| No | Information of every subject | |
|---|---|---|
| 1 | Unit name: | Theory of Machines I |
| 2 | Code: | ME-31015 |
| 3 | Classification: | Engineering subject |
| 4 | Credit value: | 3 |
| 5 | Semester/ Year Offered: | 1/2 |
| 6 | Pre-requisite: | Engineering Mechanics (Statics, Dynamic) |
| 7 | Mode of delivery: | Lecture ,Practical |
| 8 | Practical | 20% |
| | Mid-term/ final Examination | 70% |
| | Viva | 5% |
| | Tutorial | 5% |
| 9 | Academic staff teaching unit: | |
| 10 | Course outcome of unit:<br>Semester (I)<br>a. To use the reference circle to describe the variation in magnitude and direction of displacement, velocity and acceleration for simple harmonic motion.<br>b. To apply the relationship between machines and mechanisms.<br>c. To distinguish kinematic and kinetic motion.<br>d. To draw velocity and acceleration diagram for a mechanisms.<br>Semester (II)<br>e. To calculate loss of power due to friction in various machines.<br>f. To determine allowable forces, stress, power and torques for flexible drive systems.<br>g. To design gear and gear trains to produce speed or torque.<br>h. To apply basic law of friction to clutches and brakes. | |
| 11 | Synopsis of unit:<br>The subject theory of machines may be defined as that branch of engineering science, which deals with the study of relative motion between the various parts of a machine, and force which act on then. The knowledge of this subject is very essential for an engineer in designing the various parts of a machine. | |
| 12 | Topics and Contact Hours:<br>**4 Simple Harmonic Motion**<br>4.1 Introduction<br>4.2 Velocity and Acceleration of a Particle Moving with Simple | |

| | |
|---|---|
| | Harmonic Motion |
| | 4.3 Differential Equation of Simple Harmonic Motion |
| | 4.4 Terms Used in Simple Harmonic Motion |
| | 4.5 Simple Pendulum |
| | 4.6 Laws of Simple Pendulum |
| | 4.7 Closely-coiled Helical Spring |
| | 4.8 Compound Pendulum |
| | 4.9 Centre of Percussion |
| | 4.10 Bifilar Suspension |
| | 4.11 Trifilar Suspension (Torsional Pendulum) |
| | |
| | **5 Simple Mechanisms** |
| | 5.1 Introduction |
| | 5.2 Kinematic Link or Element |
| | 5.3 Types of Links |
| | 5.4 Structure |
| | 5.5 Difference between a Machine and a Structure |
| | 5.6 Types of Constrained Motions |
| | 5.7 Kinematic Pair |
| | 5.8 Classification of Kinematic Pairs |
| | 5.9 Kinematic Chain |
| | 5.10 Types of Joints in a Chain |
| | 5.11 Mechanism |
| | 5.12 Number of Degree of Freedom for Plane Mechanisms |
| | 5.13 Application of Kutzbach Criterion to Plane Mechanisms |
| | 5.14 Grubler's Criterion for Plane Mechanisms |
| | 5.15 Inversion of Mechnism |
| | 5.16 Types of Kinematic Chains |
| | 5.17 Four Bar Chain or Quadirc Cycle Chain |
| | 5.18 Inversions of Four Bar Chain |
| | 5.19 Single Slider Crank Chain |
| | 5.20 Inversions of Single Slider Crank Chain |
| | 5.21 Double Slider Crank Chain |

| | | |
|---|---|---|
| | | 5.22 Inversions of Double Slider Crank Chain |
| | **6** | **Velocity in Mechanisms (Instantaneous Centre Method)** |
| | | 6.1 Introduction |
| | | 6.2 Space and Body Centrodes |
| | | 6.3 Methods for Determining the Velocity of a Point on a Link |
| | | 6.4 Velocity of a Point on a Link by Instantaneous Centre Method |
| | | 6.5 Properties of the Instantaneous Centre |
| | | 6.6 Number of Instantaneous Centre in a Mechanism |
| | | 6.7 Types of Instantaneous Centres |
| | | 6.8 Location of Instantaneous Centres |
| | | 6.9 Aronhold Kennedy (or Three Cenres –in –Line) Theorem |
| | | 6.10 Method of Locating Instantaneous Centre in a Mechanism |
| | **7** | **Velocity in Mechanisms (Relative Velocity Method)** |
| | | 7.1 Introduction |
| | | 7.2 Relative Velocity of Two Bodies Moving in Straights Lines |
| | | 7.3 Motion of a Link |
| | | 7.4 Velocity of a Point on a Link by Relative Velocity Method |
| | | 7.5 Velocities in a Slider Crank Mechanism |
| | | 7.6 Rubbing Velocity at a Point Joint |
| | | 7.7 Forces Acting in a Mechanism |
| | | 7.8 Mechanical Advantage |
| | **8** | **Acceleration in Mechanisms** |
| | | 8.1 Introduction |
| | | 8.2 Acceleration Diagram for a Link |
| | | 8.3 Acceleration of a Point on a Link |
| | | 8.4 Acceleration in the Slider Crank Mechanism |
| | | 8.5 Coriolis Component of Acceleration |
| | **10** | **Friction** |
| | | 10.1 Introduction |

| | | |
|---|---|---|
| | | 10.2 Types of Friction |
| | | 10.3 Friction Between Unlubricated Surfaces |
| | | 10.4 Friction Between Lubricated Surfaces |
| | | 10.5 Limiting Friction |
| | | 10.6 Laws of Static Friction |
| | | 10.8 Laws of Solid Friction |
| | | 10.9 Laws of Fluid Friction |
| | | 10.10 Coefficient of Friction |
| | | 10.11 Limiting Angle of Friction |
| | | 10.12 Angle of Repose |
| | | 10.14 Friction of a Body Lying on a Rough Inclined Plane |
| | | 10.15 Efficiency of Inclined Plane |
| | | 10.16 Screw Friction |
| | | 10.17 Screw Jack |
| | | 10.18 Torque Required of Lift the Load by a Screw Jack |
| | | 10.20 Efficiency of the Screw Jack |
| | | 10.21 Maximum Efficiency of a Screw Jack |
| | | 10.22 Over Hauling and Self Locking Screws |
| | | 10.23 Efficiency of Self Locking Screws |
| | | 10.24 Friction of a V-thread |
| | | 10.25 Friction in Journal Bearing-Friction Circle |
| | | 10.26 Fiction of Pivot and Collar Bearing |
| | | 10.27 Flat Pivot Bearing |
| | | 10.28 Conical Pivot Bearing |
| | | 10.29 Trapezoidal or Truncated Conical Pivot Bearing |
| | | 10.30 Flat Collar Bearing |
| | | 10.31 Friction Clutches |
| | | 10.32 Single Disc or Plate Clutch |
| | | 10.33 Multiple Disc Clutch |
| | | 10.34 Cone Clutch |
| | | 10.35 Centrifugal Clutches |
| | **11** | **Belt, Rope and Chain Drives** |
| | 11.1 | Introduction |

| | |
|---|---|
| | 11.2 Selection of a Belt Drive<br>11.3 Types of Belt Drives<br>11.4 Types of Belt<br>11.5 Material used for Belts<br>11.6 Types of Flat Belt Drives<br>11.7 Velocity Ratio of Belt Drive<br>11.8 Velocity Ratio of a Compound Belt Drive<br>11.9 Slip of Belt<br>11.10 Creep of Belt<br>11.11 Length of an Open Belt Drive<br>11.12 Length of Cross Belt Drive<br>11.13 Power Transmitted by a Belt<br>11.14 Ratio of Driving Tension for Flat Belt Drive<br>11.15 Determination of Angle of Contact<br>11.16 Centrifugal Tension<br>11.17 Maximum Tension in the Belt<br>11.18 Condition for the Transmission of Maximum Power<br>11.23 Rope Drive<br>11.24 Fiber Ropes<br>11.26 Sheave for Fiber Ropes<br>11.27 Wire Ropes<br>11.28 Ratio of Driving Tension for Rope Drive<br>11.29 Chain Drives<br>11.30 Advantages and Disadvantages of Chain Drive Over Belt or Rope Drive<br>11.31 Terms Used in Chain Drive<br>11.32 Relationship between Pitch and Pitch Circle Diameter<br>11.33 Relation Between Chain Speed and Angular Velocity of Sprocket<br>11.34 Kinematic of Chain Drive<br>11.35 Classification of Chains<br>11.36 Hoisting and Hauling Chains<br>11.37 Conveyor Chains |

| | | |
|---|---|---|
| | | 11.38 Power Transmitting Chains |
| | | 11.39 Length of Chains |
| | **12** | **Toothed Gearing** |
| | | 12.1 Introduction |
| | | 12.2 Friction Wheel |
| | | 12.3 Advantage and Disadvantage of Gear Drive |
| | | 12.4 Classification of Toothed Wheels |
| | | 12.5 Terms Used in Gears |
| | | 12.6 Gear Materials |
| | | 12.7 Law of Gearing |
| | | 12.8 Velocity of Sliding of Teeth |
| | | 12.9 Forms of Teeth |
| | | 12.10 Cycloidal Teeth |
| | | 12.11 Involute Teeth |
| | | 12.12 Effect of Altering the Centre Distance |
| | | 12.13 Comparison Between Involute and Cycloidal Gears |
| | | 12.14 Systems of Gear Teeth |
| | | 12.15 Standard Proportions of Gear Systems |
| | | 12.16 Length of Path of Contact |
| | | 12.17 Length of Arc of Contact |
| | | 12.18 Contact Ratio |
| | | 12.19 Interference in Involute Gears |
| | | 12.20 Minimum Number of Teeth on the Pinion |
| | | 12.21 Minimum Number of Teeth on the Wheel |
| | | 12.22 Minimum Number of Teeth on a Pinion for Involute Rack in Order to Avoid Interference |
| | | 12.23 Helical Gears |
| | | 12.24 Spiral Gears |
| | | 12.25 Centre Distance For a Pair of Spiral Gears |
| | | 12.26 Efficiency of Spiral Gears |
| | **13** | **Gear Trains** |
| | | 13.1 Introduction |

| | | |
|---|---|---|
| | | 13.2 Types of Gear Train<br>13.3 Simple Gear Train<br>13.4 Compound Gear Train<br>13.5 Design of Spur Gear<br>13.6 Reverted Gear Train<br>13.7 Epicyclic Gear Train<br>13.8 Velocity Ratio of Epicyclic Gear Train<br>13.9 Compound Epicyclic Gear Train(Sun and Planet Wheel)<br>13.10 Epicyclic Gear Train With Bevel Gears<br>13.11 Torques in Epicyclic Gear Trains |
| | **19** | **Brakes and Dynamometers**<br>19.1 Introduction<br>19.2 Materials for Brake Lining<br>19.3 Types of Brakes<br>19.4 Single Block or Shoe Brake<br>19.5 Pivoted Block or Shoe Brake<br>19.6 Double Block or Shoe Brake<br>19.7 Simple Band Brake<br>19.8 Differential Band Brake<br>19.9 Band and Block Brake<br>19.10 Internal Expanding Brake<br>19.11 Braking of a Vehicle<br>19.12 Dynamometer<br>19.13 Types of Dynamometers<br>19.14 Classification of Absorption Dynamometers<br>19.15 Prony Brake Dynamometer<br>19.16 Rope Brake Dynamometer<br>19.17 Classification of Transmission Dynamometers<br>19.18 Epicyclic-train Dynamometers<br>19.19 Belt Transmission Dynamometer-Froude or Throneycraft Transmission Dynamometer<br>19.20 Torsion Dynamometer |

| | |
|---|---|
| | 19.21 Bevis Gibson Flash Light Torsion Dynamometer |
| 14 | Main references:<br>"Theory of Machines"by R.S.Khurmi, J.K.Gupta |
| 15 | Additional references:<br>Theory of Machines(Third Edition) S S RATTAN |