



Gyanmanjari
Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-7 (B. Tech)

Subject: Machine Design-II - BETME17329

Type of course: Professional Core

Prerequisite: Kinematics of Machinery and Machine Design-I

Rationale: This course provides fundamental knowledge of machine element design under static and dynamic loading conditions. It develops the ability to analyze and select mechanical components such as shafts, screws, columns, and crane elements based on strength and safety considerations. The course enhances practical engineering skills required for industrial machine and material handling applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P		C	Theory Marks		Practical Marks		
			ESE		MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.



Course Content:

Unit No	Course content	Hrs.	% Weightage
1	<p>Design against Static and Fluctuating Loads Static Loads: Mechanical properties of material, Factor of safety, Principal Stresses, Maximum Principal stress theory (Rankine's theory), Maximum shear stress theory (Tresca and Guest theory), Distortion Energy theory (Von Mises and Hencky theory), Eccentric loading, Cotter Joints, Knuckle Joints, Design of Lever. Fluctuating Loads: Stress Concentration, Fatigue, Factors Affecting Endurance Strength, Design for Reversed Stresses, Design for Fluctuating Stresses, Modified Goodman Diagrams.</p>	20	25
2	<p>Beam and Column Design Introduction, Failure of a Column or Strut, Types of End Conditions of Columns, Euler's Column Theory, Rankine's Formula for Columns, Johnson's Formula for Columns, Long Columns Subjected to Eccentric Loading, Design of Piston Rod, Design of Push Rods, Design of Connecting Rod, Buckling of Columns.</p>	15	25
3	<p>Shafts and Keys Introduction to Shaft, Design of Shafts, Introduction to Keys, Types of Keys Power Screws and Threaded Joints Introduction, Basic types of Screw Fastening, Power Screws, Forms of Threads, Multiple Threaded Screws, Terminology of Power Screw, Torque Required to Raise the Load, Torque Required to lower the Load, Over Hauling and Self Locking Screws, Efficiency of Square Threaded Screw.</p>	15	30
4	<p>Design of Cranes: Basic objectives of material handling system, Types of load, Classification and application of various Material handling equipment, Basic principles in selection of material handling system, Classification of cranes, Stress analysis and selection of Hooke (IS 15560, 2005), Pulley System (hoisting tackle analysis), Steel Wire ropes: Classification and coding, stress analysis and selection, Design of Sheave and drums.</p>	10	20



Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	Failure Theory and Fatigue Analysis Each group of students will analyze machine elements subjected to static and fluctuating loads using different failure theories and fatigue criteria. Students will calculate stresses, factor of safety, and endurance limits for given loading conditions. The calculations, diagrams, and observations should be compiled into a brief report and uploaded on the GMIU portal.	10
2	Design of Shaft and Power Screw Each group of students will perform the design and analysis of shafts and power screws for specified mechanical applications. Students will calculate dimensions, torque, efficiency, and safety parameters using standard design equations. The complete design procedure, calculations, and sketches should be documented in a brief report and uploaded on the GMIU portal.	10
3	Crane Component Selection and Analysis Each group of students will conduct stress analysis and selection of crane components such as hooks, wire ropes, pulleys, and drums based on standard design practices. Students will evaluate load carrying capacity and safety requirements for the given application. The analysis, calculations, and component details should be compiled into a brief report and uploaded on the GMIU portal.	10
Total		30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	10 %	20 %	30 %	20 %	10 %	10 %

Course Outcome:

After learning the course, the students should be able to:	
CO1	Apply failure theories and fatigue concepts for designing machine elements under static and fluctuating loads.
CO2	Analyze and design beams, columns, and rod elements under different load conditions.
CO3	Evaluate shafts, keys, threaded joints, and power screws for mechanical applications.
CO4	Design and select crane and material handling components using standard design principles.



List of Practical:

Sr. No	Descriptions	Unit No	Hrs.
1	Study and application of theories of failure for machine elements under static loading conditions.	1	2
2	Design and analysis of cotter joint and knuckle joint using standard design procedure.	1	2
3	Fatigue analysis and determination of factor of safety under fluctuating loading conditions.	1	2
4	Design and analysis of columns using Euler's and Rankine's formulas.	2	2
5	Design calculations for piston rod, push rod, and connecting rod.	2	2
6	Design and analysis of transmission shafts subjected to combined loading.	3	2
7	Study and design of different types of keys and keyed joints.	3	2
8	Performance analysis of power screws and threaded joints.	3	2
9	Calculation of efficiency and self-locking condition of square threaded screws.	3	2
10	Stress analysis and selection of crane hook as per IS standards.	4	2
11	Selection and analysis of steel wire ropes for lifting applications.	4	2
12	Design and analysis of pulley system, sheave, and drum for crane applications.	4	4
		Total	30

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

- [1] Machine Design-An Introduction, Norton R. L., Pearson.
- [2] Design of Machine Elements, Bhandari V. B., Mc Graw-Hill.
- [3] Machine Design Data Book, Bhandari V. B., Mc Graw-Hill.

