Lok Jagruti Kendra University
University with a Difference

Diploma in Mechanical Engineering

LJ Polytechnic

Course Code: 025060509

Machine Design

Programme / Branch Name			Diploma in Mechanical Engineering			
Course Name	Machine Design				**Course Code**	025060509
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				Evaluation Scheme			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
3	0	2	4	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ Strength of Material
- ✓ Applied Mechanics
- ✓ Engineering Drawing
- ✓ Measure basic mechanical quantities/parameters
- ✓ Use CAD command for modeling of design

3. Rationale

In order to produce Machine parts and components it is required that Specific Shape and size of Machine parts are determined and their drawings are prepared. This process is called as Design. This course curriculum provides the students' knowledge of Design process, as well as familiarity with Design of Components subjected to various stresses and moments like Direct Stress, Bending Stress, Twisting Moment and Combined Stresses.

4. Objectives

- ✓ To Introduce Design considerations for various Machine Elements.
- ✓ Learn Design Procedure for Bell Crank and Rocker Arm Lever.
- ✓ Learn Design of C-Clamp.
- ✓ Learn Design of Helical Spring and Leaf Spring.
- ✓ Learn Design of Pressure Vessel.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1.	**Introduction**	1.1. State the Design Considerations of Machine Elements and Design Processes. 1.2. Explain the Loads, Stresses, Stress Concentration Factor and Factor of Safety. 1.3. Select Standard items and Preferred Numbers for Designing Simple Machine Elements. 1.4. Examples	• General Consideration and Factors influencing the design of Machine Elements and Design Process • Materials used in Manufacturing of Machine Elements and their Properties • Types of Loads, Stresses, Stress Concentration and Factor of Safety. • Standardization and Preferred Numbers, Numeric Examples on Preferred Numbers	10	6
2.	**Levers**	2.1. Explain the Principle of Bending with its equation Basic Terminology 2.2. First Order Lever 2.3. Second Order Lever 2.4. Third Order Lever 2.5. State Modulus of Various Sections Subjected to Pure Bending like Levers, Beams and Axles 2.6. Design Bell Crank Lever and Rocker Arm based on given input. 2.7. Examples	• Principle of Bending And Its Fundamental Equation. • Types of Levers: First Order , Second Order And Third Order Levers. • Modulus of Various Sections, Subjected To Pure Bending Like Levers, Beams, Axle . • Design Procedure (with Numeric Example) of Levers.	25	8
3.	**Eccentric Loading**	3.1. Define Eccentric Loading 3.2. Explain the Features of Eccentric Loading on Machine Elements such as Bracket, Foundation and others.	• Eccentric loading: Concept; C-clamp, Bracket, Foundation bolt, Bolts in Flange. • Design of C-Clamp, Bracket, Foundation Bolt and Bolts in Flange	30	14

		3.3. Design Simple Machine components Subjected to Eccentric. 3.4. Examples.			
4.	**Spring**	4.1. Introduction 4.2. Terminology used in Spring 4.3. Types of Spring. 4.4. Helical Spring applications 4.5. Design Helical Spring. 4.6. Construction of Leaf spring 4.7. Design Leaf Spring. 4.8. Examples.	• Fundamental equation of Twisting Moment with Design Procedure. • Types of Spring, Terminology related to Helical ,Leaf spring and its applications	15	6
5.	**Pressure Vessel**	5.1. Define Pressure Vessels. 5.2. State types of Pressure Vessels with range of Pressure. 5.3. Design Simple thick and Thin Cylinder Pressure Vessels. 5.4. Design Simple thin Spherical Shell.	• Types and applications of Pressure Vessels used In Industries. State range of Pressure also. • Design of Thick and Thin Cylinders (with Numeric Examples). • Design of Thin Spherical Shell (with Numeric Examples).	20	8
				Total Hours	**42**

6. List of Practicals / Exercises

The practicals/exercises have been properly designed and implemented in an attempt to develop different types of skills, so that students can acquire the competencies/programme outcomes. Following is the list of practicals/exercises.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	General Design Consideration for the Design of Mechanical component.	Prepare the Report on this, which will include the Procedure and steps to design any Mechanical Component.	6
2.	Design of Bell Crank Lever and Rocker arm Lever.	Prepare the Report on this, which will include Calculations, Sketches with identification of areas	8

		subjected to induced Stresses.	
3.	Design of Mechanical Joints	Design showing other assumptions, steps and final dimensions of C-Clamp, Bracket, Foundation Bolt, Bolts in Flange.	6
4.	Design of Spring	Design showing other assumptions, steps and final dimensions of Spring.	4
5.	Design of Pressure Vessel	Prepare the Report on this, which will include Calculations, Sketches with identification of areas subjected to induced Stresses in Pressure Vessel.	4
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	Ap %	C %	E %	An %
1.	Introduction	35	12	15	18	12	8
2.	Levers	20	12	15	15	18	20
3.	Eccentric Loading	28	12	25	25	5	5
4.	Spring	15	25	8	25	12	15
5.	Pressure Vessel	20	15	15	25	5	20

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. Textbooks

1. Machine Design by R.S. Khurmi and JK Gupta, Eurasia Publishing House (Pvt.) Limited, New Delhi.
2. Machine Design by R.K. Jain, Khanna Publishers, New Delhi

3. Reference Books

1) Machine Design by VB Bhandari, Tata McGraw Hill, New Delhi
2) Machine Deisn by AP Verma, Katson Publishers
3) Machine Design by V.B.Bhandari, Tata McGraw Hill, New Delhi.
4) Machine Design by JK Kapoor D Bharat Parkashan, Meerut.

4. Open Sources (Website, Video, Movie)

1) https://nptel.ac.in/courses/112105125
2) https://archive.nptel.ac.in/courses/112/105/112105124/
3) https://www.researchgate.net/publication/276291185_Machine_Design_Selection_of_Materials_for_Design
4) http://160592857366.free.fr/joe/ebooks/Mechanical%20Engineering%20Books%20Collection/MACHINE%20DESIGN/Standard%20Handbook%20of%20Machine%20Design.pdf
5) https://www.youtube.com/watch?v=g3Vj7uO86ps
6) https://www.youtube.com/watch?v=awGjOGo_Mis
7) https://www.youtube.com/watch?v=Lsr0_vLS0Bo
8) http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Machine%20design1/left_mod5.html
9) http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Machine%20design1/left_mod8.html
10) http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Machine%20design1/left_mod4.html