GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3162001
Semester – VI
Subject Name: Design of Mechanisms

Type of course: Professional Core Course

Prerequisite: Zeal to learn the subject

Rationale: The course aims to impart basic skills of force and stress analysis for design of machine elements. With the help of drawing various elements of mechanism students can enhance their ability of drawing and visualization.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Design Considerations** Standardization, Preferred numbers, Tolerances and Fits, Ergonomics, System design, Manufacturing considerations, Mechanical Properties of Materials, Effect of Alloying elements and heat treatment on properties of steels, Materials Selection in Machine Design	**02***
2	**Design Against Static Load** Concepts of stresses and Strain, Factor of safety, Contact stresses, Crushing and Bearing stress, Combinations of Axial, Shear, Torsional and Bending loads; Theories of Failures: Distortion energy (von Mises), Maximum-Shear stress, Maximum Principal stress, Selection and Use of theories of failures;. Application Problems: Eccentric Loading; Design of Socket & Spigot Cotter joint, Knuckle Joint; Design and analysis of levers: Cranked, Bell crank, Foot, Rocker arm	**13**
3	**Design Against Fluctuating Loads:** Stress Concentration, Endurance limit and Fatigue failure, Factors affecting endurance limit, S-N Diagram, Design for reversed stresses and cumulative damage, Fluctuating stresses: Soderberg, Gerber, Goodman and Modified Goodman criteria, Combined stresses	**05**
4	**Beams and Columns** Different types of supports / end conditions, Revision of Stresses in beams: Effect of Section, Orientation, and type of loading; Deflection of beams for different loading conditions. Compressive axial loading of columns and struts, Slenderness ratio, Compressive stress and Buckling of members, Effect of end conditions; Euler's Formula, Applications, validity and limitations; Rankine's Formula, stresses in curved beam	**05**

5	**Power Screws and Threaded Joints** Forms of thread, Single and Multiple threaded screw, Terminology of power screw, Torque requirement of lifting/lowering, Self-locking, Efficiency of threads, coefficient of friction, design of screw and nut. Basic types of screw fastening, Cap and Set screw, Bolt of Uniform strength, locking devices, Terminology of Screw thread, Bolted Joint: Simple and Eccentric loading, Torque requirement for bolt tightening.	**07**
6	**Power Transmission Mechanisms** Design of solid and hollow circular shaft subjected to torque and combined loading for rigidity and stiffness; Design of Keys and splines, Types of coupling, Design of Muff coupling, Clamp coupling, Rigid flange coupling and Bush pin type flexible coupling, Design of Flat belt and CI pulleys	**12**
7	**Rolling contact bearings**** Types of rolling-contact bearings, Selection of bearing type, Static load carrying capacity of bearing, Dynamic load carrying capacity of bearing, Equivalent bearing load, Load-life relationship, Selection of bearing from manufacturer's catalogue, Bearing with probability of survival other than 90 percent, Design for cyclic load	**04**
8	**Design of Spur gear **** Classification of gears, Selection of type of gears, Standard system of gear tooth, Force analysis, Gear tooth failures, selection of material, Beam strength of gear tooth, Wear strength of gear tooth	**05**

* Topic should be covered during practical class.

** Provide necessary equations/data/chart/Tables in exams.

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**10**	**20**	**45**	**10**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Design of Machine Elements, V B Bhandari, 3/e, Tata McGraw Hill.
2. A Textbook of Machine Design, P C Sharma and D K Aggarwal,S K Kataria & sons.
3. Shigley's Mechanical Engineering Design, R G Budnyas, J K Nisbett, McGraw Hill.
4. Fundamentals of Machine Component Design, R C Juvinall, 4/e, Wiley.
5. Machine Design: An Integrated Approach, R L Norton, Pearson
6. Machine Tool Design and Numerical Control, N K Mehta, Tata McGraw Hill Edu.
7. Design Data, Faculty of Mechanical Engineering, PSG College of Engineering, Coimbatore.

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Course Outcomes:

After learning the course the students will be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify basic failure modes of machine elements.	20
CO-2	Determine forces and stresses in power transmitting elements.	30
CO-3	Design and dissect mechanisms for strength and improve their life.	30
CO-4	Perceive and analyse machine components under fluctuate loading.	10
CO-5	Select and evaluate appropriate bearings and gears for mechanisms.	10

List of Experiments:

1. Detail and assembly drawing which includes various standards, tolerances, fits and manufacturing considerations.
2. Material selection, force and stress analysis of components like Joints, Levers and curved beams.
3. Design of power transmission mechanisms.
4. Design of machine elements under fluctuate loadings.
5. Design of spur gears and selection of bearings.
6. Design of hoisting mechanisms.* (only in practical)

Major Equipment:

NA

List of Open Source Software/learning website:

http://nptel.ac.in