

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

SYLLABUS FOR BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (Effective from academic session 2018-19)

Subject Code : PC-ME602	Category: Professional Core Courses
Subject Name : Design of Machine Elements	Semester : Sixth
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: Strength of materials, Machine Drawing	

Course Objectives:

This course seeks to provide an introduction to the design of machine elements commonly encountered in mechanical engineering practice, through

1. a strong background in mechanics of materials based failure criteria underpinning the safety-critical design of machine components
2. an understanding of the origins, nature and applicability of empirical design principles, based on safety considerations
3. an overview of codes, standards and design guidelines for different elements
4. an appreciation of parameter optimization and design iteration
5. an appreciation of the relationships between component level design and overall machine system design and performance

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Objective and scope of Mechanical Engineering Design; Design considerations; Review and selection of materials and manufacturing processes; codes and standards;	4
2	Modes of failure; Design/allowable stress; Factor of safety (FoS); Theories of failure – maximum normal stress theory, maximum shear stress theory, Distortion energy theory. Choice of Failure criteria; Design for stability : buckling analysis – Johnson and Euler columns	4
3	Fatigue in metals; S-N curve; Endurance limit and fatigue strength; Stress concentration factors – effect of discontinuity, fillets and notches; Effect of size, surface finish, stress concentration and degree of reliability on endurance limit; Design for finite and infinite life; Goodman, modified Goodman and Soderberg diagrams with respect to fatigue failure under variable stresses; Cumulative fatigue damage – Miner's equation.	5
4	Design of (i) Cotter joint; (ii) Knuckle joint and (iii) Fillet Welded joint of brackets under different types of loading.	6
5	Bolted joints : Metric thread, standard sizes, use of lock nuts and washers; Applications in structures including brackets, turn buckle; Pre-stressed bolts; Riveted joints : Unwin's formula; Brief discussion on single, double and triple row lap joints, butt joints with single or double strap / cover plate; simple strength design; joint efficiencies.	6

6	Design of : (i) Solid and hollow shafts, strength design of shafts, design based on torsional rigidity; (ii) Shaft coupling-rigid, pin-bush and geared flexible type, alignment of coupling; (iii) Belt drives-geometrical relations, derivation of torque and power transmission by flat and V-belt drives, selection of belt from manufacturers' catalogues, pulley (iv) Chain drives – roller chains, polygonal effect, power rating, sprocket wheel, silent chain	10
7	Design of: (i) Transmission screw, Screw jack, (ii) Helical compression spring - stress and deflection equations, stiffness, curvature effect : Wahl's factor, springs in parallel and series; (iii) Multi-leaf springs : load-stress and load-deflection equations, Nipping	8
8	Analysis and design of sliding and rolling contact bearings, Design of transmission elements: spur, helical, bevel and worm gears; Analysis of clutches and brakes	5

Course Outcomes:

Upon completion of this course, students will get an overview of the design methodologies employed for the design of various machine components.

Learning Resources:

1. J.E. Shigley and C.R. Mischke, Mechanical Engineering Design, 5th Edition, McGraw Hill International, 1989.
2. D. Deutschman, W.J. Michels and C.E. Wilson, Machine Design Theory and Practice, Macmillan, 1992.
3. R.C. Juvinal, Fundamentals of Machine Component Design, John Wiley, 1994.
4. M.F. Spottes, Design of Machine elements, Prentice-Hall India, 1994.
5. R. L. Norton, Mechanical Design– An Integrated Approach, Prentice Hall, 1998.
6. V. B. Bhandari, Design of Machine Elements by, McGraw Hill Publishing Co. Ltd., 2007.
7. P. Kannaiah, Machine Design, 2nd Edition, Scitech Publications.
8. Sadhu Singh, Machine Design, Khanna Book Publishing Co.