Type	Code					
DE	NMED503	Rotor Dynamics	3	0	0	3

Course Objective
• The course aims to equip the students to the methods of modelling and analyzing rotating machines for their dynamic behavior.
Learning Outcomes
After completing the course, students will be able to • derive the equations of motion of rotors in absolute and rotating coordinate systems • calculate the critical speeds of rotors, • balance a rotor, • explain the gyro effect on critical speed

Unit No.	Topics	Lecture Hours	Learning Outcome
1	Introduction: Rotating machine Components, Aspects of rotating machine behavior, examples of rotating machines: Electrical Machines, Turbo generators, Gas Turbines	3	Understanding the significance of rotor dynamics.
2	Introduction to vibration analysis: Single degree of freedom systems, Multiple degrees of freedom systems, Discrete Fourier transform	3	Writing equations of motion of single and multiple degree of freedom system
3	Free lateral response of simple rotor models: Gyroscopic couples, Rigid rotors on flexible supports, Isotropic flexible supports, Simple model for flexible rotors	6	Students will be able to obtain equations of motion of simple rotors
4	Finite element modeling: Finite element modeling of discrete systems, Axial deflection of bar, Lateral deflection of bar, Elemental equations for bar and torsion element,	4	Students will be able to obtain response of continuous systems using finite element
5	Free lateral response of complex systems: Disk elements, Shaft elements, Bearings and seals, Foundation, Free response of complex systems	6	Students will be able to obtain elemental matrices for different rotor elements
6	Forced lateral response: Rotor models, Critical speeds, Mode shapes associated with critical speeds, Stresses in rotors, Asymmetric rotors and instability	5	Students will be able to calculate the critical speeds and mode shapes of rotors
7	Balancing: balancing rigid rotors at design stage, Field balancing of rigid rotors, Field balancing of	6	Students will be able to do calculations for balancing the

	flexible rotors		rotors
8	Axial and Torsional vibration: Simple system models for axial vibration, Simple system models for torsional vibration, Finite element models	6	Students will be able do the axial and torsional vibration analysis of rotors
9	Condition Monitoring of rotating machines: Different faults in rotors and their signatures, Data acquisition, Basic signal processing	3	Understand the vibration signature of different rotor faults
	Total	42	

Textbooks:

1. M. I. Friswell, J. E. T. Penny, S. D. Garvey, A. W. Lee, Dynamics of Rotating Machines, 1st edition, Cambridge University Press.

Reference Books:

1. Tiwari R., Rotor Systems: Analysis and Identification, 1st edition, CRC Press, Florida.
2. Rao J.S., Rotor Dynamics, 3rd edition, New Age, New Delhi.

Course Type	Course Code	Name of Course	L	T	P	Credit