

Name of Institute: Institute of Technology & Engineering, Indus
University Name of Faculty: Ravi Dabla

Course code: ME0542

Course name: Machine Design-I

Pre-requisites: Engineering Mechanics, Strength of Material, Design of Machine

Element Credit points: 4

Offered Semester: 5th

Course Coordinator:

Full Name: Ravi Dabla

Department with sitting location: DH-01, Third floor, Bhanwar Building

Telephone: 8866161938

Email: ravidabla.me@indusuni.ac.in

Consultation times: Friday 2:25 pm to 3:20pm

Course Lecturer:

Full Name: Parita Sheth

Department with sitting location: DoM lab, First floor, Bhanwar

Building Telephone: 9925846097

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Consultation times: Friday 2:25 pm to 3:20pm

Students will be contacted throughout the Session via Mail with important information relating to this Course.

Course Objectives

By participating in and understanding all facets of this Course a student will:

1. To develop an ability to design a mechanical component subjected to fluctuating loads.
2. To develop an ability to design mechanical springs, clutch, brakes and pressure vessels.
3. To develop an ability to design coil springs (compression, tension and torsion) under various loading conditions.

Course Outcomes (CO)

On the completion of this course, students will be able to...

1. Estimate the fatigue strength and fluctuating loads that will cause failure in real parts using the Soderberg and Goodman techniques. Determine
2. suitable material and size for structural components in machines,
3. including effects of fatigue and stress concentration.
Analyze and design components with non-uniform cross sections.
4. Analyze the stress and strain in springs, thick and thin cylinders and clutch plates.

Course Outline

Unit 1 – Design against Fatigue loading, Different design criteria for fatigue loading

Unit 2 - Design of Different type of mechanical springs, spring material, Leaf and torsion springs

Unit 3 - Design of clutches under uniform pressure and uniform wear criteria, design of different type of brakes

Unit 4 – Stress generation of pressurized vessels, design of cylindrical pressure vessel, end condition, compounding

Method of delivery

For this subject face to face lectures are conducted with ppt and conventional method.

Study time

- 1) Three lectures in a week.
- 2) One hour tutorial for each sub group (once in a week).

CO-PO Mapping (PO: Program Outcomes)

- PO1 Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2 Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3 Design/development of solutions:** Design solutions for complex 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.
- PO5 Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex 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 engineering practice.
- PO7 Environment and sustainability:** Understand the impact of the professional 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 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.
- PO10 Communication:** Communicate effectively on complex 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 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.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	3	2	3	-	-	-	-	-	1	-	2
CO2	3	2	2	2	-	-	-	-	-	1	-	2
CO3	3	2	1	1	-	-	-	-	-	2	-	1
CO4	3	3	2	1	-	-	-	-	-	2	-	1

1-Lightly Mapped 2- Moderately Mapped 3- Highly Mapped

Blooms Taxonomy and Knowledge retention(For reference)

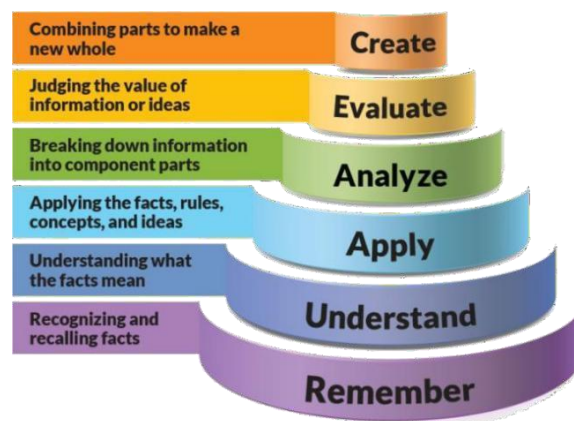


Figure 1: Blooms Taxonomy

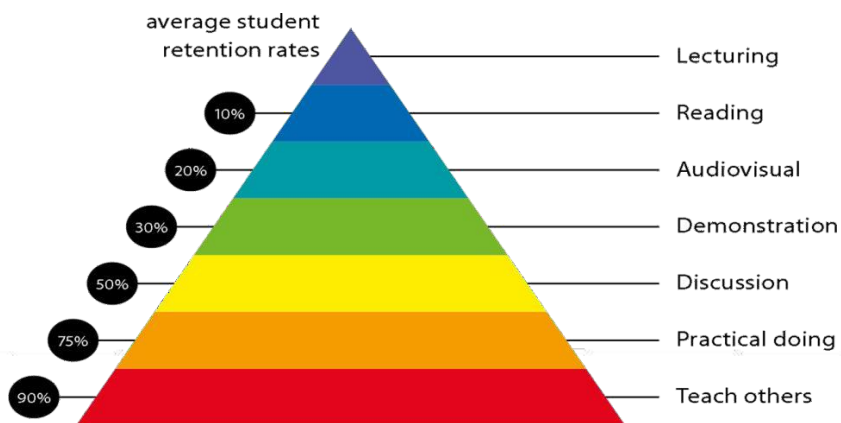


Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

General Graduate Qualities	Specific Department of Mechanical Graduate Capabilities
<p>Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally.</p> <p>Know how to apply this knowledge.</p> <p>Understand how an area of study has developed and how it relates to other areas.</p>	<p>1 Professional knowledge, grounding & awareness</p>
<p>Independent learners Engage with new ideas and ways of thinking and critically analyze issues.</p> <p>Seek to extend knowledge through ongoing research, enquiry and reflection.</p> <p>Find and evaluate information, using a variety of sources and technologies.</p> <p>Acknowledge the work and ideas of others.</p>	<p>2 Information literacy, gathering & processing</p>
<p>Problem solvers Take on challenges and opportunities.</p> <p>Apply creative, logical and critical thinking skills to respond effectively.</p> <p>Make and implement decisions.</p> <p>Be flexible, thorough, innovative and aim for high standards.</p>	<p>4 Problem solving skills</p>
<p>Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings.</p> <p>Recognize how culture can shape communication.</p>	<p>5 Written communication</p>
	<p>6 Oral communication</p>
	<p>7 Teamwork</p>
<p>Responsible Understand how decisions can affect others and make ethically informed choices.</p> <p>Appreciate and respect diversity.</p> <p>Act with integrity as part of local, national, global and professional communities.</p>	<p>10 Sustainability, societal & environmental impact</p>

Practical work:
NA

Lecture/tutorial times

Lecture:

- 1) Three lectures in a week.

Tutorial:

- 1) One hours tutorial for each sub group (once in a week).

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the Course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for mid and end semester examinations.

Details of referencing system to be used in

written work Text books

- 1 V.B. Bhandari, Design of Machine Elements, Tata McGraw Hill Publishing Co. Design
- 2 of Machine Elements, M.F.Spotts, T.E.Shoup, L.E.Hornberger, S.R.Jayaram and C.V. Venkatesh, Pearson Education.
- 3) Josheph Shighly, Mechanical Engineering Design, Tata McGraw Hill Book Co.
- 4) Farazdak Haideri, Machine Design - Volume 1, 2, Nirali Prakashan.
- 5) Dr. S.S. Wadhwa, Machine Design, Dhanpat rai & Co.
- 6) P.C.Sharma & Aggarwal, Machine Design, Katariya& Sons.

Reference Books

- 1 Joseph Shigley, Charles Mischke, Thomas Brown, Standard Handbook of Machine Design, McGraw-Hill Publishing Co .
- 2 Norton and Norton, Machine Design: An Integrated Approach, Pearson Publication.

1) Theory Assessment:

- a) CIE theory will contains **60** marks and the distribution of marks will be as follows:

Distribution	Marks	Remarks
Active participation during lecture and tutorial	10	Based on active participation marks will be allotted
Assignment / Tutorial	20	Tutorial will be shared with the students.
Quiz	20	Two class tests will be conducted during the semester (MCQ's) <ul style="list-style-type: none"> - Class Test 1 - Class Test 2
Presentation	10	<ul style="list-style-type: none"> - Presentation content will not be from the syllabus topics but must contain the application of subject - Presentations marks will be provided on the basis of : Content, communication, presentation, questionnaires.
Total marks	60	

- b) ESE theory will contain **40** marks.

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in mid semester or end semester will be considered for supplementary assessment in the respective components (i.e. mid semester or end semester) of semester concerned. Students have to remain present during the supplementary examination period to take up the respective components (mid semester or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of marks based on number of days after due date.

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Course schedule

Weeks 1	Stress Concentration, Stress Concentration Factors, Reduction of Stress Concentration, Fluctuating Stresses, Fatigue Failure, Endurance Limit ,	1,2,3	Chalk and talk
Weeks 2	Low-cycle and High-cycle Fatigue, Notch Sensitivity, Endurance Limit—Approximate Estimation, Reversed Stresses—Design for Finite and Infinite Life,	1,2,3	Chalk and talk
Week 3	Cumulative Damage in Fatigue, Soderberg and Goodman Lines, Modified Goodman Diagrams, Gerber Equation, Fatigue Design under Combined Stresses.	1,2	Chalk and talk
Week 4	Types of Springs, Terminology of Helical Springs, Styles of End, Stress and Deflection Equations, Series and Parallel Connections,	3,4	Chalk and talk
Week 5	Spring Materials, Design of Helical Springs, Spring Design—Trial-and-Error Method, Design against Fluctuating Load,	3,4	Chalk and talk
Week 6	Optimum Design of Helical Spring, Multi- Leaf Spring, Nipping of Leaf Springs, Shot Peening.	2,3,4	Chalk and talk
Week 7	Classification, positive clutches, friction clutches, material for friction surfaces, types of friction clutches, considerations in designing a friction clutch, single disc or plate clutch, design of a disc or plate clutch,	3,4	Chalk and talk
Week 8	Multiple disc clutch, cone clutch and centrifugal clutch.	3,4	Chalk and talk
Week 9	Brakes Types of brakes, design of band brake, pressure between band and drum, average pressure,	2,3,4	Chalk and talk
Week 10	Heat generation and dissipation. Band and Block brake, Block brake.	3,4	Chalk and talk
Week 11	Thin cylinders, change in the volume of cylindrical shell due to internal pressure, thin spherical shell subjected to internal pressure,	2,4	Chalk and talk
Week 12	Thin spherical shell- change in dimensions, thick cylinders, Lamé's equation,	2,3,4	Chalk and talk

	Week 13	Clavarino's and Birnie's equations, compound cylinders, cylinder heads and cylinder plates.	3,4	Chalk and talk
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