SARVAJANIK UNIVERSITY

Sarvajanik College of Engineering and Technology

Bachelor of Technology

Mechanical Engineering Department
B. Tech. Semester VI

Course Name: **Design of Machine Elements** **Course Code: BTME13601**
Type of course: **Professional Core Course**
Prerequisite: Strength of Material, Kinematics & Theory of Machines, Industrial Drafting and Fundamentals of Machine Design.
Rationale of Course: The major objective of this course is to provide fundamental knowledge for material selection, design of components like springs, gears, pressure vessels, bearings, gear drives, gear box and material handling equipment.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**Elements of Material Handling System:** Introduction to material handling system and its elements, types of material handling system, study of different induced stresses in crane hook, pulley and wire ropes for design of such material handling elements.	04	10 %
2	**Design of Shafts, Keys and Couplings**: Design of solid and hollow circular shaft subjected to torque and combined loading for rigidity and stiffness, design of keys and splines, Design of Couplings: rigid and flexible couplings.	09	20%

Sr. No.	Topics	Teaching Hrs.	Module Weightage
3	**Design of Spring:** Types and applications of springs, stress and deflection equations, spring materials, design of helical spring, concentric springs, and design of multi-leaf spring.	**04**	**10 %**
4	**Design of Bearings:** Rolling contact bearings: Classification of bearings, selection criteria, bearing designation; static, dynamic and equivalent bearing load, load-life relationship, bearing life and factors affecting its failures. Sliding contact bearings: Modes of lubrications, properties and characteristics of lubricants, heat dissipation of bearings, petroff's equation, mckee's equations, hydrostatic and hydrodynamic thrust bearing, performance parameters for journal bearings, design of journal bearing.	**12**	**25 %**
5	**Design of Gears:** Classification of gears, selection of type of gears, law of gearing, gear terminology, standard system of gear tooth, thermal consideration in gear drive, force analysis of spur gear, static strength of spur gear tooth, dynamic load on spur gear tooth, wear strength of spur gear tooth, design for spur gear, helical gear, bevel gear, worm gear.	**09**	**20 %**
6	**Design of Gear Box:** Classification of gear boxes, consideration in design of multi-speed gear box, various laws of stepped regulation, standard values of G. P. ratio, structural diagram, speed chart, general recommendations for developing the gearing diagram.	**07**	**15 %**

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Percentage Distribution of Marks as per Bloom's Taxonomy (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	**15**	**30**	**25**	**10**	**05**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create
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 from above table.

Reference Books:

Sr. No.	Title of book /article	Author(s)	Publisher	Publication year	Publication edition
1	Design of Machine Elements	V B Bhandari	McGraw Hill	2020	5th
2	Design of Machine Elements	C. Sharma and K. Purohit	PHI Publishers	2013	2nd
3	Design of Machine Elements	U. Jindal	Pearson Education	2019	8th
4	Mechanical Engineering Design	J. Shigley, C. Mischke, R. Budynas	Tata(McGraw Hill Publishers	2017	10th
5	Fundamental of Machine Component Design	R. Juvinall, K. Marshek	John Wiley and Sons Publishers	2021	7th

Course Outcomes (CO's):

CO. No.	CO Statements After learning this subject, students will be able to	Marks % weightage
CO-1	Illustrate the fundamental design approach of materials handling systems in industries.	10
CO-2	Evaluate the design of the shaft, keys and couplings under torque and combined loading.	20
CO-3	Calculate spring dimension in various condition.	10
CO-4	Determine various dimensional parameters of bearings.	25
CO-5	Design and analyze the different gears.	20
CO-6	Design the gear box used in various engineering application.	15

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Mapping of (CO's) with Program Outcomes (PO's) and Program Specific Outcomes (PSO's):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	2	2	2	1	0	1	1	2	1	1	1	1	3	1
CO-2	2	2	2	1	1	1	1	1	1	2	2	2	2	2	1
CO-3	2	2	2	1	1	1	1	1	1	2	1	1	1	2	1
CO-4	2	1	2	1	1	1	1	1	1	1	1	1	1	2	1
CO-5	2	2	3	3	1	1	1	1	1	1	1	1	1	3	2
CO-6	2	1	2	2	1	1	1	1	1	1	1	1	1	3	2
Rationale*	**13**	**10**	**13**	**10**	**6**	**5**	**6**	**6**	**7**	**8**	**7**	**7**	**7**	**15**	**8**

Rationale - Mapping of CO's with PO's and CO's with PSO's:

It states that the course will develop engineering knowledge, problem analysis and design / development of solutions for complex problem. This course also focuses on design and analyze different mechanical systems.

This course highly maps with Program outcomes 1,2,3,4 and Program Specific Outcomes 2. It states that the course will develop engineering knowledge, problem analysis, design / development of solutions, conduct investigations of complex problems and finally it will lead to with the use of modern computing tools.

List of Practical:

1. Design of elements for material handling system
2. Design of helical spring
3. Design of leaf spring
4. Design of coupling
5. Design of sliding contact bearing
6. Design of rolling contact bearing
7. Design of spur gear
8. Design of gear box

Major Equipment:

1. Computational facilities

List of Open Source/learning website:

1. https://nptel.ac.in/courses/112105124
2. https://nptel.ac.in/courses/112106137

List of Open Source Software: 3D Modeling Software