19ME301 DESIGN AND MODELING OF MACHINE ELEMENTS

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P
45	-	30

WA/RA	SSH/HSH	CS	SA	S	BS
5	40	-	8	5	-

Soource:
https://eta-academy.co.za/product/photography-for-beginners/

PRE-REQUISITE COURSE: Solid Mechanics

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the basic engineering design against static and dynamic loading by considering strength and rigidity. The objective of this course is to enrich fundamental in the concept for design of machine components subjected to various loading and operating conditions.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Apply suitable failure theory for design of various machine elements subjected to loading.	1
2	Estimate the effect of cyclic loading on the life of machine components.	2
3	Evaluate the strength and the rating life of different types of mechanical elements.	2
4	Develop various machine components as per user specifications.	3
5	Construct machine components using modeling software.	5

SKILLS:

- ✓ *Choose appropriate material to design machine components.*
- ✓ *Apply appropriate failure theory.*
- ✓ *Estimate the life and strength of machine components.*
- ✓ *Model the machine components using software's such as Creo and CATIA.*

UNIT- I **L-9**

DESIGN FOR STATIC STRENGTH: Introduction to Design, Phases of design, Factor of safety, Design of Socket and Spigot joint and knuckle Joint, Maximum principal stress theory, Maximum shear stress theory and distortion energy theory, Applications of failure theories for combined loading.

UNIT- II **L-9**

DESIGN FOR FATIGUE STRENGTH: Stress concentration, Methods to reduce stress concentration, Fluctuating stresses, Fatigue failure, Endurance limit, Factors influencing fatigue strength, Fatigue stress concentration, Notch sensitivity, Low cycle and high cycle fatigue, Cumulative fatigue, Design for finite and infinite life, Soderberg, Goodman and Gerber equations for fatigue design.

UNIT- III **L-9**

DESIGN OF JOINTS: Welded joints - introduction, types and applications; Strength of transverse and parallel fillet welds; Design of bolted joints, Eccentric loading of welded and bolted joints.

UNIT- IV **L-9**

DESIGN OF GEARS: Types of gear drives, Design of spur and helical Gears - Lewis form factor for beam strength of spur and helical gears, concept of virtual number of teeth for helical gear, design of module based on beam strength and wear strength.

UNIT- V **L-9**

DESIGN OF BEARINGS: Classification, Hydrodynamic and Hydrostatic Lubrication, McKee equation, Design of Journal bearings; Classification, avantages and limitations of rolling contact bearings, static load carrying capacity, dynamic load carrying capacity, life-load relationship, selection of bearings using manufacturers' catalogue.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS **TOTAL HOURS: 30**

1. To create wire frame and surface models using Creo/CATIA.
2. To model machine components using Creo/CATIA.
3. To design the shafts based on various theories of failure using C/MATLAB.
4. To determine the finite or infinite life of shafts subjected to fatigue load using C/MATLAB.
5. Modeling and assemblyof Cotter/Knuckle Joints.
6. To design and modeling of spur gear using MATLAB/Creo.
7. To design and modeling of helical gear using MATLAB/Creo.
8. Modeling and assembly of Plummer block.
9. To estimate the rating life of ball bearing using MATLAB.
10. To estimate the rating life of taper roller bearing using MATLAB.

TEXT BOOKS:

1. V.B. Bhandari, "Design of Machine Elements", 3rd edition, Tata McGraw-Hill, 2010.
2. J.E. Shigley, "Mechanical Engineering Design", 9th edition, Tata McGraw-Hill, 2013.

REFERENCE BOOKS :

1. Juvinell and Marshell, "Fundamentals of Machine Components", 5th edition, John Wiley and Sons, 2011.
2. R.L.Norton, "Machine Design - An Integrated Approach", 5th edition, Pearson Publications, 2013.
3. R.S. Khurmi and J.K. Gupta, "Machine Design", 14th edition, S. Chand publications, 2010.