

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**B. E. SEMESTER: V**  
**PRODUCTION ENGINEERING**

Subject Name: **Design of Machine Elements**

Subject Code: **152503**

<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>		
<b>Theory</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Total</b>	<b>University Exam (Theory) (E)</b>	<b>Mid Sem Exam (Theory) (M)</b>	<b>Practical (I)</b>
4	2	0	6	70	30	50

<b>Sr. No.</b>	<b>Course content</b>
1.	<p><b>Variable Stresses in Machine Parts:</b></p> <p>Introduction, Completely reversed or cyclic stresses, Fatigue and endurance limit, Effect of loading on endurance limit- load factor, Effect of surface finish on endurance limit – surface finish factor, Effect of size on endurance limit-size factor, Effect of miscellaneous factors on endurance limit, Relation between endurance limit and ultimate tensile strength, Factor of safety for fatigue loading, Stress concentration, Theoretical or form stress concentration factor. Stress concentration due to holes and notches, Method of reducing stress concentration. , Factors to be considered while designing machine parts to avoid fatigue failure, Stress concentration factor for various machine members, Fatigue stress concentration factor, Notch sensitivity, Combine steady and variable stresses</p> <p><b>Failure theories:</b></p> <ol style="list-style-type: none"> <li>a) Gerber method of combination of stresses</li> <li>b) Goodman method of combination of stresses</li> <li>c) Soderberg method of combination of stresses</li> <li>d) Combine variable normal stress and variable shear stress</li> <li>e) Application of Soderberg's equation</li> </ol>
2.	<p><b>Design of Clutches and Brakes:</b></p> <p><b>A. Clutches:</b></p> <p>Introduction, Types of clutches, Positive clutch , Friction clutches , Material for friction surfaces , Consideration in designing or friction clutch , Types of friction clutches , Single disc or plate clutch , Design of a disc or plate clutch , Multiple disc clutch , Cone clutch , Design of cone clutch , Centrifugal clutch , Design of centrifugal clutch.</p>

	<p><b>B. Brakes:</b>  Introduction, Energy absorbed by a brake, Heat to be dissipated during braking, Materials for brake lining, Types of brakes. , Single block or shoe brake. , Pivoted block or shoe brake. , Double blocks or shoe brake. , Simple band brake. Differential band brake, Band and block brake. , Internal expanding brake.</p>
3.	<p><b>Design of Belts and Pulleys:</b>  Introduction, Materials for belts, Design of belts, Design procedure for flat belts, V-belt drives and its design. Pulleys: Materials and types, Cast iron pulleys, Design of steel pulleys, Fast and loose pulleys, Speed cones.</p>
4.	<p><b>Design of Flywheel:</b>  Introduction, Co efficient of Fluctuation of Speed, Fluctuation of, Maximum Fluctuation of Energy , Co efficient of Fluctuation Energy ,Energy Stored in Flywheel ,Stresses in a Flywheel Rim , Stresses in Flywheel Arms, Design of Flywheel Arms ,Design of Shaft, Hub, and Key, Construction of Flywheel.</p>
5.	<p><b>Design of Gears:</b></p> <p><b>A. Spur Gears:</b>  Introduction, Friction wheels, Advantages and disadvantages of gear drives  Classification of gears. Terms used in Gears. Condition for constant velocity ratio of gears-law of gearing , Forms of teeth , Cycloid teeth , Involute teeth , Comparison between Involute and Cycloid gears , Systems of gear teeth , Standard proportions of gear system , Interference in Involute gears , Minimum number of teeth on pinion in order to avoid interference , Gear materials , Design consideration for gear drive , Beam strength of gear teeth- Lewis equation , Permissible working stress for gear teeth in Lewis equation , Dynamic tooth load , Static tooth load , Wear tooth load , Causes of gear tooth failure , Design procedure for spur gears. , Spur gear construction ,Design of shaft for spur gears , Design of arms for spur gear.</p> <p><b>B. Helical Gears:</b>  Introduction,. Terms used in helical gear, Face width of helical gears, Formative or equivalent number of teeth for helical gears, Proportion for helical gears, Strength of helical gears.</p> <p><b>C. Bevel Gears:</b>  Introduction, Classifications of bevel gears, Terms used in bevel gears. , Determination of pitch angle for bevel gears , Proportions for bevel gears , Formative or equivalent number of teeth for bevel gear-Tredgold's approximation , Strength of bevel gears , Forces acting on a bevel gear , Design of shaft for bevel gear.</p> <p><b>D. Worm Gears:</b>  Introduction, Types of worms, Types of worm gears. , Terms used in worm gearing, Proportions for worms, Proportions for worm gears, Efficiency of worm gearing , Strength of worm gear teeth 9. Wear tooth load for worm gear, Thermal rating of worm gearing 11. Forces acting on worm gears, Design of worm gearing.</p>

6.	<p><b>Column and Strut:</b></p> <p>Introduction, Failure of Column and Strut,. Types of End Conditions of Columns, Euler's column theory, Assumptions in Euler's column theory, Euler's Formula, slenderness Ratio, Limitations of Euler's theory, Equivalent length of column , Rankine's Formula for column, Johnson's formula for columns, Long Columns subjected to Eccentric loading, Design of Piston Rod, Push Rod and Connecting Rod, Forces acting on connecting rods.</p>
7.	<p><b>Springs:</b></p> <p>Introduction, Types of Springs, Material for Helical springs, Standard size of spring Wire, Terms used in Compression Springs, End Connections for compression helical spring, End Connections for Tension Helical spring, Stresses in helical spring of circular wire, deflection of helical spring of circular wire, eccentric loading of spring, buckling of compression spring, surge in spring, Energy stored in helical spring of circular wire, stress and deflection in helical spring of non-circular wire, helical spring subjected to fatigue loading, spring in series , spring in parallel, concentric or composite spring, helical torsion springs, flat spiral spring, leaf spring , construction of leaf spring, equalized stresses in spring leaves, length of leaf spring leaves, standard sizes of automobile suspension spring, material for leaf springs.</p>
8.	<p><b>Thin and Thick Cylinders:</b></p> <p>Introduction, classification of pressure vessel, stresses in thin cylindrical shell due to an internal pressure, Circumferential or Hoop Stress, longitudinal Stresses, change in dimensions of thin cylindrical shell due to an internal Pressure, Thin Spherical shells Subjected to an internal Pressure, Change in dimensions of thin cylindrical shell due to an internal Pressure, Thick cylindrical shell subjected to an internal pressure, Compound Cylindrical Shells, Stresses in Compound Cylindrical shells, Cylindrical heads and Cover Plates.</p>
9.	<p><b>Threaded Joints:</b></p> <p>Bolted joint analysis, Eccentrically Loaded Bolted Joints in Shear, Eccentric Load perpendicular to axis of bolt, Eccentric load on Circular Base, Torque requirement for Bolt tightening, Dimensions of Fasteners, Elastic analysis for Bolted joints, Bolted Load under Fluctuating load, connecting rod bolts, Tolerances for bolt spacing.</p>

### Reference Books:

1. Machine Design by V.B.Bhandari, Tata McGrawhill.
2. Machine Design by R.C.Patel, C JamanaDas & Co.
3. Machine Design by R.S. Khurmi & J.K.Gupta, S Chand & Co.
4. Design Data (PSG College of Engg. &Tech.), Coimbtore.
5. Machine Design by Sadhusingh.
6. Machine Design by P.C.Sharma, Kataria & Sons.