Lok Jagruti Kendra University
University with a Difference

Diploma in Mechanical Engineering

LJ Polytechnic

Course Code: 025060203

Applied Mechanics

Programme / Branch Name			Diploma in Mechanical Engineering			
Course Name	Applied Mechanics				**Course Code**	025060203
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	0	2	4	50	50	50	150

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

- ✓ Fundamentals of Physics
- ✓ Fundamentals of Mathematics

3. Rationale

Applied mechanics bridges the gap between physical theory and its technical application. This subject provides an exceptional appearance to the entire extent of topics like kinetics, kinematics, Force, Moment, Friction, Center of Gravity, Work, Power Energy, Law of Machines. The subject Applied Mechanics deals with fundamental concepts of mechanics which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students & its real-life applications in the various fields of engineering.

Applied Mechanics provides the base for further studies in Structural Analysis which are required for the structural design of different components of buildings or bridges. Good knowledge of support reactions is also important to understand the behavior of structures.

4. Objectives

- ✓ To make the students know the importance of this subject in the field of engineering particularly Mechanical & Civil Engineering.
- ✓ To develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.
- ✓ Highlight the importance of friction in human life.
- ✓ It will build mathematical and numerical backgrounds for the design of simple machines.
- ✓ To understand the application of mathematics, science, and engineering fundamentals in order to solve mechanical engineering problems.

- ✓ To make the students understand the properties of surfaces and solids, predict of behavior of particles and rigid bodies under motion.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1.	**Introduction to Mechanics and Force Systems**	1.1. Significance and relevance of Engineering Mechanics, Applied Mechanics, Statics, Dynamics, Kinetics, and Kinematics. 1.2. Scalar and Vector Quantities. 1.3. Fundamental and Derived Quantities and their SI units. System of Units (FPS, CGS, MKS & SI units). 1.4. Force, Unit of Force, Characteristics of force, Principle of Transmissibility & Principle of Superposition. Force System & its classification. 1.5. Resultant Force & Equilibrant Force Composition of Forces, Analytical & Graphical Method for Law of Parallelogram, Law of Triangle 1.6. Resolution of Forces, Method of Resolution for the Resultant Force, Polygon Law of Forces.	• Applied in a static analysis of structural and mechanical systems. • Understand the differences between Scalar and Vector Quantity. • Know about the System of Units. • Calculate the resultant of various forces. • Understand and Apply Triangle Law Forces and Polygon Law of Forces and their application in real life.	30	12
2.	**Equilibrium of Forces**	2.1. Rigid Body, Free Body Diagram, Action and Reaction, Conditions of Equilibrium, Types of Equilibrium. Lami's Theorem. 2.2. Moment (Types , Applications & Graphical Representation of Moment), Varignon's	• Learn about the types of bodies and their behavior. • Understand to differentiate between moment and couple. • Calculate support reactions through	20	10

		Principle of Moment, Couple (Types, Applications & Properties of Couple) 2.3. Types of Beams and , Supports (simple, hinged, roller and fixed) and Loads (Point, UDL & UVL), Calculate support reactions for beam with or without overhanging – subjected to combination of Point load & UDL	equilibrium for various structures. • Understand the types of beams and support, their behavior after loading on it.		
3.	**Centroid & Center of Gravity**	3.1. Centroid of Geometrical Plane Figures (Triangle, Square, Rectangle, Circle, Semi-Circle, and Quarter Circle), Axis of Reference and Axis of Symmetry, Centroid of Composite Figures composed of not more than three geometrical figures. 3.2. Center of gravity of simple solids (Cube, Cuboid, Cylinder, Cone, Sphere, Hemi-Sphere), Center of Gravity of composite solids composed of not more than two simple solids. Center of Gravity of Sections with Cut Out Holes.	• Understand the difference between Axis of Symmetry and Axis of Reference • Analyses the centroid and center of gravity for various objects	10	4
4.	**Moment of Inertia**	4.1. Definition and Importance of moment of inertia, formula of moment of inertia for rectangle, triangle, circle, solid & Hollow sections. 4.2. Parallel and perpendicular axis theorem. 4.3. Examples on moment of inertia about C.G for I section, H section, Channel section, Angle section, T section and built-up section having	• Analyses moment of inertia of basic shapes of structure. • Analyzing the flight of a jet or orbit of a satellite requires understanding its moment of inertia.	15	6

		flange plates to I & H section Types: Single Phase and Three Phase Induction Motor- Specification, construction, working and starting method, connection diagram, and application.			
5.	**Simple Machines**	5.1. Simple Lifting Machine, Compound Machine, Load, Effort, Mechanical Advantage, Applications and Advantages. 5.2. Velocity Ratio, Efficiency of Machines, Ideal Machine, Reversible and Non-reversible Machines Conditions for Reversibility. 5.3. Law of Machine, Maximum Mechanical Advantage, Maximum Efficiency, Numerical Examples. 5.4. Different Simple Machines and their Velocity ratio.	• Explain velocity ratio, mechanical advantage and efficiency of machine • Understand about reversible and non-reversible machine • Know about laws of machines and their applications	25	10
	Work, Power and Energy	5.5. Work done, Units of Work, Force – Displacement Diagram, Power, Units of Power 5.6. Energy, Units of Energy, Potential & Kinetic Energy, Spring Energy, Different forms of Energy, Law of Conservation of energy, it's proof in case of a free-falling body under gravity.	• Understand about work, power and energy • Differentiate between potential and kinetic energy • Explain law of conservation of energy		
				Total Hours	**42**

6. List of Practicals / Exercises

The practicals/exercises have been 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 practicals/exercises.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	To verify and calculate the resultant force through parallelogram law of forces.	Learn to find the resultant of two forces	4
2.	To verify and calculate the resultant force through polygon law of forces.	Learn to find the resultant of more than two forces	4
3.	To study the equilibrium of three forces by Lami's Theorem.	To understand about equilibrium conditions	4
4.	To find the reactions at the support of a simply supported beam.	To calculate the support reaction of Beams	4
5.	To calculate centroid of lamina and different sections.	To know about Center of Gravity	4
6.	Work-out M. A, Velocity Ratio & Efficiency of Simple Wheel and Axle.	Finding efficiency of Simple Wheel and Axle	4
7.	Work-out M. A, Velocity Ratio & Efficiency of Simple Screw Jack.	Finding efficiency of Simple Screw Jack	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.	Introduction to Mechanics and Force Systems	30	20	20	10	10	10
2.	Equilibrium of Forces	20	20	30	-	20	10
3.	Centroid & Center of Gravity	20	20	30	-	10	20
4.	Moment of Inertia	20	30	20	-	20	10
5.	Simple Machines	20	30	30	-	10	10

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

8. Textbooks

1) Engineering Mechanics by R. S. Khurmi(22nd edition), S. Chand & Company Ltd., New Delhi.
2) Engineering Mechanics by S. S. Bhavikatti, New Age International, New Delhi.
3) Engineering Mechanics by Dr. R.K. Bansal, Laxmi Publication (P) Ltd., New Delhi.
4) A Textbook of Applied Mechanics by R.K. Rajput, Laxmi Publication (P) Ltd., New Delhi.
5) Mechanics of Materials by Timoshenko and Gere, Stanley Thornes (Publishers) Ltd., UK

9. Reference Books

1) Mechanics of Structures Vol-I by Junarkar S.B. & Shah H.J., Charotar publishing house, Anand
2) Intermediate Structural Analysis by Wang C. KTata McGraw Hill book Company, New Delhi.
3) Engineering Mechanics of Solids by Popov E.P. Prentice Hall of India, New Delhi.
4) Strength of Materials by Ryder G.H.; Mcmillan Publishers, Ahmedabad
5) Introduction to Mechanics by M K Verma
6) Mechanics of Materials by Gere & Timoshenko, CBS Publishers & Distributors, Delhi.
7) Structural Analysis by Hibbler R C, Pearson Publication, Chennai.

10. Open Sources (Website, Video, Movie)

1) https://en.wikipedia.org/wiki/Applied_mechanics
2) https://www.youtube.com/watch?v=Bls5KnQOWkY
3) https://www.youtube.com/watch?v=C-FEVzI8oe8
4) https://www.youtube.com/watch?v=A4KhJYrt4-s
5) https://www.youtube.com/watch?v=hCQrBY2oC7I
6) https://www.youtube.com/watch?v=vAThuCmwp9I
7) https://www.youtube.com/watch?v=gvoqENvHLE0