	National Institute of Technology Meghalaya An Institute of National Importance	CURRICULUM

Programme **Bac elor of Technology in Mechanical Engineering**		Year of Regulation **2018**	
Department **Mechanical Engineering**		Semester **IV**	

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
ME 202	**Kinematics and Dynamics of Machines**	**3**	**1**	**0**	**4**	**50**	**50**	**100**	**200**

Course Objectives	To introduce different approaches and mathematical models used in kinematic and dynamic analysis of machineries.	Course Outcomes	CO1	Demonstrate the knowledge of kinematic chain and perform the kinematic analysis of a given mechanism
			CO2	Analysis of the lower pair joints.
			CO3	Design and analysis cam, gear and gear trains.
			CO4	Static analysis of linkage
			CO5	Analyze common dynamical problems in a machinery

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	**3**	**2**	2	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**0**
2	CO2	**3**	**3**	2	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**0**
3	CO3	**3**	**3**	3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**0**
4	CO4	**3**	**3**	3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**0**
5	CO5	**3**	**3**	3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**0**
6	CO6	**0**	**0**	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

SYLLABUS

No.	Content	Hours	COs
I	**Analysis of Kinematic Chain:** Links-types, Kinematics pairs-classification, Constraints-types, Degrees of freedom of planar mechanism, Grubler's equation, Linkage mechanisms, Inversions of four bar chain, Slider crank chain and double slider crank chain, Displacement analysis, Transmission angle.	**05**	**CO1**
II	**Velocity Analysis:** Velocity of point in mechanism, Relative velocity method, Velocities in four bar mechanism, Slider crank mechanism and quick return motion mechanism, Rubbing velocity at a pin joint, Instantaneous center method, Types & location of instantaneous centers, Kennedy's theorem, Velocities in four bar mechanism & slider crank mechanism. **Acceleration Analysis:** Acceleration of a point on a link, Acceleration diagram, Coriolis component of acceleration, Crank and slotted lever mechanism, Klein's construction for slider crank mechanism and four bar mechanism, Analytical method for slider crank mechanism.	**11**	**CO1**
III	**Mechanisms with Lower Pairs:** Pantograph, Exact straight line motion mechanisms-Peaucellier's, Hart and Scott Russell mechanisms, Approximate straight line motion mechanisms–Grass-Hopper, Watt and Tchebicheff mechanisms, Analysis of Hooke's joint, Davis and Ackermann steering gear mechanisms.	**03**	**CO2**
IV	**Cams:** Cams and followers – classification & terminology, Cam profile by graphical methods with knife edge and radial roller follower for uniform velocity, Simple harmonic and parabolic motion of followers, Analytical methods of cam design – tangent cam with roller follower and circular cams with flat faced follower.	**05**	**CO3**
V	**Gears and Gear Trains:** Classification & terminology, law of gearing, Tooth forms & comparisons, Systems of gear teeth, Length of path of contact, Contact ratio, Interference & under cutting in involute gear teeth, Minimum number of teeth on gear and pinion to avoid interference Simple, Compound, Reverted and Planetary gear trains, Sun and planet gear.	**05**	**CO3**
VI	**Static and Dynamic Analysis of Linkages:** Static analysis of four bar linkages, Dynamic analysis of slider crank mechanism, Dynamically equivalent systems, Turning moment diagram, Analysis of flywheel.	**03**	**CO4**
VII	**Balancing:** Balancing of reciprocating and rotary machines, Single and multi cylinder engine balancing, V and radial engine balancing, Balancing machines, Field balancing.	**06**	**CO5**
VIII	**Gyroscope:** Euler's equation, Spin and precession, Gyroscopic effect in airplane, Ship and automobile.	**05**	**CO5**
IX	**Governors:** Classifications, Analysis of Watt, Porter, Proell, Hartnell and Wilson-Hartnell governors, Inertia governor, Sensitivity, Controlling force, Stability, Power and effort.	**05**	**CO5**
	Total Hours	**48**	

Essential Readings

1. S. S. Rattan, "Theory of Machines", McGraw Hill, Second Edition, 2014.
2. J. J. Uicker, G. R. Pennock, J. E. Shigley, "Theory of Machines and Mechanisms", Oxford Education, Fourth Edition, 2011.

Supplementary Readings

1. A. Ghosh and A. K. Mallick, "Theory of Mechanisms and Machines", Ease-West Press, Third Edition, 1998.
2. T. Bevan, "Theory of Machines", Pearson Publication, Third Edition, 1996.
3. J. L. Meriam, L. G. Kraige, "Engineering Mechanics – Dynamics", Wiley, Seventh Edition, 2013.