

OBJECTIVE:

To understand the method of static force analysis and dynamic force analysis of mechanisms

To study the undesirable effects of unbalances in rotors and engines.

To understand the concept of vibratory systems and their analysis

To understand the principles of governors and gyroscopes.

UNIT I FORCE ANALYSIS AND FLYWHEELS 12

Static force analysis of mechanisms – D' Alembert's principle - Inertia force and Inertia torque – Dynamic force analysis - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque–Engine shaking Forces - Turning moment diagrams - Flywheels of engines and punch press

UNIT II BALANCING 12

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine – Primary and secondary unbalanced forces - Balancing Multi-cylinder Engines – Firing order – Pivoted cradle balancing machines

UNIT III FREE VIBRATION 12

Basic features of vibratory systems - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped free vibration – Whirling of shafts and critical speed - Torsional systems; Natural frequency of two and three rotor systems.

UNIT IV FORCED VIBRATION 12

Response to periodic forcing - Harmonic Forcing – Forced vibration caused by unbalance - Support motion – Force transmissibility and amplitude transmissibility - Vibration isolation

UNIT V MECHANISMS FOR CONTROL 12

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors – Characteristics - Effect of friction - Controlling Force – Quality of governors – effect of friction. Gyroscopes - Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in Automobiles and ships

TUTORIAL = 15 L = 45 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Ambekar A. G., Mechanism and Machine Theory, Prentice Hall of India, New Delhi, 2007.

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", Affiliated East-West Press Pvt. Ltd., New Delhi, 1988.
3. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 1995.
4. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory", Wiley-Eastern Limited, New Delhi, 1992.
5. John Hannah and Stephens R.C., "Mechanics of Machines", Viva low-Priced Student Edition, 1999.
6. Sadhu Singh "Theory of Machines" Pearson Education, 2002.

STANDARDS:

1. IS 11717: 2000, Vocabulary on Vibration and Shock
2. IS 13301: 1992, Guidelines for vibration isolation for machine foundations?
3. IS 10000: Part 7: 1980, Methods of tests for internal combustion engines: Part 7 Governing tests for constant speed engines and selection of engines for use with electrical generators
4. IS 13274: 1992, Mechanical vibration - Balancing - Vocabulary?
5. IS 13277: 1992, balancing machine - Description and evaluation