

GUJARAT TECHNOLOGICAL UNIVERSITY

PRODUCTION ENGINEERING(25)

FUNDAMENTALS OF MACHINE DESIGN

SUBJECT CODE: 2142503

B.E. 4th SEMESTER

Type of course: Under Graduate

Prerequisite: None.

Rationale: The course aims to impart basic skills for analysis of mechanical component and communicate assembly and production drawings for the components designed.

Teaching and Examination Scheme:

| Teaching Scheme | | | Credits C | Examination Marks | | | | | | Total Marks |
|-----------------|-----|-----|--------------|-------------------|----|--------|-----------------|-----------|----|----------------|
| L | T | P | | Theory Marks | | | Practical Marks | | | |
| | | | ESE (E) | PA (M) | | PA (V) | | PA (I) | | |
| PA | ALA | ESE | | OEP | | | | | | |
| 4 | 2 | 0 | 6 | 70 | 20 | 10 | 30 | 0 | 20 | 150 |

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Content:

| Sr. No. | Content | Total Hrs | % Weightage |
|----------|---|-----------|-------------|
| 1 | Design consideration of Machine Parts: Definition and understanding of various types of design, Morphology of design, Design procedure, Selection of materials, factors of safety, Stress Concentration and methods of relieving stresses, Types of stresses-tensile, compressive, shear, bending, bearing, crushing, Eccentric axial stresses, principle stress, Residual stresses. | 8 | 15 |
| 2 | Design of Fasteners: a) Design of Riveted Joints: Types of riveted joints, design of double and triple riveted butt joints with equal and unequal cover plates, Design of Circumferential joint, Longitudinal Butt Joint, Eccentric loading. b) Welded Joints: Types of welded joints, stresses in welded joints, Design for various loading conditions in torsion, shear, or direct load, eccentrically loaded welded joints. c) Miscellaneous Joints: Design of Gibb and cotter, and knuckle joint, Design of Spigot and socket Joint, Design of Turn buckle d) Threaded Joints: Basic types of screw fastening, Cap and Set screw, Bolt of Uniform strength, locking devices, Bolted Joint: Simple and Eccentric loading. | 16 | 35 |
| 3 | Shafts, Keys and Couplings: Design of solid and hollow circular shaft subjected to torque and combined loading; Design of shaft for rigidity and stiffness; Design of axle; Design of Keys: Saddle, Sunk, Woodruff, Square, Flat, Kennedy key and Splines; | 12 | 25 |

| | | | |
|----------|---|----------|-----------|
| | Design of rigid and flexible couplings.. | | |
| 4 | Levers: General Procedure for design of levers, designs of lever for safety valve, design of bell crank lever, design of rocker arm for exhaust valves. | 4 | 10 |
| 5 | Column & Strut: Introduction, Failure of Column and Strut,. Types of End Conditions of Columns, Euler's column theory, Assumptions in Euler's column theory, Euler's Formula, slenderness Ratio, Limitations of Euler's theory, Equivalanent length of column , Rankine's Formula for column, Johnson's formula for columns, Long Columns subjected to Eccentric loading, Design of Piston Rod, Push Rod and Connecting Rod. | 6 | 10 |
| 6 | Production , Assembly Drawing & Symbols: Elements of production drawing, Drawings of assembled view for the part drawings. Roughness and Machining symbols, indication on drawings | 2 | 5 |

Suggested Specification table with Marks (Theory):

| Distribution of Theory Marks | | | | |
|------------------------------|---------|---------|---------|---------|
| R Level | U Level | A Level | N Level | E Level |
| 7 | 14 | 14 | 14 | 21 |

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. Design of Machine Elements, V B Bhandari, 3/e, McGraw Hill.
2. Machine Design: Fundamentals and Applications, P C Gope, 1/e PHI.
3. Fundamentals of Machine Component Design, R C Juvinall, 4/e, Wiley.
4. Machine Design: An Integrated Approach, R L Norton, Pearson
5. Machine Drawing, B Bhattacharyya, 1/e, Oxford Press.
6. Machine Drawing, K C John, PHI.

Course Outcome:

After learning the course the students should be able to:

1. Design and analyse various mechanical components for various loading and boundary conditions.
2. Students would be able to generate and interpret assembly and production drawings.
3. Limit fits & tolerance and its applications in drawing

List of Tutorials:

Should be designed to include followings:

1. Problems related to different types of loads & stresses on machine components.
2. Solve problems related to Riveted Joint, Welded joints, threaded joints & Miscellaneous Joints for simple & eccentric loading.
3. Design of shafts, keys and Couplings.
4. Design and Analysis of Levers: Cranked, Bell Crank, Foot, Rocker arm.
5. Using drafting software, generate Assembly and Production drawings.
6. Problems related design of Push rod, Piston rod & Connecting rod.

7. Case study for design and analyse of machine parts.

Major Equipment:

1. Computational facility.
2. CAD Software.

List of Open Source Software/learning website:

1. **AutoCAD**
2. <http://nptel.ac.in>

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.