GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Diploma Engineering				Branch	Mechatronics Engineering		
Semester	III				Version	1.0.0.0		
Effective from Academic Year		2019-20			Effective for the batch Admitted in			June 2018
Subject code	1ME2304		Subject Name		Strength of Materials			
Teaching scheme					Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)	Total		CE	SEE	Total
	L	TU	P	TW				
Credit	3	0	1	0	4	Theory	40	60	100
Hours	3	0	2	0	5	Practical	30	20	50

Pre-requisites:
Basic Knowledge of Engineering Mechanics/Applied Mechanics.

Course Learning Outcomes:
The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies and course learning outcomes:
CO1. Understand the behaviour and analyse Statically Determinate structure like Beam, Column, & shaft under statics loads & Twisting moments.
CO2. Calculate the machine material properties & Dimension of machine component due to direct & lateral loading and due to deflection.
CO3. Determine centroid and moment of inertia of a different geometrical shape and able to understand its importance.
CO4. Understand the different types of stresses and strains developed in the member subjected to axial, bending, shear, torsion & thermal loads.

CO5. Know behaviour & properties of engineering materials.

Course Content				
Name of UNIT	Unit Content	Unit Learning Outcomes	Marks	Hrs
UNIT – 1 Direct Stress & Strain	1.1 Different types of Structures & Loads. 1.2 Stress, Strain, Elongation, Hook's Law and Modulus of Elasticity. 1.3 Principle of superposition. 1.4 Loads and Stresses in composite section 1.5 Linear strain, Lateral strain, Poisson's ratio, Volumetric strain, Bulk modulus, shear modulus, Shear stress & Shear strain, Modulus of rigidity.	1a Evaluate Material Properties Under Longitudinal , Lateral Loads & Thermal variation 1b Analyse Composite & Compound Section for stress & strain. 1c Compute Strain Energy under Different types of Loading on elements.	10	9

	1.6 Thermal stress and strain. 1.7 Strain energy and Differentiate Sudden, Gradual & Impact loading.			
UNIT – 2 Shear Force (S.F.) & Bending Moment (B.M.) in Beam	2.1 Shear force and Bending moment, Relation between S.F. and B.M., Point of contra flexure & its importance. 2.2 S.F & B.M. Diagram, Sagging & Hogging bending moment and its importance. 2.3 S.F. & B.M Diagram for Cantilever beam, simply supported beam & Over Hanging beam subjected to Point load and/or UDL.	2a Draw the Shear Force & Bending Moment Diagram for Statically Determinate Beams	10	6

UNIT – 3 Moment of Inertia	3.1 Moment if Inertia, Section modulus & Radius of Gyration. 3.2 Parallel axis & Perpendicular axis Theorem. 3.3 Formula of Moment of Inertia of Solid & Hollow sections like Rectangle, Circle and Triangle etc. 3.4 umerical based on Moment of Inertia about C.G for T-Section, I-section, C-section, Channel Section, Angle Section and Built up Section.	3a Compute Moment of Inertia of Symmetric & asymmetric structural sections.	8	5
UNIT – 4 Bending Stresses in Beam	4.1 Bending stress, Neutral plane and Neutral axis, moment of Resistance. 4.2 Bending theory Equation & its assumptions and its Numerical. 4.3	4a Use 'Theory of Bending' to compute stresses in Beams	5	5

	quation of Shear stress and Shear stress distribution diagram of different section.			
UNIT – 5 Slope & Deflection of Beam	5.1 Slope & Deflection	5a Determine deflection induced in Statically Determinate Beams	5	3
	5.2 Formulae for Cantilever beam subjected to Point load at free end & UDL with full span.			
	5.3 Formulae for Simply Supported beam subjected to Centre Point load & UDL with full span.			
	5.4 Numerical on Slope & Deflection for Cantilever beam & Simply Supported beam.			

UNIT – 6 Column & Strut	6.1 Column, Strut, Short & Long Column, Radius of Gyration, Slenderness Ratio. 6.2 End condition of Column and Effective length of Column. 6.3 Euler's Formula for Crippling load and its assumptions & its Numerical. 6.4 Rankine's Empirical Formula & its Numerical.	6a Calculate Load carrying capacity of Column & Strut	5	3

UNIT – 7 Combined Direct and Bending Stresses	7.1 Axial load, Eccentric load and Eccentricity. 7.2 Formula for Combined Direct & Bending Stresses. 7.3 Limit of Eccentricity (No tension condition). 7.4 Core section for Rectangular & Circular (Hollow & Solid) 7.5 Numerical on Combined Stresses for Rectangle & Circular Section.	7a Analyse Structural components subjected to Axial Eccentric Loads	5	4
UNIT – 8 Principal Plane and Principal Stresses	8.1 Principal Plane & Principal Stress. 8.2 Formulae for Normal, Tangential & Resultant Stresses & its Numerical.	8a Calculate Principal Stresses on a plane in a Strained structural Material	5	5

	8.3 Formulae for Principal Stresses and Location of Principal Planes & its Numerical. 8.4 Graphical method (Mohr Circle Method) for Numerical.			
UNIT – 9 Torsion	9.1 Torsion, Angle of Twist, Polar Moment of Inertia, Polar Section Modulus and Torsional Rigidity. 9.2 Formula of Torsional Stress & Power Transmitted / Consumed for shaft, spindle and axle of solid and hollow sections subjected to Torsion. 9.3 Numerical based on torsion.	9a Analyse Machine Components subjected to Torsion for torsional stress. 9b Calculate Power Transmitted by Shaft subjected to Torsion.	5	3

UNIT – 10 Mechanical Properties of Materials	10.1 Various Mechanical Engineering Materials & its Properties.		10a Identify various materials used in Mechanical Engineering	2	2
	10.2 Mechanical al Testing of Materials like Tensile, Compressive, Hardness, Impact, Shear test		10b Evaluate Mechanical Properties of Materials used.		

List of Practical		
No.	Unit	Name of Practical
1		Draw Stress Strain Curve for Tension Test on Ductile Materials like Mild Steel.
2		Find out Compressive Strength of Material using Compression Testing Machine.
3		Determine Young's Modulus of wire of Given Material.
4		Calculate Moment of Inertia of Given Section.
5		Demonstrate End Conditions of Column.
6		Calculate Impact Value of Mild Steel using IZOD Impact Test Apparatus.
7		Calculate Impact Value of Mild Steel using Charpy Impact Test Apparatus.
8		Calculate Hardness of given material using Brinell Hardness Number machine.
9		Calculate Hardness of given material using Rockwell Hardness machine.

List of Instruments / Equipment / Trainer Board	
1	Universal Tensile Testing Machine
2	Compressive Testing Machine
3	SEARL's Apparatus to find Young's Modulus
4	Different section for Moment of Inertia
5	Working Model of End Conditions of Column
6	IZOD Impact Test Apparatus
7	CHARPY Test Apparatus
8	Brinell Hardness Testing machine
9	Rockwell Hardness Testing machine

List of Reference Books			
No	Title of Reference Books	Authors	Publication
1	Strength of Materials	Dr. R. K. Bansal	Laxmi Publication
2	Strength of Materials	R. S. Khurmi	S. Chand

3	Strength of Materials & Mechanics of Structures	Dr. B C Punamia	
4	Strength of Materials	Dr. D. S. Bedi	Khanna Publication

Link of Learning Web Resource	
1	nptel.iitm.ac.in/courses/.../IIT.../lecture%2023%20and%2024.htm
2	en.wikipedia.org/wiki/Shear_and_moment_diagram
3	www.freestudy.co.uk/mech%20prin%20h2/stress.pdf
4	www.engineerstudent.co.uk/stress_and_strain.html
5	https://www.iit.edu/arc/workshops/pdfs/Moment_Inertia.pdf

CO'S AND PO'S MAPPING

PO'S/CO'S		CO1	CO2	CO3	CO4	CO5
PO1	Proficiently applies concepts, theories and techniques of the relevant natural, physical sciences and knowledge in mathematics.	**SUB**	**SUB**	**SUB**	**SUB**	**SUB**
PO2	Use basic principles of statics, dynamics, fluid mechanics, engineering materials, strength of materials engineering standards and manufacturing processes to aid in the design, characterization, analysis and troubleshooting of mechanical system.	**SUB**	**SUB**	**SUB**	**SUB**	**SUB**
PO3	Apply their engineering knowledge, critical thinking and problem solving skills in professional engineering practice or in non-engineering fields, such as law, medicine or business.	**SUB**	**SUB**	**SUB**	**SUB**	**SUB**
PO4	Continue their intellectual development, through, for example, graduate education or professional development courses	**SLI**	**SLI**	**SLI**	**SLI**	**SLI**
PO5	Use of appropriate computer languages, modern tool and application software that pertain to Mechanical engineering technology systems.	**SLI**	**SLI**	**SLI**	**SLI**	**SLI**
PO6	Ability to identify problems, conducts experiments, gather data, analyze data and produce results.	**MED.**	**MED.**	**MED.**	**MED.**	**MED.**
PO7	Retain the intellectual curiosity that motivates lifelong learning and allows for a flexible response to the rapidly evolving challenges of the 21st century	**NONE**	**NONE**	**NONE**	**NONE**	**NONE**
PO8	Design a system component or process to meet desired need within realistic constraints, such as economic, environmental and social.	**SLI**	**SLI**	**SLI**	**SLI**	**SLI**
PO9	Values the need for, and demonstrates, ethical conduct and professional accountability.	**NONE**	**NONE**	**NONE**	**NONE**	**NONE**
PO10	Demonstrates effective communication to professional and wider audiences.	**SLI**	**SLI**	**SLI**	**SLI**	**SLI**
PO11	Appreciates entrepreneurial approaches to engineering practice.	**SLI**	**SLI**	**SLI**	**SLI**	**SLI**
PO12	Apply commitment to quality, timeliness, and continuous improvement.	**NONE**	**NONE**	**NONE**	**NONE**	**NONE**