Name of Institute: ITE, Indus University
Name of Faculty: Parita Sheth
Course code: ME0315
Course name: Strength of Materials
Pre-requisites: Engineering mechanics
Credit points: 4
Offered Semester: 3rd

Course coordinator (16 weeks July to Dec 2021)
Full name: Parita Sheth
Department with siting location:Mechanical Department , SoM lab.
Telephone:9925846097
Email:paritasheth.me@indusuni.ac.in
Consultation times:4 p.m. to 5 p.m.

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 gain a fundamental understanding of the concepts of stress and strain by analysis of solids and structures.

2. To study engineering properties of materials, force-deformation and stress-strain relationship

3. To learn fundamental principles of equilibrium, compatibility, and force-deformation relationship, and principle of superposition in linear solids and structures

4. To analyze, determinate and indeterminate axial members, tensional members and beams to determine axial forces, torque, shear forces, bending moments, slopes and deflection.

5. To determine stress, strain, and deformation of bars, beams and springs.

6. To be able to perform structural analysis by hand computations and design axial and tensional members.

Course Outcomes (CO)
1.Analyze and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials.
2. Utilize appropriate materials in design considering engineering properties, sustainability, cost and weight.

3. Perform engineering work in accordance with ethical and economic constraints related to the design of structures and machine parts

Course Outline

Simple Stresses and Strains
Elastic Constants
Principal Stresses and Strain
Beams
Bending of Beams
Deflection of Beam
Columns and Struts

Method of delivery : chalk and talk

(Face to face lectures, Problem solving Techniques)

Study time

(5 hours per week)

CO-PO Mapping (PO: Program Outcomes)

Program Outcomes (PO's)

Engineering Graduates will be able to:

- 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.

2 Programme Specific Outcome

1. Apply the principles of analysing, planning, designing and executing Mechanical engineering projects keeping in view the project timeline by using the modern tools, equipment and software available, in order to achieve the smooth functioning of the projects.
2. Interact effectively with stakeholders and provide sustainable solution to Mechanical engineering problems.

Mapping of CO with PO's & PSO's

7.1 Mapping CO's with PO's

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1	3	1	1	-	-	-	-	-	-	-	-	1
CO 2	3	2	3	1	3	-	-	-	-	-	-	-

CO 3	3	2	2	2	3	-	-	-	-	-	-	-

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

7.2 Mapping of CO's with PSO's

	PSO 1	PSO 2
CO1	1	-
CO2	2	-
CO3	2	-

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

Blooms Taxonomy and Knowledge retention (For reference)

(Blooms taxonomy has been given for reference)

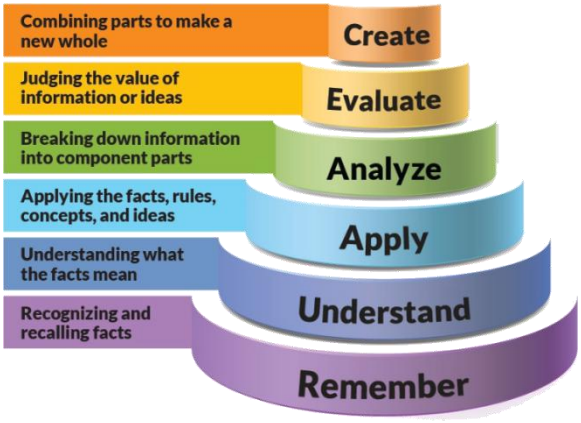

Figure 1: Blooms Taxonomy

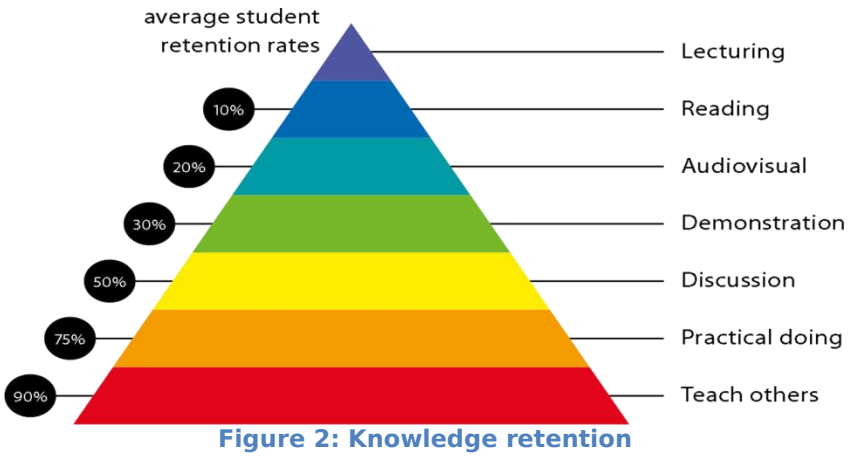

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

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

Practical work:

1. To study mechanical properties
2. To perform tensile test.
3. To study compression test.
4. To Perform Torsion test.
5. To Perform Fatigue test.
6. To Perform Impact test.
7. To Perform Brinell hardness test.
8. To Perform Rockwell hardness test.
9. To Perform Deflection of Beam.
10. To study various type of strain gauge.

Lecture/tutorial times

(Give lecture times in the format below)

Example:
Time table under progress

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 semester examinations.

Details of referencing system to be used in written work

Text books

1. Strength of Materials, Dr. R.K. Bansal, Laxmi Publication, 6th edition, 2015
2. Strength of Materials, U.C. Jindal, Pearson, 2nd edition, 2018
3. Strength of Materials, R.K. Rajput, Schand Publication 6th edition, 2015.

Additional Materials

1. Elements of Strength of Material – Timoshenko & Young- EWP press
2. Mechanics of Material-Gere and Timoshenko CBS Publications
3. Mechanics of Solids – Beer & Johnson, Tata McGraw Hill Publications
4. Strength of material – Ryder–ELBS
5. Introduction to Solid Mechanics – I. H. Shames–PHI
6. Engineering Mechanics of Solids – E.P. Popov – PHI

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

Example:

evaluation component of the 60 marks internal

Proposed Bifurcation for Theory **CIE 60 mark**s :

MSE : 40 Marks

a. Attendance and active participation in class : 10 Marks

b. Assignments: 10 Marks

Proposed Bifurcation for **Practical CIE 60 marks** :

10 marks for each experiments(10*10)=100 will be converted in to 60 Marks

SUPPLEMENTARY ASSESSMENT

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

Practical Work Report/Laboratory Report:

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -% of the maximum mark per calendar day

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.

Do not copy the work of other students.
Do not share your work with other students (except where required for a group activity or assessment)

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Course schedule (subject to change)

(Mention quiz, assignment submission, breaks etc as well in the table under the Teaching Learning Activity Column)

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
	Weeks 1	**Simple Stresses and Strains** Introduction, Stress, Strain, Types of stresses and strains, Elasticity and elastic limit, Hook's law and elastic moduli, Stress-strain relationship,	1	Chalk and talk
	Weeks 2	**Simple Stresses and Strains** Elongation of uniformly tapering circular and rectangular member, Elongation due to self-weight, Stresses in composite section, Thermal stresses	1	Chalk and talk
	Week 3	**Elastic Constants** Longitudinal, Lateral and Volumetric strain, Shear stain, Young's modulus, Bulk modulus,	*2*	Chalk and talk
	Week 4	**Elastic Constants** Shear modulus, Poisson's ratio, Relationship between Young's, Bulk and Shear modulus	2	Chalk and talk
	Week 5	**Principal Stresses and Strain** Stress in Tensile member due to pure shearing, two mutually perpendicular direct stress, principal plane, principal stresses, and Mohr circle of stress.	3	Chalk and talk
	Week 6	**Principal Stresses and Strain** Stress in Tensile member due to pure shearing, two mutually perpendicular direct stress, principal plane, principal stresses, and Mohr circle of stress.	*3*	Chalk and talk

	Week 7	**Beams** Introduction of Beams, Various type of Beams, Various type of Supports, Reactions at supports, Shear force and bending moment at any section of a beam, Methods for determination of S.F. and B.M. diagrams of beams (simply supported, overhang and cantilever) subjected to various loads, Relation between Shear Force and Bending Moment, Point of contra-flexure.	3	Chalk and talk
	Week 8	**Bending of Beams** Theory of simple bending, section modulus, symmetric section practical application of bending equation.	3	Chalk and talk
	Week 9	**Deflection of Beam** Relation between slope deflection and radius of curvature, problem by Macaulay's method, Double integration method, Moment Area Method, Conjugate Beam method.	*4*	Chalk and talk
	Week 10	**Columns and Struts** Classification, end condition, equivalent length,	4	Chalk and talk
	Week 11	**Columns and Struts** Euler's theory formula, limitation, application	5	Chalk and talk
	Week 12	**Columns and Struts** derivation, Rankine's hypothesis.	6	Chalk and talk