Birla Institute of Technology & Science, Pilani
Hyderabad Campus

ACADEMIC-GRADUATE STUDIES AND RESEARCH DIVISION
FIRST SEMESTER 2023-2024
Course Handout Part II

Date: 01-08-2023

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 G521**
Course Title	: **MECHANICAL SYSTEM DESIGN**
Instructor-in-Charge	: Dr Arnab Guha
Instructor for lab	: Dr Arnab Guha
Course Prerequisites	: Knowledge in Solid Mechanics and Design of Machine Elements is desirable
Software Prerequisites	: Knowledge in MATLAB, ANSYS, CAM and SOLIDWORKS will be needed

Course Description: Concept of system design; modeling of structural and kinematic systems, and determination of system characteristics; reliability of systems; design of machine elements for specified reliability; concepts of optimization; techniques of design optimization for linear and non-linear problems.

Scope and Objective of the Course:
The aim of the course is to present a comprehensive and clear approach to systematic design of mechanical systems. Because of the complex nature of modern technology, it is rarely possible for an individual to tackle the design and development of a major new product single-handedly. Often a large team is required and the design process is broken down into a logical sequence of distinct steps, each with its own working methods. The design process must also be carefully planned and executed. The relevant methodologies and techniques are dealt with in this course. Case study on power transmission system design is included. Reliability, design evaluation and optimization techniques as applied to design process are also studied.

Textbooks:
1. "Mechanical System Design", A. Goel, Technical Publications, 1st Ed., 2020.
2. "Mechanical System Design", K.U. Siddiqui and M.K. Singh, New Age Publisher, 2nd Ed., 2017.

Reference books:
1. "Mechanical System Design", S.P. Patil, JAICO Publisher, 2nd Ed., 2012
2. "Design Optimization using MATLAB and SOLIDWORKS", K. Suresh, Cambridge University Press, 1st Ed., 2021

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Text Book
1-3	Introduction to the design of mechanical systems	Concept of system design, Model of a mechanical system, Classification of mechanical systems, Nature of Mechanical Systems, Design Processes.	TB 2, RB 1
4-7	Mechanical system characteristics and modelling	Classification of systems based on characteristics, Linear Graph modelling concepts, Mathematical modelling concepts, System behavior, Modelling and Simulation	TB 2
8-10	Statistical consideration in mechanical system design	Introduction to Statistics, Causes of Variation and Frequency Distribution	TB 1
11-12	Statistical consideration in mechanical system design	Probability Distribution Curve, Population Combinations	TB 1
13-14	Statistical consideration in mechanical system design	Design and Natural Tolerances	TB 1
15-16	Statistical consideration in mechanical system design	Acceptance or Rejection of component and assembly	TB 1
17-19	Statistical consideration in mechanical system design	Reliability and factor of safety	TB 1
20-23	Optimum design of mechanical systems	Calculus methods for optimization	TB 2, RB 1, RB 2
24-25	Optimum design of mechanical systems	Classification of Design parameters, Adequate design and Optimum design	TB 1
26-29	Optimum design of mechanical systems	Johnson's method of optimum design for non-linear system, Optimum design with normal and redundant specifications	TB 1
30-31	Case Study: Design of Machine Tool Gear Box	Multi-Speed Gear Box in Machine Tools and Stepped regulation of speed	TB 1, RB 1
32-35	Case Study: Design of Machine Tool Gear Box	Kinematic design of multispeed gearbox and Kinematic diagram of gearbox	TB 1, RB 1
36-40	Case Study: Design of Machine Tool Gear Box	Optimum Structure diagram, Optimum Ray diagram and Optimum Speed diagram	TB 1, RB 1

Evaluation Scheme:

Component	**Duration**	**Weightage**	**Date & Time**	**Nature of component**
Mid-Semester Test	90 min	20%	14/10 - 4.00 - 5.30PM	CB
Quiz		10%		CB
Seminar on Literature review and research summary related to research articles on mechanical system design		5%		OB
Design project delivery and presentation	Throughout the semester	20%		OB
Draft journal paper based on Design project		15%		OB
Comprehensive Examination	180 mins	30%	21/12 AN	CB

Chamber Consultation Hour: Every Thursday, 5 pm to 6 pm in D-303.

Notices: All the notices regarding the course will be displayed on the CMS.

Make-up Policy: Only for genuine cases with prior permission

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Arnab Guha

INSTRUCTOR-IN-CHARGE