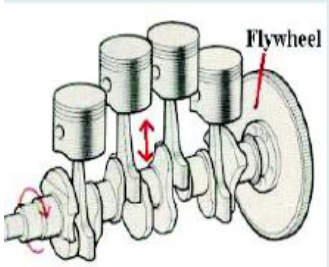

16ME303 DYNAMICS OF MACHINERY

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P
45	-	30

WA/RA	SSH/HSH	CS	SA	S	BS
20	40	5	5	5	3

Course Description and Objective:

This course is designed to strengthen the fundamental concepts on dynamic forces acting on various machine components. The objective of this course is to analyze dynamic forces and its effects on different machine components such as cam, flywheel, clutches, etc.

Course Outcomes:

The student will be able to:

- analyze the dynamic forces acting on the engine components
- understand energy transformation in flywheels, brakes and clutches
- calculate the gyroscopic effect in automobiles, ships and aeroplanes
- balance machine components running at high speed.
- compute natural frequencies of machine components.

SKILLS:

- ✓ *Calcualate inertial forces on a moving machine components.*
- ✓ *Design flywheels for various types of engines and machines.*
- ✓ *Compute the gyroscopic effect on two wheelers and four wheelers.*
- ✓ *Predict the amount of mass required for balancing of rotating and reciprocating machine components.*
- ✓ *Identify resonant frequency of 1D and 2D freedom systems.*

UNIT - 1 **L- 9**

DYNAMIC FORCE ANALYSIS: Introduction; analytical methods to find displacement, velocity and acceleration of the piston; forces acting on connecting rod and crank.
FLYWHEEL: Turning moment diagram; determination of work done and power from turning moment diagram; fluctuation of energy.

UNIT - 2 **L- 9**

BRAKES: Introduction; block , band and differential band brakes; self-locking and self-energizing brakes; braking force analysis of a four wheeler.
GYROSCOPE: Precision motion and its effect on stability of ships, Airplanes and four wheelers.

UNIT - 3 **L- 9**

GOVERNORS: Introduction; classification; Watt, Porter and Proell governors; spring loaded governors- Hartnell and Hartung governors; terms associated with governor performance - sensitiveness; isochronism and hunting.
CLUTCHES: Introduction; Uniform pressure and uniform wear; single and multi plate clutches; cone clutch.

UNIT - 4 **L- 9**

BALANCING OF ROTATING MASSES: Balancing of single and multiple masses rotating in single and different planes.
BALANCING OF RECIPROCATING MASSES: primary; secondary balancing; analytical and graphical methods; unbalanced forces and couples; locomotive balancing- hammer blow; swaying couple and tractive efforts; balancing of inline engines.

UNIT - 5 **L- 9**

VIBRATIONS: Introduction; Definitions; Types of Vibrations; Free Longitudinal Vibrations; Damped Vibrations; Logarithmic Decrement; Forced Vibrations Transverse and Torsional vibrations; Free Torsional vibrations. **Whirling of Shafts:** Critical speeds; Two rotor systems.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS: Total hours: 30

ACTIVITIES:

- *Balancing of rotating and reciprocating machine components.*
- *Calculate critical speed of shafts*
- *Determine moment of inertia and radius of gyration of simple and compound pendulums.*
- *Plot characteristics curves of different types of Governors.*
- *Calculate the natural frequency of a spring mass system.*

LIST OF EXPERIMENTS: Total hours: 30

1. Moment of inertia and the radius of gyration of Bifilar suspension.
2. Characteristics curves of Watt, Hartnell and Proell governor
3. Experiments on static and dynamic balancing of rotating masses.
4. Calculation of critical speed of whirling of shaft.
5. Radius of gyration and the moment of inertia of a compound pendulum
6. Free longitudinal vibrations of a spring mass system
7. Forced vibrations of equivalent spring mass system
8. Damped torsional oscillations and damping coefficient
9. Experimental verification of natural frequency of undamped free vibration of equivalent spring mass system.

TEXT BOOKS:

1. J.E. Shigley, "Theory of Machines and Mechanisms", 4th edition, Oxford University Press, 2010.
2. R.S.Khurmi and J.K.Gupta, "Theory of Machines", 15th edition, S.Chand Publications., New Delhi, 2010.

REFERENCE BOOKS:

1. William J. Thomson, "Theory of Vibrations with Applications", 5th edition, Prentice Hall, 1997.
2. J.S. Rao and R.V. Dukkipati, "Mechanism and Machine Theory", 2nd edition, New Age International, 2009.
3. S.S. Rattan, "Theory of Machines", 3rd edition, Tata Mc Graw-Hill, New Delhi, 2009.