Lok Jagruti Kendra University
University with a Difference

Diploma in Mechanical Engineering

LJ Polytechnic

Course Code: 025060501

Design of Machine Elements

Programme / Branch Name	Diploma in Mechanical Engineering					
Course Name	Design of Machine Elements				**Course Code**	025060501
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 Modelling 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 student's 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. In this course students will learn design of machine components/elements like cotter joint, knuckle joint, nut, bolt, shafts, keys, couplings, bearings etc.

4. Objectives

- ✓ To Introduce Design Considerations for various types of Joints.
- ✓ Learn Design Procedure for selection of Antifriction Bearings.
- ✓ Learn Design of Shafts, Keys and Couplings.
- ✓ Identify Various Failures and Calculate Resisting areas of Machine Elements.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1.	**Introduction**	1.1. Machine Design 1.2. Basic Procedure of Machine Design 1.3. Basic requirement of Machine Elements 1.4. Types of Loads and types of Stresses 1.5. Use of Standard in Design 1.6. Engineering Materials-Mechanical Properties, Plain carbon steel, cast steel, creep, selection of material 1.7. Modes of failure 1.8. Factor of safety 1.9. Standardization and its Application	• Select materials that can be used for design of Machine Elements. • Explain Loads, Stresses, Stress Concentration Factor and Factor of Safety. • Select standard items and Preferred Numbers in Automobile Gear System	20	8
2.	**Design Against Static load**	2.1. Elements Subjected to Direct Stresses 2.2. Stresses due to Bending Moment 2.3. Stresses due to Torsional moment 2.4. Cotter joints- Design and Application 2.5. Knuckle Joints-Design and Application 2.6. Difference between Cotter and knuckle joint	• Fundamental equation of Bending and Torsional. • Designing of Joints such as Cotter Joint And Knuckle Joint used in Automobiles, Machine. • Difference in the Design of Cotter Joint and Knuckle Joint.	25	10
3.	**Design of Joints**	3.1. Introduction 3.2. Rivet Joints-Important terms and types. 3.3. Design of Rivet Joint 3.4. Welded Joints-Important terms and types. 3.5. Design of Welded Joints 3.6. Types of Screw Thread	• Calculate Resisting area of simple Machine Element subjected to Direct Independent Stress. • Designing of Rivet, Welded and Screw Joint used in Fastening Purpose.	15	6

		3.7. Screw Joints-Stresses in Screwed Fastening due to static loading 3.8. Design of Bolt 3.9. Design of Nut			
4.	**Shaft, Keys and Coupling**	4.1. Introduction 4.2. Types of Shafts 4.3. Fundamental Equation of Twisting Moment with Design Procedure. 4.4. Design of Solid Shaft 4.5. Design of Hollow Shaft 4.6. Introduction of Key 4.7. Types of Keys 4.8. Design of Sunk Key 4.9. Introduction of Coupling 4.10. Design of Rigid Coupling 4.11. Design of Flange Coupling	• Fundamental equation of Twisting Moment. • Examine different Shafts used in Mechanical Purpose. • Knowledge of Types of Keys, Couplings, Spring & Applications of each. • Designing of Shafts, Keys and Couplings used in Motors, Automobiles.	25	10
5.	**Bearing**	5.1. Antifriction Bearings: Types of Bearing, Advantages, applications 5.2. Rolling Contact Bearing 5.3. Bearing Life 5.4. Basic Static Load Rating 5.5. Static Equivalent Load 5.6. Basic Dynamic Load Rating 5.7. Dynamic Equivalent Load Rating	• Examine different Types of Bearing. • Select appropriate Anti-friction Bearings from Manufacturer's Catalogue. • Calculate the Load on the Bearings that are used in Machine.	15	8
				Total Hours	**42**

6. List of Practicals / Exercises

The practical/exercises should be 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 practical exercises for guidance.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	Fundamental Activity	• To study about S.I unit and their conversions.	2

		• To Study about Tolerance, Factor Of Safety, Ultimate Tensile Strength, Yield Strength, Density, Modulus of Elasticity and Poisson's Ratio of Commonly used Materials.	
2.	Design of Cotter Joint	• Prepare the Report on this, which will include Calculations, Sketches with identification of areas subjected to Induced Stresses. • Design showing other assumptions, steps and final dimensions of Cotter Joint. • Sketch production drawings of details (Individual Parts).	4
3.	Design of Knuckle Joint	• Prepare the Report on this, which will include Calculations, Sketches with identification of areas subjected to induced Stresses. • Design showing other assumptions, steps and final dimensions of Knuckle Joint. • Sketch production drawings of details (Individual Parts).	8
4.	Design of Flange Coupling	• Prepare the Report on this, which will include Calculations, Sketches with identification of areas subjected to Induced Stresses. • Design showing other assumptions, steps and final dimensions of Shafts, Keys and Flange Coupling. • Sketch production drawings of details (Individual Parts).	8
5.	Modeling	• Create 3D Models of all Parts and Assemblies (In group of 4 students) • Each student will perform design using any Parametric CAD software (like Creo, Solid Edge and Inventor).	6
		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	30	12	12	16	20	10
2.	Design Against Static Load	30	20	0	50	0	0
3.	Design of Joints	28	12	25	25	5	5
4.	Shaft, Keys, and Coupling	15	25	8	25	12	15
5.	Bearing	20	15	15	25	5	20

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

8. Textbooks

1) A Text book of Machine Design, R.S.Khurmi and J.K.Gupta, S. Chand.

9. Reference Books

1) Design of machine elements, V.B.Bhandari Publication, McGraw-Hill.
2) Machine Design, R.K.Jain, Khanna Publishers.
3) Design of Machine Elements, Shigley, Tata McGraw-Hill Education.
4) Machine Design, P.Kannaiah, Scitech publications

10. Open Sources (Website, Video, Movie)

1) http://nptel.ac.in/courses/Webcourse
2) https://www.youtube.com/watch?v=ZeCHbVrsi70&list=PLtpgVX7NgMc_J1JnSgj3qmyaXjha6UJgJ
3) https://youtu.be/uI22Yd0aEsg
4) https://youtu.be/hw4hsbbyxRY
5) https://youtu.be/kQ3kubpQfws
6) https://youtu.be/S8Qmy4fGnnE
7) https://youtu.be/CwiaS075YzQ
8) https://youtu.be/QhTI8CnRic8
9) https://youtu.be/TutiB9_EuIQ
10) https://youtu.be/YQoegtLFL5A