**Lesson Plan**

**Subject : Tribology & Mechanical Vibration**

Lesson plan Duration : 15 Weeks

Work load (lecture/Practical) per week (in hours): Lectures:3 hours, Practical:2 hours

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| **Lecture No** | **Theory** | **Practical** | |
| **Practical Day** | **Topic** |
| 1 | Brief detail regarding syllabus and overview of subject, books required | 1 | Tostudy undamped free vibrations and determine the natural frequencyof: 1. spring mass system 2. simple pendulum 3. torsional spring type double pendulum and compare them with theoretical values. |
| 2 | Unit-1Introduction to vibration, fundamentals, elements of a vibratory system. |  |
| 3 | Periodic and Simple harmonic motion, degree of freedom, types of vibrations. |  |
| 4 | Work done by a harmonic force and beats phenomenon, Numericals | 2 | To study the torsional vibration of a single rotor shaft system and determine the natural frequency |
| 5 | Undamped free vibrations with single degree of freedom: Introduction, Differential equations related to it. |  |
| 6 | Natural frequency by equilibrium and energy method, Torsional vibrations, spring and shaft combinations. |  |
| 7 | Equivalent spring: series and parallel combinations , linear and torsional system. | 3 | To study the free vibration of the system for different damper setting. Draw decay curve and determine log decrement and damping factor. Find natural frequency. |
| 8 | Compound pendulum and bifilar suspension. |  |
| 9 | Trifilar suspension, numericals |  |
| 10 | Numericals on undamped free vibration. | 4 | To verify the Dunkerley’s rule. |
| 11 | Damped free vibrations: Introduction, different types of damping |  |
| 12 | Differential equations of damped free vibrations and initial conditions. |  |
| 13 | logarithmic decrement, Vibrational energy, numericals | 5 | To determine the radius of gyration for: Bifilar, Trifilar suspensions and compound pendulum. |
| 14 | Unit-iii, introduction to single degree of freedom with forced vibration systems:sources of excitation, equation of motion with harmonic force. |  |
| 15 | Response of rotating and reciprocating unbalanced system, support motion. |  |
| 16 | Vibration isolation, force and motion transmissibility. | 6 | To study the forced vibration system with damping, load magnification factor vs frequency and phase angle vs frequency curve. Determine the damping factor. |
| 17 | forced vibrations with coloumb damping and viscous damping,Vibratio measuring instruments |  |
| 18 | Resonance, bandwidth, quality factor and half power points, Numericals on single degree of freedom. |  |
| 19 | critical speed of shaft with and without damping with single and multiple discs, problems. | 7 | To find out and locate machinery faults viz vibration and unbalancing using machinery fault simulator in: direct driven reciprocating and centrifugal pump., defective straight tooth gearbox pinions. |
| 20 | Introduction to multi degree of freedom, principle modes of vibration, influence coefficient, numerical. |  |
| 21 | Matrix method and numerical, Matrix iteration method and numerical. |  |
| 22 | Orthogonality principle, Dunkerleys method and numericals | 8 | To determine the wear rate, friction force and coefficient of friction of a metallic pin/ball by using wear and friction monitor apparatus. |
| 23 | Holzer method, Rayleigh method and numericals |  |
| 24 | Rayleigh ritz method, stodola method and numerical |  |
| 25 | Introduction to continous system, Transverse vibrations of strings. Longitudinal vibrations of bar . | 9 | To determine abrasion index of a material with the help of dry abrasion testrig. |
| 26 | lateral vibration of beams, torsional vibration of uniform shaft. |  |
| 27 | Numericals |  |
| 28 | Numericals | 10 | Toevaluatethewearandextremepressurepropertiesofalubricatingoilbyusingfourballtester |
| 29 | Introduction to tribology concept, elements of tribology, tribology system,tribology in industry, consideration in industry. |  |
| 30 | Economic aspects of tribology, types of lubrication, selection of lubricants, purpose of lubrication. |  |
| 31 | Types of lubricants, properties of lubricants. | 11 | To determine the roughness of a specimen using surface roughnesstester |
| 32 | Lubricant additives and its detail., recycling of used oil, oil conservation and oil disposal, oil emulsion. |  |
| 33 | Wear, sources of wear, wear debries, effect of wear, types of wear,. |  |
| 34 | Measurement of wear, methods. |  |  |
| 35 | Wear between solids and liquids, erosive wear, cavitation phenomenon. |  |  |
| 36 | Theory of wears, Rabinowicz,s quantitative law, theory of abrasive wear expression. |  |  |
| 37 | Theory of adhesive wear, Archard's wear theory, mathematical expression. |  |  |
| 38 | Introduction of friction, laws of friction, kinds of friction, causes of friction |  |  |
| 39 | Measurement of friction, theories of friction. |  |  |
| 40 | Effect of surface preparation etc. |  |  |