

**LOK JAGRUTI UNIVERSITY (LJU)**  
**INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**Department of Mechanical Engineering (710)**

**Bachelor of Engineering (B.E.) – Semester - V**

<b>Course Code:</b>	017103502
<b>Course Name:</b>	Machine Design 1
<b>Category of Course:</b>	Professional Core Course (PCC)
<b>Prerequisite Course:</b>	Mathematics 1 (017101191), Engineering Mechanics (017102291), Strength of Materials (017103391) Manufacturing Technology (017103401), Material Science and Metallurgy (017103404)

Teaching Scheme				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Total Hours
4	1	2	6	50

Syllabus				
Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	<b>Design Against Fluctuating Loads</b>			<b>5 (10%)</b>
	1.1 Stress concentration, Methods of Reducing Stress Concentration.	Stress (017103391-Unit-01)	---	
	1.2 Endurance limit and fatigue failure	Types of loads (017103391-Unit-01)	---	
	1.3 Factors affecting endurance limit, Notch Sensitivity	Mechanical properties (017103404-Unit-01)	---	
	1.4 S-N Diagram, design for reversed stresses and cumulative damage in fatigue	Stress and strain (017103391-Unit-01)	---	
02	<b>Fluctuating Stresses</b>			<b>4 (8%)</b>
	2.1 Soderberg, Gerber, Goodman and modified-Goodman criteria	Tensile and compressive stress (017103391-Unit-01)	---	
	2.2 Combined stresses	Stress (017103391-Unit-01)	---	
03	<b>Design of Springs</b>			<b>4 (8%)</b>
	3.1 Classification of springs (Helical, Conical and Volute, torsion, Leaf, Disc, Special Type)	---	---	
	3.2 Terms used in Compression Spring	---	---	
	3.3 Helical spring: style of ends, stresses, correction factors, and deflection	Stress and strain (017103391-Unit-01)	---	
	3.4 Design against static and fluctuating loads	Shear stresses (017103391-Unit-06)	---	

	3.5 Concentric springs, surge phenomenon	Shear force (017103391-Unit-04)	---	
	3.6 Helical torsion and spiral springs, shot peening of springs	Torsion (017103391-Unit-09)	---	
	3.7 Terminology, nipping and Design of multi-leaf spring	Deflection (017103391-Unit-01)	---	
	<b>Belt Drives</b>			
04	4.1 Introduction to Belt Drive, Selection of a Belt Drive, Types of Belt Drives (Light, medium and heavy), Types of Belts (Flat belt, V-belt and circular belt), Material used for Belts (Leather, cotton, Rubber and Balata belt)	---	---	6 (12%)
	4.2 Types of Flat Belt Drives (Open belt drive, Crossed or twist belt drive, quarter turn belt drive, Belt drive with idler pulleys, Compound belt drive, Stepped or cone pulley drive, Fast and loose pulley drive) and Length of the belt: open and cross drive types	Trigonometry and geometry (017101191-Unit-02)	---	
	4.3 Velocity Ratio of a Belt Drive, Slip of the Belt and Creep of Belt	---	---	
	4.4 Power Transmitted by a Belt and Ratio of tensions on tight side to slack side	Coplanar concurrent forces (017102291-Unit-02)	---	
	4.5 Centrifugal Tension, Maximum Tension in the Belt and Condition for maximum power transmission	---	---	
	4.6 Initial Tension in the Belt	---	---	
	<b>Governors</b>			
05	5.1 Necessity of governor, classification of governors (Centrifugal governors and Inertia governors)	Moments (017102291-Unit-03)	---	6 (12%)
	5.2 Working principle of centrifugal Governors and Terms Used in Governors	Centrifugal forces (017102291-Unit-02)	---	
	5.3 Analysis of Governors (Watt, Porter, Proell, Hartnell and Pickering Governors)	---	---	
	5.3 Concept of control force, control force diagram (for Porter and Spring Controlled Governors)	---	---	
	5.4 Stability of governor, condition for stability	---	---	
	5.5 Concept of isochronism, sensitivity of governor	---	---	
5.6 Characteristics of governors, hunting of governors	---	---		
	<b>Friction Devices: Clutches</b>			
06	6.1 Introduction and Types of clutches (Positive clutches and Friction clutches)	Friction (017102291-Unit-07)	---	5 (10%)
	6.2 Material for Friction Surfaces, Types of Friction Clutches (Disc or plate clutches)	Friction (017102291-Unit-07)	---	

	(single disc or multiple disc clutch, Cone clutches, and Centrifugal clutches)			
	6.3 Design of a Disc or Plate Clutch by Considerations for uniform wear and uniform pressure theory	Basic differentiation and integration (017101191-Unit-03)	---	
	6.4 Design of Multi-plate clutch and Centrifugal Clutch	Friction (017102291-Unit-07)	---	
	<b>Friction Devices: Brakes</b>			
07	7.1 Introduction and Energy Absorbed by a Brake, Classification of brakes, Materials for Brake Lining	---	---	5 (10%)
	7.2 Analysis of brakes: Single Block or Shoe Brake, Pivoted Block or Shoe Brake, Double Block or Shoe Brake	Friction (017102291-Unit-07)	---	
	7.3 Design of Simple Band Brake, Differential Band Brake, Band and Block Brake, Internal Expansion Shoe Brake (Only Theory)	Moments (017102291-Unit-03)	---	
	<b>Dynamometers and Strain Gauges</b>			
08	8.1 Classification of dynamometers	---	---	3 (6%)
	8.2 Prony brake and rope brake dynamometers	Moments and couple (017102291-Unit-03)	---	
	8.3 Hydraulic, belt transmission dynamometers	Belt drives (D-007-Unit-05)	---	
	8.4 Epicyclic-Train and Bevis-Gibson torsion dynamometers	Torsion (017103391-Unit-09)	---	
	8.5 Strain measuring instrument (Measurement of strain: Mechanical strain gauges, electrical strain gauges, strain gauge: materials, gauge factors, theory of strain gauges and method of measurement, bridge arrangement, temperature compensation.)	---	---	
	<b>Threaded Joints</b>			
09	9.1 Introduction to Threaded joint, Terminology of Screw Threads and Basic types of screw fastening,	---	---	6 (12%)
	9.2 Cap and Set screw, Bolt of Uniform strength	---	---	
	9.3 locking devices (Jam Nut, Castle Nut, Split nut, Locking with Setscrew, Locking with Spring Washer)	---	---	
	9.4 Design of Bolted Joint: Simple and Eccentric loading (Eccentric Load Acting Parallel to the Axis of Bolts and Eccentric Load Acting Perpendicular to the Axis of Bolts)	Stress and types of stress, Strain and types of strain (017103391-Unit-1.2) Moment of a force, Principle of moments, Couples, Equivalent couples (017102291-Unit-3.1)	---	
	9.5 Torque requirement for bolt tightening	---	---	
	9.6 Design of turnbuckle	---	---	
	9.7 Screw thread measurement, Errors in	---	---	

	threads			
	9.8 Screw thread gauges, measurement of element of the external and internal threads, thread caliper gauges	---	---	
<b>10</b>	<b>Welded Joints</b>			<b>6 (12%)</b>
	10.1 Introduction of welded joints, Advantages and Disadvantages of welded Joints over Riveted Joints, stress relieving of welded joints	Welding processes (017103401-Unit-06)	---	
	10.2 Types of Welded Joint (Lap and Butt Joint)	---	---	
	10.2 Strength of butt, Parallel and Transverse fillet joint	---	---	
	10.3 Maximum Shear Stress in Parallel Fillet Weld and Maximum Shear Stress in Transverse Fillet Weld	Basic differentiation and integration (017101191-Unit-03)	---	
	10.4 Eccentric load in the plane of weld, welded joint subjected to bending and torsion	Torsion (017103391-Unit-09)	---	

**Proposed Theory + Practical Evaluation Scheme by Academicians  
(% Weightage Category Wise and it's Marks Distribution)**

**L: 4      T: 1      P: 2**

**Note: In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject.**

**Each Test will be of 25 Marks.**

**Each Test Syllabus Weightage: Range should be 20% - 30%**





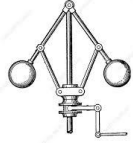
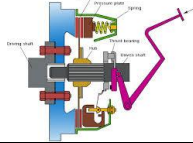



Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage
Theory	<b>5</b>	<b>6</b>	MCQ	25%	30
Theory			Theory Descriptive	0%	00
Theory			Formulas and Derivation	17%	20
Theory			Numerical	42%	50
<b>Expected Theory %</b>			<b>84%</b>	<b>Calculated Theory %</b>	<b>84%</b>
Practical	<b>1</b>		Individual Project	10%	60
Practical		Group Project	0%	0	
Practical		Internal Practical Evaluation (IPE)	0%	0	

Practical			Viva	6%	40
Practical			Seminar	0%	0
<b>Expected Practical %</b>	<b>16%</b>		<b>Calculated Practical %</b>	<b>16%</b>	<b>100</b>
<b>Overall %</b>	<b>100%</b>			<b>100%</b>	<b>200</b>

<b>Course Outcomes</b>	
	<i>Upon completion of the course students will be able to</i>
1	Analyze variable stresses induced in components subjected to fluctuating loads and calculate stresses and deflection in design of springs.
2	Design different dimensions and parameters like speed & power transmitted in Belt Drives and Governors.
3	Evaluate power lost in friction and design parameters to design friction devices like Clutches, brakes and dynamometers.
4	Compute design calculations of components joined by Threaded and Welded joints based on design procedure.
<b>Suggested Reference Books</b>	
1	Design of Machine Elements by V B Bhandari, McGraw Hill.
2	Fundamentals of Machine Component Design by R C Juvinall, Wiley.
3	Machine Design: Fundamentals and Applications by P C Gope, PHI.
4	Machine Design an Introduction by R L Norton, Pearson.
5	Mechanics of Materials by E J Hearn, BH.
6	Theory of Machines by S S Rattan 4/e, McGraw-Hill.
7	Theory of Machines and Mechanisms by J. Uicker, Gordon R Penstock and J.E. Shigley, Oxford.
8	Mechanism and Machine Theory by A G Ambekar, PHI.
9	Machine Drawing by K C John, PHI.

<b>List of Open Source Software/Learning Website</b>	
1	<a href="http://nptel.ac.in">http://nptel.ac.in</a>
2	<a href="https://www.coursera.org">https://www.coursera.org</a>
3	<a href="https://www.edx.org">https://www.edx.org</a>
4	<a href="https://in.linkedin.com">https://in.linkedin.com</a>
5	<a href="https://www.skill-lync.com">https://www.skill-lync.com</a>

## Real Practical Problem/ Hands on Project

Sr. No.	Real Practical Problem		Linked with Unit
1	Fatigue failure analysis of a helical compression spring for a heavy vehicle's suspension system.		Unit 01,02
2	How much force apply on spring for controlling the motion, as in brakes and clutch in automobile.		Unit 03
3	Design of leaf spring for bus.		Unit 04
4	Belt and drive analysis of flour mill.		Unit 05
5	In automobile, controlling the RPM of an engine by regulating the fuel supply.		Unit 06
6	Design of single-plate for four wheeler		Unit 07
7	Design of block brake for train		Unit 08
8	Measure torque and power of pelton wheel turbine using rope brake dynamometer.		Unit 09
9	Suggest the process for joining elbow in pipe.		Unit 10