COURSE TITLE	**MACHINE DESIGN & INDUSTRIAL DRAFTING**
COURSE CODE	**01ML0402**
COURSE CREDITS	**4**

Objective:

1 To develop the ability to analyze, design, and draft mechanical components using stress analysis, failure theories, and standard engineering design practices

Course Outcomes: After completion of this course, student will be able to:

1 Apply principles of stress analysis and Mohr's circle to determine principal stresses, maximum shear stress, and resultant stresses, and evaluate the stress conditions in mechanical components.

2 Analyze and evaluate mechanical components using different theories of failure to determine the factor of safety and assess their suitability under various loading conditions.

3 Analyze and evaluate the strength and suitability of temporary and permanent mechanical joints such as cotter joints, knuckle joints, power screws, welded joints, and riveted joints under different loading conditions.

4 Apply and analyze design equations and standard design procedures to determine appropriate dimensions of machine elements including shafts, keys, and couplings based on strength and rigidity requirements.

5 Apply, analyze, and evaluate design principles to determine forces and dimensions of different types of levers such as cranked lever, bell crank lever, foot lever, and rocker arm based on strength and equilibrium conditions.

Pre-requisite of course: Nil

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Principal Stresses** Introduction: Two-dimensional stress system. Evaluation of stresses in an inclined plane for members subjected to orthogonal stresses., Definition of principal plane, principal stresses, angle of obliquity, and resultant stress., Principal Stress and Strain: Evaluation of Principal plane and principal stresses using analytical method, Analysis of Principal stresses and principal planes for two-dimensional stress system, Application ofMohr's circle and ellipse of stress.	6

Contents : Unit	Topics	Contact Hours
2	**Design concepts of Mechanical Components** Different theories of Failures and its limitation and application for Different theories i.e., Distortion energy, Maximum Shear stress, Maximum Principal stress, Coulomb-Mohr Theory,, Factor of safety and its different parameters for selection, Selection of theories of failures and Use of theories of failures, Contact stresses, Crushing and Bearing pressure.	6
3	**Design of mechanical joints** Temporary joints:Cotter and Knuckle joints: Design of Cotter and Knuckle Joints., Screw and nut: Different types of thread for Single as well as Multiplethreaded screw, screw fastening and its types, Cap and Set screw, conceptof uniform strength in bolt, locking devices, Different Terms of Screwthread. Torque calculation for bolt tightening., Design of power screw:Different terms used to describe power screw, Calculation of torquerequired for lifting and lowering of Load, Efficiency of threads, Self-locking phenomenon, Co-efficient of friction.	6
4	**Design of mechanical joints** Permanent joints:Welded joints: Different types of welded joints and stress relievingmethods in weld joints, Strength of butt and fillet joint, Eccentric loading inthe plane of weld, welded joint subjected to bending and torsion., Riveted joints: material selection and criteria for rivet joints and typesof its failure, riveted joints efficiency and strength calculation,strengthen method for riveted joints like Caulking and Fullering,Longitudinal lap joint and Circumferential lap joint, Eccentric loading condition in riveted joint.	6
5	**Design of shaft** Design of solid and hollow circular shaft subjected totorque as well combined loading, Design of shaft based on rigidity andstiffness.	6
6	**Design of machine component** Design of key: Saddle, Sunk, Woodruff, Square, and Flat., Design of coupling: Design and Concept of Couplings, Rigid coupling,Flexible coupling.	6
7	**Design of lever** Cranked, Bell crank, Foot, Rocker arm.	6
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment 1** Create 2D sketches of standard mechanical profiles using CADsoftware and apply dimensional and geometric constraints.	2
2	**Experiment 2** Determine principal stresses and maximum shear stresses for a giventwo-dimensional stress system and verify results graphically.	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
3	**Experiment 3** Analyse a given mechanical component using Maximum ShearStress and Distortion Energy theories to determine the factor of safety.	2
4	**Experiment 4** Apply design equations to determine dimensions of a cotter joint	2
5	**Experiment 5** Calculate dimensions for a knuckle joint subjected to tensile load	2
6	**Experiment 6** Determine torque required for lifting and lowering loads in a powerscrew	2
7	**Experiment 7** Analyse a welded joint subjected to eccentric loading and prepare	2
8	**Experiment 8** Calculate strength and efficiency of a riveted lap joint and prepare aproduction drawing of the joint	2
9	**Experiment 9** Apply torsion and rigidity equations to determine shaft dimensions.	2
10	**Experiment 10** Determine suitable dimensions of square or rectangular keys forpower transmission	2
11	**Experiment 11** Apply design equations for bolts and keys in a rigid flange couplingand develop a complete assembly model.	2
12	**Experiment 12** Analyse forces acting on a bell crank or rocker arm lever	2
Total Hours		**24**

Textbook :

1 Design of Machine Elements, V B Bhandar, McGraw Hill, 2023

2 Machine Design: Fundamentals and Applications, P C Gope, PHI Learning, 2020

References:

1 Fundamentals of Machine Component Design, Fundamentals of Machine Component Design, R C Juvinall, Wiley, 2020

2 Design of Machine Elements, Design of Machine Elements, C. S. Sharma, Kamlesh Purohit, PHI Learning, 2018

3 Machine Design, Machine Design, Abdul Mubeen,, Khanna Publishers, 2020

4 Machine Design: An Integrated Approach, Machine Design: An Integrated Approach, R L Norton, Pearson, 2023

5 Design of Machine Elements,, Design of Machine Elements,, Sadhu Singh, Khanna Publishers, 2020

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
0.00	0.00	40.00	30.00	30.00	0.00

Instructional Method:

1 PPT

Supplementary Resources:

1 https://nptel.ac.in/courses/112/105/112105124/
2 http://www.mece.ualberta.ca/tutorials/ansys/
3 http://learningexchange.ptc.com/tutorials/listing/product_version_id:44
4 http://www.3ds.com/products-services/enovia