

# FIRST SEMESTER 2023-2024

Course Handout Part II

Date: 10-08-2023

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

*Course No.* : **ME F314 (L-P-T-U:3-0-1-3)**

*Course Title* : **Design of Machine Elements**

*Instructor-in-Charge* : **Prof. Srinivasa Prakash Regalla**

*Tutorial Instructors* : ***S1: Suswanth Poluru, S2: Mr. Veeraiahgari Vamshi, S3: Himanshu shukla, S4: Vicky Lad***

**Scope and Objective of the Course:** Design methodology, fundamental principles, materials, design for static failure, design for fatigue failure, design and selection of machine elements such as shafts, screw fasteners, welded joints, springs, belt drive, brakes & clutches, bearings & gears.

# Textbooks:

1. Budynas R. G. and Nisbett J. K., “Shigley’s Mechanical Engineering Design" Tata–McGraw Hill, 11th SI (Indian) Edition, New Delhi, 2020.

# Reference books

1. Spotts M. F., Shoup T.E., Hornberger L.E., “Design of Machine Elements”, 8th Edition, Pearson Education, New Delhi, 2008.
2. Juvinall R.C., Marshek K.M., “Fundamentals of Machine Component Design”, 6th Edition, John Wiley & Sons, Hoboken, NJ, 2017.
3. Schmid S.R., Hamrock B.J., Jacobson B.O., “Fundamentals of Machine Elements”, 3rd Edition, SI Version, CRC Press, Boca Raton, FL, 2014.

# Course Plan:

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| **Lecture**  **No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the**  **Text Book** |
| 1-2 | Design methodology, fundamental principles, materials | Introduction to mechanical engineering design, stress and strength, factor of safety, material strength and stiffness, materials selection, equilibrium and free- body diagram, shear force, bending moment, stress  and Cartesian stress components, Mohr’s circle, beam deflections and strain energy. | CH1 to CH4 (TB1) |
| 3-6 | Design of machine elements for static failure | Design for static loading. Static failure criteria for design of machine components made of both ductile  and brittle materials. MSS, DE, DCM, BCM and MM criteria. | CH5 (TB1) |

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| 7-10 | Design of machine elements for fatigue failure | Design for fatigue loading. S-N curve and its mathematical model. Fatigue failure criteria, including Soderberg, Modified Goodman, Gerber and ASME- ellpitic, for design of machine components. Combined  loading. Cumulative fatigue damage and Miner’s rule. | CH6 (TB1) |
| 11 -13 | Design of shafts | Design of shaft components | CH7 (TB1) |
| 14 -17 | Design screw fasteners | Design of power screws. Design of bolted joints in  tensile, torsion and bending type joints. Design riveted joints | CH8 (TB1) |
| 18 - 21 | Design of welded joints | Standard welding symbols. Design of welded joints in butt, lap, direct shear, torsional, bending and  combined loading cases. | CH9 (TB1) |
| 22 - 27 | Design of mechanical springs | Fundamentals of helical springs. Design of compression, tension and torsional springs. | CH10 (TB1) |
| 28 - 31 | Design of belt drives | Design of flat belts, v-belts | CH17 (TB1) |
| 32 - 35 | Design of brakes & clutches | Design of drum brake and clutch with internally expanding shoes. | CH16 (TB1) |
| 36-39 | Selection of rolling element bearings and  design of journal bearings | Selection of ball and roller bearings with load-life- reliability trade-off models. Design of journal  bearings. | CH11 & CH12 (TB1) |
| 40-43 | Design of gears | Fundamentals of gears. Design of spur gears. Lewis bending equation. Surface endurance model. | CH13-14 (TB1) |

**Evaluation Scheme:**

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| **Component** | **Duration (min)** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Mid-semester  Examination | 90 | 25%=50M | 14/10 - 9.30 - 11.00AM | Closed Book |
| Design Project (Hand-written report)  (Batch work) | - | 10%=20M |  | Open Book |
| Tutorials | Weekly | 20%=40M |  | Open Book |
| Surprise Quiz | 10 min each  on selected Fridays | 5%=10M | In Lecture Classes | Open Book |
| Comprehensive Examination | 180 | 40%=80M | 20/12 FN | Closed Book |

**Chamber Consultation Hour:** To be announced in the first lecture class.

**Notices:** CMS

# Make-up Policy: Only for Mid-semester and Comprehensive examinations and only in genuine cases of illness with prior intimation with medical documents enclosed. No makeup for tutorials as the best (N-2) assignments will be taken into account for grading.

**Academic Honesty and Integrity Policy**: Academic honesty and integrity are to be maintained by all the students throughout the semester. Any form of academic dishonesty would lead to serious actions.

# INSTRUCTOR-IN-CHARGE