Approval: 10th Senate Meeting

Course Number: ME 632

Course Name: Mechanics for Energy Systems

Credits: 3-0-0-3

Prerequisites: Mechanics of Solid

Intended for: B. Tech./ M. Tech. /MS

Distribution: Compulsory for M. Tech in Mechanical Engineering with specialization in Energy Systems, and Elective for others

Semester: Odd/Even

Preamble: Energy systems and subsystems for both conventional and emerging ones, have components of complex geometry and are composed of materials with diverse constitutive properties. This course aims to impart an ability to carry out stress and vibration analysis of critical components like turbine rotors, bearings etc., which are of complex geometry and often made of special materials.

Course Modules:

Module – 1: Brief overview of linear elasticity

Material constitutive relations, generalized Hooke's law, problems of linear elasticity, principle of Virtual work; minimum Potential energy; Hamilton's equation (**4L**)

Module – 2: Stress Analysis

Analysis of various components used in energy systems/ subsystems under different types of stresses - axial, bending and torsion; piping systems, turbine blade, rotors, boilers, compressor, nozzle, blower, generator, solar concentrating collectors and associated drives (**22L**)

Module – 3: Dynamic Analysis

Free and forced vibrations; analysis of rotor systems, geared systems; natural frequencies and natural modes, steady state response

Different kinds of bearing used in various types of turbine-rotor; stiffness and damping coefficients of journal bearings, half frequency whirl and resonance whip (**10L**)

Module – 4: Balancing

Balancing of rigid and flexible turbine rotors, influence coefficient and modal balancing techniques for flexible rotors (**4L**)

Reference Books:

1. Boresi, A.P. and Sidebottom, O.M., Advanced Mechanics of Materials, John Wiley, 1993.
2. Timoshenko, S.P. and Goodier, J.B., Theory of Elasticity, McGraw-Hill Kogakusha Ltd., 1970 3. J. S. Rao, "*Rotor Dynamics*", New Age International Publishers, New Delhi.
4. Timoshenko, D H. Young and W. Weaver, "*Vibration Problems in Engineering*", John Wiley.