DYNAMICS OF MACHINERY

V Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEC18	Core	3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

Prerequisite: Basic principles of Engineering Mechanics

I. COURSE OVERVIEW:

This course focuses on mechanical devices that are designed to have mobility to perform certain functions. In this process they are subjected to some forces. The study of Dynamics of machinery leads us to design machines by understanding the relationship between the movement of various parts of machine and the different forces that are acting on them. This course will provide the knowledge on how to analyze the motions of mechanisms and design mechanisms to give required strength. This includes relative static and dynamic force analysis and consideration of gyroscopic effects on aero planes, ships, automobiles like two wheelers and four wheelers.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The concepts of precision, static and dynamic forces of planer mechanisms by neglecting friction of aero planes, sea vessels, auto mobiles and various force members.
II. The knowledge of engineering mechanics for identifying the coefficient of friction and engine speed of the various contact bodies (Clutches and Brakes) and speed-controlled devices, variations of torques and fluctuation of speeds of IC engines.
III. The magnitude and direction of balanced mass for unbalanced rotary and reciprocating engines with the fundamentals of applied physics.
IV. Mathematical modeling of various degree of freedom systems to interpret the various vibration parameters.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Discuss** the Gyroscopes, effect of precession motion on the stability ofmoving vehicles such as motor car, motor cycle, aero-planes and ships.	Understand
CO 2	**Determine** the angle of heel to avoid upside down of a two wheeler vehicle while taking in left and right turns.	Evaluate
CO 3	**Illustrate** the static and dynamic force analysis of two and three force members by graphical super position method.	Understand
CO 4	**Apply** the laws of friction on clutches, brakes and dynamometers toreduce the power losses for the effective torque transmission.	Apply
CO 5	**Justify** the importance of torque and fluctuation of speeds for single and multi cylindered engines and governors to increase the mechanicalefficiency.	Evaluate
CO 6	**Determine** the balanced mass and natural frequency for unbalanced rotary and reciprocating engines by analytical and graphical methodsand equations of motion	Evaluate

IV. COURSE SYLLABUS:

MODULE-I: PRECESION, STATIC AND DYNAMIC FORCE ANALYSIS (12)

Precession: Gyroscopes, effect of processional motion on the stability of moving vehicles such as motor car, motor cycle, aero-planes and ships, static and dynamic force analysis of planar mechanisms: Two and three force members, inertia forces and D'Alembert's principle, planar rotation about a fixed centre.

MODULE –II: CLUTCHES AND BRAKES (12)

Clutches: Friction clutches, Single disc or plate clutch, multiple disc clutches, cone clutch and centrifugal clutch; Brakes : Simple block brakes, internal expanding brake, band brake of vehicle.

MODULE –III: TURNING MOMENT AND GOVERNORS (12)

Turning moment diagrams and flywheels: turning moment: Inertia torque, angular velocity and acceleration of connecting rod, crank effort and torque diagrams, fluctuation of energy.

Design of flywheels. Governors: Dead weight type and spring loaded governors, sensitiveness, iso-chronism and hunting.

MODULE –IV: BALANCING (12)

Balancing: Balancing of rotating masses, single and multiple-single and different planes-balancing of reciprocating masses, primary and secondary balancing-analytical and graphical methods; unbalanced forces and couples, Locomotive balancing.

MODULE –V: MECHANICAL VIBRATIONS (12)

Vibrations: Free vibration, Damped Vibration, Forced vibration; Vibration isolation and transmissibility, whirling of shafts, critical speeds, Torsional vibrations, two and three rotor systems.

V.TEXT BOOKS:

1. Thomas Bevan, "Theory of Machines", Pearson Education, 3rd Edition, 2009.
2. S.S Ratan, "Theory of Machines", Tata McGraw-Hill, 4th Edition, 2014.
3. R. L. Norton, "Kinematics and Dynamics of Machinery", McGraw-Hill, 1st Edition, 2009.
4. P.L. Balleny, "Theory of Machines and Mechanisms", Khanna publishers, 49th Edition, 2013.

VI. REFERENCE BOOKS:

1. J. S. Rao, R.V. Dukkipati, "Mechanism and Machine Theory", New Age Publication, 1st Edition, 2013.
2. Uiker, Penock, Shigley, "Theory of Machines and Mechanisms", Oxford University Press, 4th Edition, 2013.
3. R.S. Khurmi, Gupta, "Theory of Machines", S.Chand & Co, New Delhi, 14th Edition, 2013.

VII. WEB REFERENCES:

1. http://www.uobabylon.edu.iq/uobcolleges/ad_downloads/4_1293_515.pdf
2. http://ebooks.library.cornell.edu/k/kmoddl/toc_hartenberg1.html