

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: Bachelor of Technology (Mechanical Engineering)

Semester: V

Course Code: 202090501

Course Title: Design of Machine Components

Course Group: Professional Core Course-IX

Course Objectives: To determine configurations and parameters of various components of a mechanical system is a crucial stage of development. This requires functional and structural analysis of elements. The course aims to provide fundamental knowledge for material selection, analysis of components subjected to fluctuating loads, design of different machine elements.

Teaching & Examination Scheme:

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

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

Detailed Syllabus:

Sr.	Contents	Hours
1	Introduction: Standardization, Selection of preferred sizes. Material selection process, Manufacturing considerations in Design	2 Labs
2	Belt Drives: Flat Belt Drive: Belt Construction, Flat Belt Drive: Length of the Belt: Open and Cross drive types, Ratio of Tensions on tight side to slack side, Condition for maximum power transmission, Creep phenomenon, Methods for tensioning, Design of Pulley for flat belt drive. V-Belt Drive: Nomenclature, Selection of Belts.	6
3	Design Against Fluctuating Loads: Stress Concentration, Endurance limit and Fatigue failure, Factors affecting endurance limit, S-N Diagram, Design for reversed stresses and cumulative damage, Fluctuating stresses: Soderberg, Gerber, Goodman and Modified-Goodman criteria, Combined stresses.	8



4	Design of Springs: Classification of springs, Helical Spring: Stresses, Correction Factors, and Deflection, Design against static and fluctuating loads, Concentric springs, surge phenomenon. Helical Torsion and Spiral Springs, Belleville spring. Multi-Leaf Spring: Terminology, Nipping, and Design of multi-leaf spring.	5
5	Pressure Vessels: Thin cylinders and spherical vessels, Wire wound cylinders. Thick cylinders: Principal stresses in cylinder subjected to internal/external pressure, Lame's equation, Clavarion's and Bernie's equations, Autofrettage, Compounding of cylinders.	5
6	Rolling contact bearings: Types of rolling-contact bearings, Selection of bearing type, Static load carrying capacity of bearing, Dynamic load carrying capacity of bearing, Equivalent bearing load, Load-life relationship, Selection of bearings, Bearing with probability of survival other than 90 percent, Design for cyclic load.	5
7	Sliding contact bearings: Basic mode of lubrication, Measurement of viscosity, Viscosity index, Petroff's equation, McKee's equations, Interpretation of Reynold's equation, Difference between hydrodynamic and hydrostatic bearing, Performance parameters for journal bearings, Bearing design – selection of parameters for journal bearing	5
8	Design of gear drives (Spur, Helical, Bevel and Worm): Classification of gears, Selection of type of gears, Standard system of gear tooth, Force analysis, Gear tooth failures, selection of material, Beam strength of gear tooth, Wear strength of gear tooth	11
		Total 45

List of Practicals / Tutorials:

1	Introduction to Design for machine elements & its Considerations.
2	Material selection process for different applications.
3	Design of mechanical components subjected to fluctuating loads.
4	Determine fatigue strength of a material.
5	Design of springs subjected to different loading conditions
6	Design of pressure vessels. Exercise should include demonstration of use of codes (ASME Section VIII Div 2 and IS 2825 (1969)).
7	Problems for design of rolling contact bearing.
8	Design for sliding contact bearing
9	Design for gear

Reference Books:

1	Design of Machine Elements by V B Bhandari, McGraw Hill.
2	Theory of Machines by V P Singh, Dhanpat Rai & Co.
3	Theory of Mechanisms and Machines by A Ghose and A K Malik, East West Press Pvt Ltd.
4	Theory of Machines, by Sadhu Singh, Pearson Education
5	Machine Design an Introduction by R L Norton, Pearson.
6	Fundamentals of Machine Component Design by R C Juvinal, 4/e, Wiley.

7	Machine Design: Fundamentals and Applications by P C Gope, 1/e PHI.
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Supplementary learning Material:

1	NPTEL and Coursera Video lectures.
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Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- 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	
10	20	15	25	25	5	

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	Understand the standardization for mechanical components and analyze components subjected to fluctuating loads.	30
CO-2	Design springs and pressure vessel for mechanical application.	25
CO-3	Understand design and selection of bearing.	25
CO-4	Understand concept of gear design.	20

Curriculum Revision:

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