CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Mechanical Engineering)**

Semester: **IV**

Course Code: **202090402**

Course Title: **Fundamentals of Engineering Design**

Course Group: **Professional Core Course-V**

Course Objectives: The course is intended to strengthen fundamentals of mechanics of solids, different forces and stresses for design and analysis of various machine elements subjected to various loading conditions**.**

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25 / 9	25 / 9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Basics of stress and strain**: Simple stresses: Tensile, Compressive and Shear, Simple strains: Linear and Lateral, Poisson's ratio, Stress – Strain diagram for ductile and brittle materials, Hooke's law, Proportional limit, Elastic limit, Yield, Ultimate and Failure stresses, Modulus of elasticity, Volumetric strain and bulk modulus, Shear strain and Modulus of rigidity, Relations between different constants.	06
2	**Moment of inertia of planar cross -sections**: Centroid, Center of gravity, moment of inertia of standard lamina using first principle, Radius of gyration, Parallel & perpendicular axes theorems, polar moment of inertia.	04
3	**Theory of bending**: Types of beams and loads, bending and deflection, Assumptions, derivation of equation of pure bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I,T, channel sections etc.	05
4	**Theory of torsion**: Torsion, Assumptions, derivation of equation of pure torsion, determination of torsional shear stress, Polar moment of inertia, Polar modulus of solid & hollow circular shaft, power transmission by shaft.	04

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5	**Introduction to Machine Design**: Definition and understanding of Machine design, Types of design, Design procedure, Materials Selection in Machine Design, Mechanical Properties of Materials.	**03**
6	**Design Against Static Load**: Types of loads and stresses, Factor of safety, Combined stresses (Principal stress), Theories of Failures, Eccentric Loading, Applications: Design of cotter joint, Knuckle joint and levers etc.	**10**
7	**Shafts, Keys and Couplings**: Design of solid and hollow circular shaft subjected to torque and Combined loading for rigidity and stiffness; Design of Keys, Design of Rigid couplings, Design of Flexible couplings.	**08**
8	**Power screw and threaded joint**: Forms of square threads, terminology of square thread, torque requires lifting and lowering the load, Efficiency of threads, co-eff of friction, Applications: Design of clamp, vise, screw jack, Toggle Jack etc.	**05**

List of Practicals / Tutorials:

1	Conventioal representation of elements for machine and production drawing
2	Details and Assembly drawing
3	Problems related to fundamental concepts of design (chapter 1)
4	Moment of inertia of planer cross sections
5	Problems related to theory of bending and torsion
6	General consideration in Machine design.
7	Design of machine components under static loading.
8	Design of Cotter & Knuckle Joints.
9	Design of levers
10	Design of Shafts and Keys and couplings

Reference Books:

1	Design of Machine Elements, V B Bhandari, 3/e, McGraw Hill.
2	A Textbook of Machine Design, P C Sharma and D K Aggarwal,S K Kataria & sons
3	Shigley's Mechanical Engineering Design, R G Budnyas, J K Nisbett, McGraw Hill
4	Fundamentals of Machine Component Design, R C Juvinall, 4/e, Wiley.
5	Farazdak Haideri, Design of Machine Elements, Nirali Prakashan.
6	Engineering Mechanics, Bansal R K, Laxmi Publication.
7	Strength of Materials, Bansal R K, Laxmi publication.
8	Strength of materials by R.K.Rajput, S.Chand & Co, New Delhi
9	Strength of Materials by S.S.Ratan, Tata McGraw hill.
10	Mechanics of Materials, E. P. Popov

Supplementary learning Material:	
1	NPTEL Resources

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations

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- Assignments/Quiz
- Continuous assessment
- Interactive methods

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20%	15%	10%	40%	15%	0 %	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Design the machine elements subjected to various loading patterns.	**30**
CO-2	Apply design procedures to design various mechanical components with considerations of appropriate materials, engineering properties, cost and weight.	**15**
CO-3	Analyze machine components under static loading and application of various basic theories of failures.	**25**
CO-4	Design and analyze shafts, keys and couplings.	**20**
CO-5	Design and analyze power screw for mechanical applications.	**10**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	--
Next Review on (Month-Year):	June-2025

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