



JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE
JECRC Campus ,Shri Ram ki Nangal, Via-Vatika ,Tonk Road, Jaipur
Department of Mechanical Engineering

Name of Subject: Design of Machine Elements-I(DME-I)

Subject Code: 5ME4-04

Year: 3rd Year, 5th Semester

Name of Faculty: 1.Mr Aashish Nagpal, Assistant Professor

2. Mr Tej Bahadur Singh, Assistant Professor

Vision and Mission of Institute:

Vision: To become a renowned center of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

Mission:

M1: Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.

M2: Identify, based on informed perception of Indian, regional and global needs, areas of focus and provide platform to gain knowledge and solutions.

M3: Offer opportunities for interaction between academia and industry.

M4: Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

Vision and Mission of Department:

Vision: The Mechanical Engineering Department strives to be recognized globally for outcome based technical knowledge and to produce quality human resource, who can manage the advance technologies and contribute to society.

Mission:

M1: To impart quality technical knowledge to the learners to make them globally competitive mechanical engineers.

M2: To provide the learners ethical guidelines along with excellent academic environment for a long productive career.

M3: To promote industry-institute relationship.

SYLLABUS

Credit: 3
3L+0T+0P

Max. Marks: 150(IA:30, ETE:120)
End Term Exam: 3 Hours

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Materials: Mechanical Properties and IS coding of various materials, Selection of material from properties and economic aspects.	3
	Manufacturing Considerations in Design: Standardization, Interchangeability, limits, fits tolerances and surface roughness, BIS codes, Design consideration for cast, forged and machined parts. Design for assembly.	4
3	Design for Strength: Modes of failure, Strength and Stiffness considerations, Allowable stresses, factor of safety, Stress concentration: causes and mitigation, fatigue failures.	4
	Design of Members subjected to direct stress: pin, cotter and keyed joints.	5
4	Design of Members in Bending: Beams, levers and laminated springs. Design for stiffness of beam: Use of maximum deflection formula for various end conditions for beam design	7
5	Design of Members in Torsion Shaft and Keys: Design for strength, rigidity. Solid and hollow shafts. Shafts under combined loading. Sunk keys.	5
	Couplings: Design of muff coupling, flanged couplings: rigid and flexible	3
6	Design of Threaded fasteners: Bolt of uniform strength, Preloading of bolts: Effect of initial tension and applied loads, Eccentric loading	4
	Power screws like lead screw, screw jack	2
	Design of members which are curved like crane hook, body of C-clamp, machine frame etc.	3
TOTAL		41

REFERENCE BOOKS (DME-I)

TEXT BOOK		
1	Bhandari, V. B., Introduction to Machine Design, McGraw Hill Education (India)	2013
REFERENCE BOOKS		
SN	Name of Authors /Books /Publisher	Year of Pub.
1	Bahl and Goel, Mechanical Machine Design, Standard Publishers Distributors	2002
2	Shigley, Joseph E., Mechanical Engineering Design, McGraw Hill Education (India)	2002
3	Sharma and Aggarwal, Machine Design, S.K.Kataria and Sons, Delhi.	1997
4	Sharma and Purohit, Design of Machine Elements, Prentice Hall India.	2002
5	Jindal U C, Machine Design, Pearson Education India	2010

COURSE OUTCOME

Subject: Design of Machine Elements - I

Code: 5ME4-04

CO-1	To select the engineering materials as per manufacturing and design consideration
CO-2	To differentiate the basic analytical design under different loading conditions.
CO-3	To estimate the stresses and strains induced in different m/c element subjected to torsion and bending .
CO-4	To design threaded fasteners.

PROGRAM OUTCOMES (PO's)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems in Mechanical Engineering.

PO2: Problem analysis: Identify, formulate, research literature, and analyze complex Mechanical Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex Mechanical Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in Mechanical Engineering.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex Mechanical Engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Mechanical Engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional Mechanical Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Mechanical Engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings in Mechanical Engineering.

PO10: Communication: Communicate effectively on complex Mechanical Engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the Mechanical Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change in Mechanical Engineering.

Co-Po Mapping (DME-I)

Subject Code	COs	Program Outcomes (POs)											
		PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
5ME4-04	CO-1	3	3	3	3	2	1	2	1	2	2	2	2
	CO-2	3	3	3	3	1	1	2	1	1	2	2	2
	CO-3	3	3	3	3	2	2	1	1	2	1	2	2
	CO-4	3	3	3	3	2	1	1	2	2	3	2	2

LECTURE PLAN

S. No	Lecture	Topic to be discussed	Relevant COs	Objective of Unit	Outcome of Lecture (After completion of this lecture students will be able to)	Method	Book referred	From page to
1	1	Introduction to the subject and course outcome	CO1, CO2, CO3, CO4					
2	2	Mechanical properties of material	CO1	Student will be able to evaluate the tolerance according to type of assembly	To learn mechanical property of material	Chalk and talk.	Machine Design, Khurmi & Gupta	1
3	3	IS coding of different Material	CO1		To learn IS coding of different type of steel.	Chalk and talk.	Machine Design, Khurmi & Gupta	2,3,4

4	4	Selection of Material from properties	CO1	required and minimize the stresses	To learn selection of material.	Chalk and talk.	Machine Design, Khurmi & Gupta	2,3
5	5	Manufacturing consideration in design and standardization	CO1		To learn manufacturing consideration in design.	Chalk and talk.	Machine Design, Khurmi & Gupta	5,6
6	6	Interchangeability, limit, fit and tolerances	CO1		To understand the concept of limit, fits and tolerances	Chalk and talk.	Machine Design, Khurmi & Gupta	32-33
7	7	Surface Roughness and BIS codes	CO1		To learn about surface roughness.	Chalk and talk.	Machine Design, Khurmi & Gupta	287-294
8	8	Design consideration for casting, forging and Machining	CO1		To understand design consideration in casting.	Chalk and talk..	Nptel	
9	9	*Study of theories of failures	CO2		Chalk and talk.	Machine Design, Khurmi & Gupta		
10	10	Different Modes of failure and strength and stiffness	CO2	Student will be select material according to factor of safety and load required.	To understand the different modes of failure.	Chalk and talk.	Nptel	
11	11	Allowable stress and factor of safety	CO2		To understand the concept of FOS and endurance limit.	Chalk and talk..	Machine Design, Khurmi & Gupta	63
12	12	Stress concentration causes and mitigation	CO2		To understand the significance of stress concentration.	Chalk and talk..	Machine Design, Khurmi & Gupta	69
13	13	Design Procedure of Knuckle joint	CO2		To design knuckle joint.	Chalk and talk.	Machine Design, Khurmi & Gupta	80
14	14	Design Procedure of Knuckle joint	CO2		To design knuckle joint.	Chalk and talk.	Machine Design, Khurmi & Gupta	125

15	15	Design procedure of cotter joint	CO2		To learn design of cotter joint.	Chalk and talk..	Machine Design, Khurmi & Gupta	126
16	16	Design procedure of cotter joint	CO2		To learn design of cotter joint.	Chalk and talk.	Machine Design, Khurmi & Gupta	127
17	17	Design of Different Beams	CO2		To learn different types of beam.	Chalk and talk.	Nptel	
18	18	Numerical Problems on knuckle joint	CO2		To solve problem on knuckle joint.	Chalk and talk.	Nptel	
19	19	Numerical Problems on cotter joint	CO2		To solve problem on cotter joint.	Chalk and talk..	Nptel	
20	20	Design of Lever	CO3	Student will be able to design leaf spring and lever.	To understand about the lever.	Chalk and talk.	Nptel	
21	21	Mathematical Problems on lever	CO3		To learn how to solve problem on lever.	Chalk and talk.	Nptel	
22	22	*Introduction to different types of springs	CO3			Chalk and talk.	Machine Design, Khurmi & Gupta	
23	23	Design of leaf spring	CO3		To learn design of leaf spring.	Chalk and talk.	Machine Design, Khurmi & Gupta	66-67
24	24	Mathematical Problems on leaf springs	CO3		To calculate stress on leaf spring.	Chalk and talk.	Machine Design, V B Bhandari	331-333
25	25	Calculation of maximum deflection of beam	CO3		To learn about maximum deflection of beam.	Chalk and talk..	Machine Design, V B Bhandari	333
26	26	Curved Beam design	CO3		To design curved beam.	Chalk and talk..	Machine Design, Khurmi & Gupta	334
27	27	Calculation of total shear stress in spring	CO3		To calculate total shear stress in spring	Chalk and talk.	Machine Design, Khurmi & Gupta	341
28	28	Calculation of deflection in spring	CO3		To know about deflection in spring.	Chalk and talk.	Machine Design, Khurmi & Gupta	342
29	29	Numerical problem	CO3		To solve numerical problem on spring.	Chalk and talk.	Nptel	

		on different type of lever						
30	30	Study of different type of lever	CO3		To learn about the lever.	Chalk and talk..	Nptel	
31	31	Numerical problem on different type of lever	CO3		To solve numericals on lever.	Chalk and talk.	Nptel	
32	32	Design of shaft on basis of strength and stiffness	CO3		To learn about design of shaft.	Chalk and talk..	Nptel	
33	33	Design of solid shaft and Mathematical problem	CO3	Student will be able to determine shaft parameters so that the design conditions for performance are met.	To solve problems on shaft.	Chalk and talk.	Machine Design, Khurmi & Gupta	50-52
34	34	Design of hollow shaft and mathematical problem	CO3		To know about the hollow shaft.	Chalk and talk.	Machine Design, Khurmi & Gupta	54-56
35	35	Design procedure of sunk key	CO3		To learn about the sunk key.	Chalk and talk.	Machine Design, Khurmi & Gupta	137-156
36	36	Design procedure of muff coupling and clamp coupling	CO3		To design muff coupling.	Chalk and talk.	Machine Design, Khurmi & Gupta	215-234
37	37	Design of flange coupling\	CO3		To design flange coupling.	Chalk and talk.	Machine Design, Khurmi & Gupta	235-239
38	38	Protected and unprotected type flange coupling	CO3		To differentiate between protected and unprotected type coupling.	Chalk and talk.	Nptel	
39	39	Pre loading of bolts and its effect	CO4		Student will be able to design threaded fasteners.	To learn about the preloading of bolts.	Chalk and talk.	Machine Design, Khurmi & Gupta
40	40	Design of Screw jack	CO4	To design screw jack.		Chalk and talk..	Machine Design, Khurmi & Gupta	530-533

41	41	Design of crane hooks and C clamp in curved beams	CO4	To learn about the design of curved beams.	Chalk and talk..	Machine Design, Khurmi & Gupta	451-453
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***BC: Beyond Curricula**