Lok Jagruti Kendra University
University with a Difference

Diploma in Automation & Robotics

Course Code: 025120402

Strength of Materials

Programme / Branch Name			Diploma in Automation & Robotics			
Course Name	Strength of Materials				**Course Code**	025120402
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
3	1	0	4	50	50	-	100

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ Basic Mathematics
- ✓ Physics
- ✓ Applied Mechanics

3. Rationale

In the strength of materials subject the mechanics of deformable solids is more concerned with the internal forces and associated changes in the geometry of the components involved of particular importance are the properties of the materials used, the strength of which will determine whether the components fail by breaking in service, and the stiffness of which will determine whether the amount of deformation they suffer is acceptable. therefore, the subject of the strength of materials is central to the whole activity of engineering design. usually, the objectives in the analysis here will be the determination of the stresses, strains, and deflections produced by loads. theoretical analyses and experimental results have an equal role in this field.

4. Objectives

- ✓ To determine the mechanical behavior of the body by determining the stresses, strains produced by the application of load.
- ✓ To apply the fundamentals of simple stresses and strains.
- ✓ To facilitate the concept of bending and its theoretical analysis.
- ✓ To apply fundamental concepts related to deformation, load-carrying capacity, principal stresses, and strains, shear forces, bending moments, truss, column, and struts.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1.	**Simple Stress and Strain**	1.1. Classification of structure and loads. 1.2. Stresses, simple stresses, and strain. 1.3. Elasticity elastic limit, hooke's law, elastic moduli, modulus of elasticity, factor of safety. 1.4. Analysis of bars of varying cross section. 1.5. Longitutional strain, lateral strain, poisson's ratio, bulk modulus volumetric strain. 1.6. Shear stress, shear modulus, relation between elastic modulus (e,c, and k). 1.7. Thermal stress and strain. 1.8. Stress vs strain curve.	• To understand understand the basics of material properties, stress and strain. • Understand the concept of stresses and strains, elastic constants and thermal stress and strain	30	12
2.	**Principal Stress and Principal Plane**	2.1. Introduction. 2.2. Principal stress and principal plane. 2.3. Methods of determining stresses on oblique section. 2.4. Analytical method for determining stresses on oblique section. 2.5. Graphical method for determining stresses on oblique section. 2.6. Mohr's circle to combination of point load & udl.	• Analyze various situations involving structural members subjected to plane stresses by application of mohr's circle of stress.	20	10
3.	**Shear Force and Bending Moment**	3.1. Basic definition. 3.2. Classification of beams 3.3. Sign convention for shear force and bending moment. 3.4. Shear force and bending moment diagrams for a point load on cantilever beams.	• To understand the structural behavior of beam. • To determine the effects of external loads such as axial loads, shear force, and bending moment at any section of the beam.	10	4

		3.5. Shear force and bending moment diagrams for a uniformly distributed load on cantilever beams. 3.6. Shear force and bending moment diagrams for a point load on simply supported beams. 3.7. Shear force and bending moment diagrams for a uniformly distributed load on simply supported beams. 3.8. Determination of shear force and bending moment of various cases.	• To derive the differential relationships between the load intensity shear force and bending moment. • To draw shear force and bending moment diagram for statically determinate beams.		
4.	**Stresses in Beams**	4.1. Theory of simple bending or pure bending with assumptions (bending equation). 4.2. Section modulus. 4.3. Position of neutral axis and section modulus. 4.4. Bending stress in symmetric and unsymmetrical section. 4.5. Numericals of bending stress in beams having various cross-section and having differently loaded.	• Develop an understanding of the models and procedures used in the analysis of transversely loaded beams with various support conditions.	15	6
	Trusses	4.6. Introduction. 4.7. Determination of reaction – graphical method. 4.8. Determination of stress using graphical or analytical method.	• Ability to analyze statically determinate trusses, beams, and frames and obtain internal loading.		
5.	**Slope and Deflection**	5.1. Introduction of beam and deflection. 5.2. Formulae for cantilever beam subjected to concentrated load and uniformly distributed load. 5.3. Formulae for simply supported beam subjected to concentrated load and	• Methods are learned for determining the slope and deflections produced in various members produced by applied loading.	25	10

		uniformly distributed load. 5.4. Numerical on slope and deflection.			
	Column and Strut	5.5. Introduction & definition. 5.6. Classification of column. 5.7. Column end condition and effective length. 5.8. Euler's formula and assumptions of euler formulae. 5.9. Numerical on column.	• Analyze slender, long columns subjected to axial loads. • Develop an understanding of analytic methods used in connection with the structural design of columns, long mechanical members under compression.		
				Total Hours	**42**

6. List of Practicals / Exercises

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills so that students can acquire the competencies/Programme outcomes. Following is the list of practical exercises for guidance.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	Stresses : simple stresses & strain, lateral strain, thermal stress and strain.	Stress, strain, and thermal stress.	6
2.	Principal stress and principal plane.	Normal, tangential, resultant, and principal stresses using mohr's circle diagram.	4
3.	Shear force and bending moment.	Shear force diagram and bending moment diagram.	8
4.	Stresses in beams.	Shear stress distribution diagrams, maximum bending stress.	6
5.	Slope and deflection.	Slope and deflection of the simply supported beam and cantilever beam under various loading condition.	4
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	Ap %	C %	E %	An %
1.	Simple stress and strain	14	18	45	12	6	5
2.	Principal stress and principal plane	12	8	40	24	8	8
3.	Shear force and bending moment	6	8	48	22	10	6
4.	Stresses in beams and trusses	14	22	26	24	4	10
5.	Slope and deflection and column and strut	18	22	28	22	4	6

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. Textbooks

1) Strength of Materials – by R. K. Rajput (S. Chand Publication)
2) Mechanics of Solids – by R.S. Khurmi (S. Chand Publication)

9. Reference Books

1) Strength of Materials- by S S Rattan, Tata McGraw Hill; New Delhi
2) Strength of Materials- by R. K. Bansal, Laxmi Publication

10. Open Sources (Website, Video, Movie)

1) https://nptel.ac.in/course.html
2) https://nptel.ac.in/courses/112/105/112105164/
3) https://youtu.be/C-FEVzI8oe8
4) https://youtu.be/AvvaCi_Nn94
5) https://youtu.be/78K0pbvHzjM
6) https://youtu.be/Hn_iozUo9m4
7) https://youtu.be/MvBqCeZllpQ