams and Followers	TLO 2.1 Define the terms related to Cam and followers. TLO 2.2 Classify Cams and Followers. TLO 2.3 Draw cam profile as per the given problems.	2.1 Concept, definition and application of Cams and Followers. 2.2 Classification of Cams and Followers. 2.3 Different follower motions and their displacement diagrams like Uniform velocity, Simple harmonic motion (SHM), Uniform acceleration and retardation. 2.4 Drawing of a profile of radial cam with a knife-edge, roller & flat faced follower with and without offset with reciprocating motion (Graphical method).	08	08
Unit-3 Bearings, Clutches, Brake and Dynamometer	TLO 3.1 Differentiate between uniform pressure and uniform wear theories. TLO 3.2 Explain construction and working of various thrust bearing. TLO 3.3 Explain construction and working of various clutches. TLO 3.4 Calculate torque and power lost in friction in bearing & clutch.	3.1 Concept, definition, basic terminology of friction, types and application of friction, simple numerical based on friction. 3.2 Uniform pressure and Uniform wear theories. 3.3 Types of thrust bearing, Torque and Power lost in Flat pivot, conical pivot, single collar, multi-collar bearing and it's numerical. 3.4 Function of Clutch and its application, Construction and working of Single plate clutch, multi-plate clutch, Centrifugal Clutch, Cone clutch, Diaphragm clutch. (Simple numerical on single and multi-plate clutch)	13	10

	TLO 3.5 Differentiate between brakes and dynamometers. TLO 3.6 Construction and working of various brakes and dynamometers.	3.5 Function of brake and its application, Construction and working of i) block brake ii) band brake iii) Band & block brake iv) internal expanding shoe brake v) disc brake. 3.6 Dynamometer- Function, Construction and working of Rope brake and Prony brake dynamometer.		
Unit-4 Power transmission	TLO 4.1 Explain the need and modes of power transmission. TLO 4.2 Calculate velocity ratio, belt tensions, slip, angle of lap, and power transmitted in belt drives. TLO 4.3 Calculate the train ratio for the given gear drives. TLO 4.4 Select suitable drives for the given application with justification.	4.1 Concept, need, and types of power transmission. 4.2 Types of Drives-Belt, Chain, Rope, Gear and their comparison with applications, advantages & limitations. 4.3 Flat belt, V-belt & its applications, material, angle of lap, belt length. Slip and Creep. Determination of velocity ratio, the ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission (Numerical on belt drives) 4.4 Rope Drives- types; application; Advantages & limitations of steel ropes 4.5 Chain Drives- Advantages & disadvantages; Selection of chain & sprocket wheels 4.6 Gear Drives- Classification of Gears - Nomenclature of a gear - explanation and applications of spur, helical and bevel gears, worm and worm wheel, rack and pinion; types of gear trains; their selection for different applications. 4.7 Train value & Speed ratio for Simple, Compound, and Riveted gear trains using spur gears (Numerical of gear drive for finding Speed ratio or Train ratio excluding epicyclic gear train).	12	08
Unit-5 Flywheel and Governors	TLO 5.1 Construct a Turning moment diagram.	5.1 Flywheel- Concept, function and application of flywheel with the help of turning moment diagram for Single cylinder double acting steam engine, Single cylinder 4 - Stroke I.C. Engine, Co-efficient of fluctuation of energy, Co-efficient of fluctuation of speed,	08	06

	TLO 5.2 Calculate the energy fluctuation and variation in speed of the Flywheel. TLO 5.3 Demonstrate the working of different types of Governors. Differentiate the working of Flywheel and Governor.	Energy stored in a Flywheel and its significance. Simple numerical. 5.2 Governor- Concept, function and application & terminology of Governors. Types, Explanation of Watt, Porter, Proell. 5.3 Comparison between Flywheel and Governor.		
Unit-6 Balancing and Vibrations	TLO 6.1 Calculate balancing mass and its position for masses revolving in the same plane. TLO 6.2 Identify different types of vibration, its causes and remedies.	6.1 Concepts and types of balancing. 6.2 Effects of unbalanced masses. 6.3 Balancing of single rotating mass. Analytical and graphical method for balancing of several masses revolving in the same plane. 6.4 Concept, types and terminology used in vibration, causes of vibrations in machines, their harmful effects and remedies.	07	05

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL			
Sr. No.	Practical/Laboratory Learning Outcome (LLO)	Practical Titles	Relevant COs
1	LLO 1.1 Interpret and write course related quantities, SI units and their conversions. Recall and write scalar and vector quantities. Demonstrate various mechanisms.	To study about kinematic fundamentals and inversions of various mechanisms.	CO1
2	LLO 2.1 Prepare various sheets on velocity and acceleration diagram for different mechanisms by relative velocity method and Klein's construction method.	Draw velocity & acceleration diagram and find the angular velocity and acceleration by different method for four bar chain and single slider crank chain mechanism.	CO2
3	LLO 3.1 Demonstrate working of any type of cam and followers. Prepare one sheet on construction of cam profile for given data (without offset). This should include knife-edge follower and roller follower. Prepare one sheet on the construction of cam profile for given data (with offset). This should include knife-edge and flat face follower.	To study about cam and follower and generate cam profile for various types of followers.	CO3
4	LLO 4.1 To demonstrate the working of plate/cone/centrifugal /diaphragm clutch.	Demonstration of Clutches	CO4
5	LLO 5.1 To demonstrate the working block/band/block & band/ Disc	Demonstration of Brakes	CO4
6	LLO 6.1 To demonstrate the working of Rope Brake/Hydraulic/Eddy current dynamometer.	Demonstration of Dynamometers.	CO4

7	LLO 7.1 Identify various power transmission systems by observing different machines and equipment used in the Mechanical engineering laboratory/workshop. Examples- IC Engine test rigs, Compressors, Machine tools, Elevators, etc. Sketch at least four mechanisms with labelling on each. Demonstrate the working of each.	Demonstration of Power Transmission Systems	CO4
8	LLO 8.1 To demonstrate the working Watt/Porter/Proell governor.	Demonstration of Governors	CO4
9	LLO 9.1 Prepare one sheet on balancing using graphical and analytical methods for a given data. This should include a minimum of two problems.	To study about balancing of rotating masses and fundamentals of machine vibrations.	CO5
10	LLO 10.1 Calculate at least one problem of power loss due to friction in bearings and clutches from given problems/experimental data. LLO 10.2 Solve at least two problems of power transmission systems by a belt drive and gear drive from given problems/ experimental data. LLO 10.3 Calculate and prepare at least one turning moment diagram from given problems/experimental data. LLO 10.4 Calculate the mass of the flywheel from given problems/ experimental data.	Tutorials on Bearings, Clutches, Brakes, Dynamometers. Belt drive, Gear train and Flywheels.	CO4, CO5

VII. SUGGESTED MICRO PROJECT / ASSIGNMENTS / ACTIVITIES FOR SELF LEARNING / SKILL DEVELOPMENT (SELF LEARNING)
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- Select any machine tool's mechanism available in the institute's workshop and perform the following activity: (a) Measuring dimensions of different links of a given shaper machine/any machine (b) Sketching (c) Labelling the sketch
- List the mechanisms which you are using in your day-to-day life. Sketch any three from these and explain in brief.
- Identify the type of clutches used in different automobiles and explain how it works.
- Identify the type of brakes used in different automobiles and bicycles. Explain how it works.
- Write the names of the five mechanical power transmissions you have seen in your daily life.
- Choose any vehicle and tell what kind of brakes it has and give a brief description of how it works.

Mini projects

- Compile information from the internet related to various mechanisms/elements like piston, crank, connecting rod, cam, clutch, brake, flywheel, governor, animation of mechanism, etc. along with functions of each.
- Prepare any simple model of a subject-related mechanism.

VIII. LIST OF INSTRUMENTS / EQUIPMENT / TRAINER BOARD	
1	Cam Analysis Apparatus.
2	Journal Bearing Apparatus.
3	Set up to show different modes of transmissions
4	Universal Governor apparatus
5	Rope Brake and Dynamometer.
6	Epicyclic Gear Train Apparatus.
7	Working / Wooden / Thermocol Models & Mechanisms of: 1. Kinematic links and pairs. 2. Single slider-crank. 3. Four bar chain. 4. Types of cams, followers, and cam/follower arrangements. 5. Friction bearing- all types. 6. Dynamometers - all types. 7. Friction clutches - all types. 8. Friction brakes - all types. 9. Rope/belt – All types of flat and V- belts. 10. Gear trains - all types. (Simple, compound, reverted, epicyclic). 11. Balancing machines -Revolving masses. 12. Steam engine, Internal combustion engine.

IX. LIST OF REFERENCE BOOKS			
Sr.No.	Title	Author	Publication
1	Theory of Machines	R. S. Khurmi & J. K. Gupta	Schad Publication, New Delhi.
2	Theory of Machines	P. L. Bellaney	Khanna Publications, New Delhi
3	Theory of Machines	S.S.Ratan	TataMcGrawHill, New Delhi.
4	Theory of Machines	Abdulla Shariff	Dhanpat Rai & Sons Publication, New Delhi.

X. LINK OF LEARNING WEB RESOURCE

1	https://nptel.ac.in/courses/112106270
2	https://nptel.ac.in/courses/112104121
3	http://kmoddl.library.cornell.edu/model.php?m=20
4	www.journals.elsevier.com/mechanism-and-machine-theory/
5	www.tequipment.com/TheoryofMachines.aspx
6	http://elearning.vtu.ac.in/12/enotes/Des_Mac-Ele2/Unit6-RK.pdf

XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	Motions and Mechanisms	CO1, CO2	8	5	5	2	12
2	Cams and Followers	CO3	8	2	2	4	8
3	Bearings, Clutches, Brake and Dynamometer	CO4	10	2	5	6	13
4	Powertransmission	CO4	8	2	4	6	12
5	Flywheel and Governors	CO4	6	2	2	4	8
6	Balancing and Vibrations	CO5	5	2	2	3	7
Grand Total			45	15	20	25	60

XII. COs AND POs AND PSOs MAPPING

Course Outcome (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	1	0	0	0	1	2	3	2	1
CO2	3	3	2	1	0	1	2	3	3	2
CO3	3	3	0	0	0	1	3	3	2	1
CO4	3	3	0	2	0	1	3	3	2	2
CO5	3	3	2	2	0	1	3	3	3	3
Legends:	-3- High	2-Moderate/Medium	1-Slight/Low	0-None						