B.E Semester: 5 Automobile Engineering
Subject Name: Theory of Machines (MA501-N)

A. Course Objective

- To develop a solution oriented approach by in depth knowledge of Theory of Machines.
- To address the underlying concepts, methods and application of different machines.
- To understand the working principals of any machine.
- To understand the motion, transmission of the motion and the forces responsible for the motion.

B. Teaching / Examination Scheme:

Teaching Scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
4	0	2	6	5	3	70	30	20	30	150

C. Detailed Syllabus:

Unit No.	Details
1	**Gyroscope** Principle of gyroscope, Definition of axes, active and reactive couples; Roll, Yaw and Pitch motions; Gyroscopic effect in a rotor, two wheelers, Four wheelers, ship and aeroplane.
2	**Friction Devices** Clutches, Brakes and Dynamometers - Classification of clutches, torque transmission capacity, considerations for uniform wear and uniform pressure theory, single plate and multi-plate clutch, centrifugal clutch, Energy equation and thermal considerations. Classification of brakes, Braking effect, Analysis of Brakes: Block Brake, Band Brake, Band and Block Brake, Internal expansion shoe brake; Braking analysis of four wheelers. Classification of Dynamometers, Analysis of Dynamometers: Prony brake, Rope brake, Hydraulic, Belt Transmission, Epicyclic-Train and Bevis-Gibson torsion.
3	**Flywheels** Significance of flywheel, Turning moment and crank effort diagrams for reciprocating machines, coefficient of fluctuation of speed and energy, Limiting velocity of flywheel, Design of flywheels for engines and punching machines.
4	**Governors** Necessity of governor, Classification of Governors, Working principle of centrifugal governors, Concept of control force, Control force diagram, Stability of governor, Condition for stability, Concept of isochronism, Sensitivity of governor, Characteristics of governors, Hunting of governors.

5	**Introduction to Dynamics** Newton's Laws of Motion, Applied and constraint forces, Free-body diagrams, conditions for equilibrium, Two and Three forces members, Four force members, Friction forces, Static force analysis with friction. Centroid and Centre of Mass, Mass Moments and products of inertia, Inertia forces and D'alembert's Principle. Planar rotation about fixed centre, Shaking forces and moments, Complex algebra approach, Equation of motion. Application of concepts to dynamic analysis of slider-crank mechanism and 4-bar mechanism. Spatial: Measuring mass moment of Inertia, Transformation of Inertia axes Euler's equation of motion, Impulse and momentum, Angular impulse and momentum.

Total hours (Theory):64
Total hours (Practical):32
Total hours:96

D. Lesson Planning:

Sr. No.	Date/Week	Unit	Weight age	Topic No
1	1^{st} ,2^{nd} ,3^{rd}	Unit 1	20%	1
2	4^{th} .5^{th} ,6^{th}	Unit 2	20%	2
3	7^{th} , 8^{th} ,9^{th}	Unit 3	20%	3
4	10^{th} .11^{th}. 12^{th}	Unit 4	20%	4
5	13^{th} , 14^{th} ,$15^{th,}$,16^{th}	Unit 5	20%	5

E. Instructional Method & Pedagogy

1	At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
2	Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal Weight age should be given to all topics while teaching and conduction of all examinations.
3	Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4	One/Two internal exams may be conducted and total/average/best of the same may be converted toequivalent of 30 marks as a part of internal theory evaluation.
5	Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6	Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overallinternal evaluation.
7	The course includes a laboratory, where students have an opportunity to build an appreciation for theconcept being taught in lectures. Suggested list of experiment is given below.

F. List of Practical:

1	To demonstrate different types of Brakes to calculate braking effort.
2	To perform evaluation of brake type dynamometer.
3	To demonstrate & perform Gravity control governors evaluation.
4	To demonstrate & perform spring control governors evaluation.
5	To demonstrate & perform gyroscope evaluation.

6	To demonstrate flywheel and its effect on dynamic of system.
7	Analyse Influence of Inertia Upon Velocity & Acceleration.
8	To perform synthesis of mechanism by analytical method.
9	To perform synthesis of mechanism by graphical method.

G. Students Learning Outcomes:

1	The student can identify different areas of Theory of Machines.
2	Can find the applications of all the areas in day to day life.

H. Text Books & Reference Books:

1	Theory of Machines by S.S. Rattan., Tata McGraw Hill.
2	Dynamics of Machinery by FarazdakHaideri, Nirali Publication.
3	Theory of Machines by Dr. Sadhu Singh Pearson Education.
4	Theory of Machines and Mechanisms by J.Uicker, Gordon R Penstock & J.E. Shigley Oxford International Edition.
5	Kinematics, Dynamics and Design of Machinery by Kenneth J Waldron, Gary L Kinzel Wiley Edition.
6	Theory or Mechanisms and Machines by Amitabh Ghosh and A. Kumar Mallik.
7	Theory of Machines – P. L. Ballaney
8	Kinematics By V.M. Fairs (McGraw Hill)
9	Mechanism Design: Analysis and Synthesis Vol. I by A. Erdman and G.N. Sander (Prentice Hall)
10	Kinematics and Dynamics of Planer Mechanisms by Jeremy Hirsihham (McGraw Hill).