

# GUJARAT TECHNOLOGICAL UNIVERSITY

## MECHATRONICS ENGINEERING (20)

### DESIGN OF MECHANISMS - II

**SUBJECT CODE: 2182004**

**B.E. 8<sup>th</sup> SEMESTER**

**Type of course:** Engineering Science

**Prerequisite:** N.A.

**Rationale:** This subject is useful to understand the design aspects of mechanical component. The various components such as couplings, brakes, pulleys, gear, etc will be studied from strength point of view. The system design study approach is developed.

#### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		ESE (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	1	0	4	70	20	10	20	10	20	150

#### Content:

Sr. No.	Content	Total Hrs	% Weightage
<b>1</b>	<b>System Design Approach:</b> Ergonomic and Aesthetic considerations in design, Design synthesis, Design for reliability	<b>03</b>	<b>8</b>
<b>2</b>	<b>Design of Power Transmission Mechanism:</b> Type of coupling, Muff coupling, Split Muff coupling, Flange coupling, Bush pin type coupling, Flat belts and CI pulley.	<b>07</b>	<b>19</b>
<b>3</b>	<b>Design of Simple and Band Brakes:</b> Energy equation, Block brake with short shoe and long shoe, Pivoted block brake with long shoe, Simple band brake, Differential band brake	<b>05</b>	<b>13</b>
<b>4</b>	<b>Design of Spur Gear :</b> Gear terminology, speed ratio and number of teeth, Force analysis, Tooth stresses, Dynamic effects, Fatigue strength, Factor of safety, Gear material, Module and Face width, Power rating calculation based on strength and wear calculation.	<b>06</b>	<b>16</b>
<b>5</b>	<b>Design of Journal bearing and Selection of Rolling contact bearings:</b> Method of lubrication, Hydrodynamic, Hydrostatic boundary, Minimum film thickness, Thermal equilibrium, Selection of antifriction bearing for different loads and load cycle	<b>07</b>	<b>19</b>
<b>6</b>	<b>Design of curved beam:</b> Stress distribution in curved beam for different cross section	<b>02</b>	<b>5</b>
<b>7</b>	<b>Design of hoisting mechanism:</b> Introduction to hoisting mechanism, Design of crane hook, Design of wire rope, Design of tackle and pins	<b>03</b>	<b>8</b>
<b>8</b>	<b>Design for cyclic loading:</b> Types of cyclic load, Stress concentration, Endurance limit, Low cycle and high cycle fatigue, Notch sensitivity, Reversed stresses, Design for	<b>03</b>	<b>8</b>

	finite and infinite life, Cumulative damage, Soderberg criteria, Modified Goodman criteria, Gerber criteria, Design for infinite life under fluctuating load		
--	--	--	--

**Suggested Specification table with Marks (Theory):**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	10	10	10	-

**Legends: R : Remembrance ; U = Understanding; A = Application 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. Bhandari V. B. Design of Machine Elements Tata McGraw Hill
2. Shigley J. E Mechanical Engineering Design McGraw Hill
3. Robert L. Norton, Machine Design: An Integrated Approach, Pearson Education Publication
4. Machine design Data book, PSG

**Course Outcome:**

After learning the course the students should be able to:

1. Understand the system design concepts and design procedure for various mechanisms like hoisting mechanisms, power transmission mechanisms (couplings, gears and belt -pulleys) and mechanisms used for brakes.
2. Understand the selection procedure of rolling contact bearing and design of sliding contact bearing for various applications.
3. Capable to design the machine components under the theory of curved beam and fatigue loading.

**List of Tutorials:**

Sr. No.	Title	No. of Hrs
1	Fundamental of design: Design of various joints	1
2	Design and drawing of rigid and flexible couplings	2
3	Design and drawing of curved beams (C-clamp)	1
4	Design and drawing of hoisting mechanism	2
5	Design and drawing of gear pairs	1
6	Design of assembly: design of shaft carrying pulley, bearing selection for specific application (real life problem)	3
7	Computer programme for any one design component	2
	<b>Total:</b>	<b>12</b>

**Design based Problems (DP)/Open Ended Problem:**

Student may be given a task to exhibit their knowledge of the course studied during the academic year.

**Major Equipments / software:**

NA.

**List of Open Source Software/learning website:**

The website of NPTL may be utilized for additional learning.

**ACTIVE LEARNING ASSIGNMENTS:** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.