



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

(Autonomous)

(ISO: 9001:2000)

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Circular

All the institute affiliated to MSBTE running Post SSC Diploma in Mechanical (ME/MH/MI) Engineering are hereby informed that following software are recommended as Learning Resource in the curriculum of subject 'Design of Machine Element (9150)' for better understanding of the subject content.

- 1) Think 3 CAD Software developed by Acebrain System & Software Pvt Ltd., Pune. Website: www.acebrain.co.in
- 2) E-Yantra Software, developed by FEAST Software Pvt Ltd., Powai, Mumbai. Website: www.feastsoftware.net

Corrected copy of curriculum is displayed on website of MSBTE.

(P. A. Naik)
Secretary

M.S. Board of Technical Education
Mumbai -400051.

COURSE NAME : DIPLOMA IN MECHANICAL ENGINEERING
COURSE CODE : ME/MH/MI
SEMESTER : SIXTH FOR ME AND SEVENTH FOR MH/MI
SUBJECT TITLE : DESIGN OF MACHINE ELEMENTS
SUBJECT CODE : 9150

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
04	--	02	04	80	20	--	25#	25@	150

Rationale:

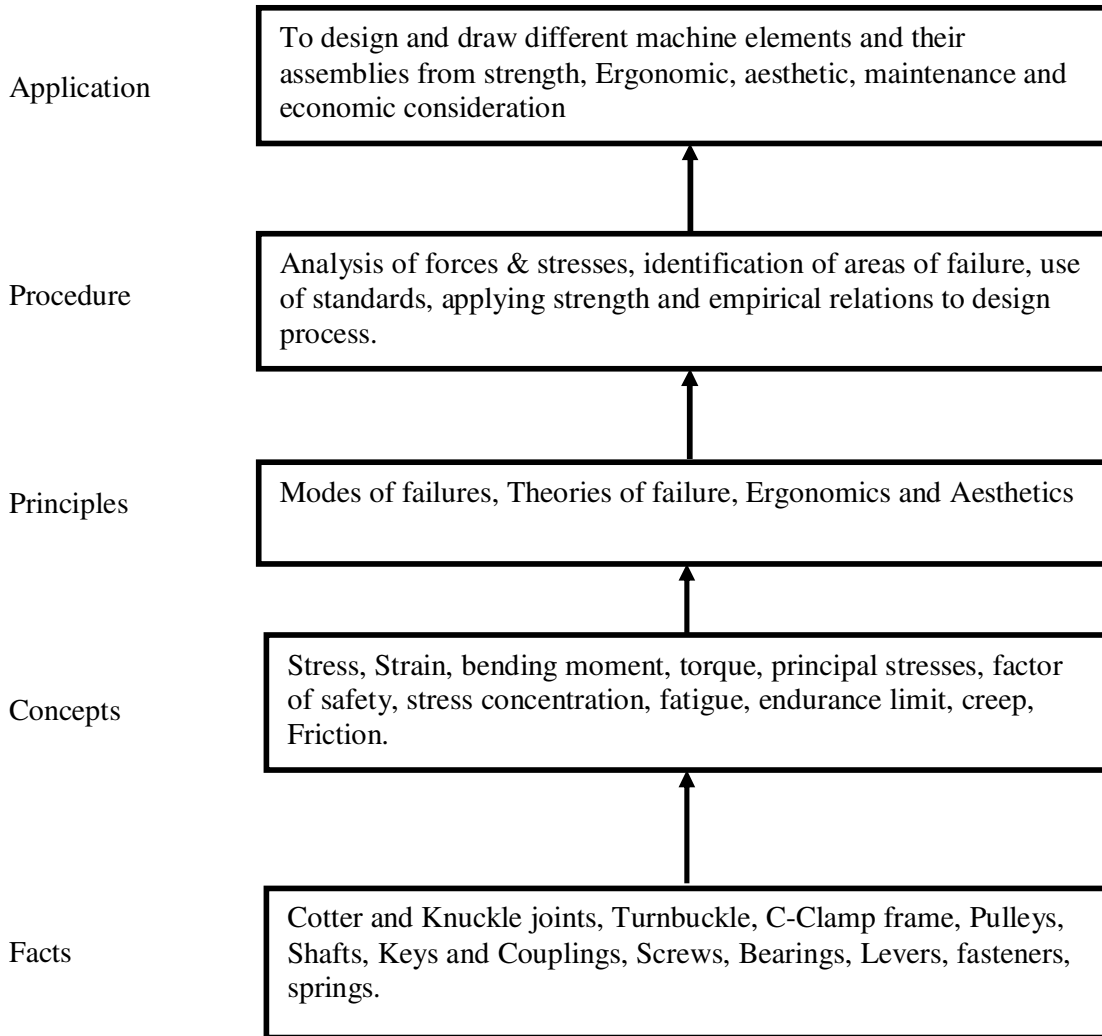
It is an Applied Technology subject. A diploma holder is expected to design and draw simple machine components used in small and medium scale industries. Fundamental knowledge of Applied Mechanics, Strength of Materials, Engineering Materials and Theory of Machines is essential. Subject aims at developing analytical abilities to give solutions to engineering design problems.

Objectives:

Students should be able to:

1. Analyze the various modes of failure of machine components under different load patterns.
2. Design and prepare part and assembly drawings.
3. Use design data books and different codes of design.
4. Select standard components with their specifications from manufacturer's catalogue.
5. Develop drawings on CAD software.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<p>Introduction to Design</p> <p>1.1 Machine Design philosophy and Procedures</p> <p>1.2 General Considerations in Machine Design</p> <p>1.3 Fundamentals:- Types of loads, concepts of stress, Strain, Stress – Strain Diagram for Ductile and Brittle Materials, Types of Stresses such as Tension, Compression, Shear, Bearing pressure Intensity, Crushing, bending and torsion, Principle Stresses (Simple Numerical)</p> <p>1.4 Creep strain and Creep Curve</p> <p>1.5 Fatigue, S-N curve, Endurance Limit.</p> <p>1.6 Factor of Safety and Factors governing selection of factor of Safety.</p> <p>1.7 Stress Concentration – Causes & Remedies</p> <p>1.8 Converting actual load or torque into design load or torque using design factors like velocity factor, factor of safety & service factor.</p> <p>1.9 Properties of Engineering materials, Designation of materials as per IS and introduction to International standards & advantages of standardization, use of design data book, use of standards in design and preferred numbers series.</p> <p>1.10 Theories of Elastic Failures – Principal normal stress theory, Maximum shear stress theory & maximum distortion energy theory.</p>	10	12
02	<p>Design of simple machine parts</p> <p>1.11 Cotter Joint, Knuckle Joint, Turnbuckle</p> <p>1.12 Design of Levers:- Hand/Foot Lever & Bell Crank Lever</p> <p>1.13 Design of C – Clamp, Off-set links, Overhang Crank, Arm of Pulley</p>	08	12
03	<p>Design of Shafts, Keys and Couplings and Spur Gears</p> <p>1.14 Types of Shafts, Shaft materials, Standard Sizes, Design of Shafts (Hollow and Solid) using strength and rigidity criteria, ASME code of design for line shafts supported between bearings with one or two pulleys in between or one overhung pulley</p> <p>1.14 Design of Sunk Keys, Effect of Keyways on strength of shaft.</p> <p>1.15 Design of Couplings – Muff Coupling, Protected type Flange Coupling, Bush-pin type flexible coupling.</p> <p>1.16 Spur gear design considerations. Lewis equation for static beam strength of spur gear teeth. Power transmission capacity of spur gears in bending.</p>	12	16
04	<p>Design of Power Screws</p> <p>1.17 Thread Profiles used for power Screws, relative merits and demerits of each, Torque required to overcome thread friction, self locking and overhauling property, efficiency of power screws, types of stresses induced.</p> <p>1.18 Design of Screw Jack, Toggle Jack.</p>	10	12

05	Design of springs 1.19 Classification and Applications of Springs, Spring – terminology, materials and specifications. 1.20 Stresses in springs, Wahl’s correction factor, Deflection of springs, Energy stored in springs. 1.21 Design of Helical tension and compression springs subjected to uniform applied loads like I.C. engine valves, weighing balance, railway buffers and governor springs. 1.22 Leaf springs – construction and application	07	08
06	Design of Fasteners 1.23 Stresses in Screwed fasteners, bolts of Uniform Strength. 1.24 Design of Bolted Joints subjected to eccentric loading. 1.25 Design of parallel and transverse fillet welds, axially loaded symmetrical section, Merits and demerits of screwed and welded joints	07	10
07	Antifriction Bearings 1.26 Classification of Bearings – Sliding contact & rolling contact. 1.27 Terminology of Ball bearings – life load relationship, basic static load rating and basic dynamic load rating, limiting speed. Selection of ball bearings using manufacturer’s catalogue.	05	05
08	Ergonomics & Aesthetic consideration in design 1.28 Ergonomics of Design – Man –Machine relationship. Design of Equipment for control, environment & safety. 1.29 Aesthetic considerations regarding shape, size, color & surface finish.	05	05
Total		64	80

Assignments:

Skills to be developed:

Intellectual skills:

1. Understand the basic philosophy and fundamentals of Machine Design.
2. Apply and use the basic knowledge of earlier subjects like mechanical Engineering. materials, strength of materials and theory of machines.
3. Analyse and evaluate the loads, forces, stresses involved in components and subassemblies and decide the dimensions.
4. Understand the modes of failures of m/c components and decide the design criteria and equations.
5. Understand the concept of standardization and selecting standard components.
6. Understand the methods of computer aided design practices.

Motor skills:

1. Draw the components assembly as per the designed dimensions.
2. Modify drawings and design as per requirement.
3. Use the different design software.
4. Use different design data books and IS codes.

List of Assignments:

1. Assignment on selection of materials for given applications [at least five applications should be covered] using design data book. List the mechanical properties of material selected. **2 Hrs**
2. Problems on design of simple machine parts like Cotter Joint, Knuckle Joint, Bell Crank Lever, Turn Buckle, Off – Set link, Arm of Pulley (One example on each component) with free hand sketches. **6 Hrs**
3. Design Project No. 1
Observe the system where transmission of power takes place through shaft, Keys, coupling, pulley and belt drive. Get the required information regarding power transmitted (power output by motor or engine etc.). By selecting suitable materials, design the shaft, key and coupling. Also select suitable Ball Bearing from Manufacture's catalogue. Prepare design report and assembly drawing indicating overall dimensions, tolerances, and surface finish. Also prepare bill of materials. (Activity should be completed in a group of five to six students) **6 Hrs**
4. Design Project No. 2
Observe the System where transmission of power takes place through power Screws. (e.g. Lead screw of lathe, feed screws of machine tools, Clamping screws, Toggle Jack screw, etc.)
Get the required information regarding effort, clamping force, etc., and selecting suitable materials design screw, nut and different simple components in assembly. Prepare design report and assembly drawing indicating overall dimensions, tolerances and surface finish. Also prepare bill of materials. (Activity should be completed in a group of five to six students) **4 Hrs**
5. Assignments on design of Helical Springs, Screwed joints, Welded joints [one each] with free hand sketches. **2 Hrs**
6. CAD Drawing for project No 1 or 2 should be prepared in practical and print out should be attached along with respective drawing sheets **8 Hrs**
7. Survey of Prime movers – Electric motors / I.C. Engines available in the market along with specifications suitable for your design project. Survey report should be prepared with the relevant catalogue. **4 Hrs**

Learning Resources:

1. Books:

SN	Author	Title	Publication
01	V.B.Bhandari	Introduction to Machine Design	Tata Mc- Graw Hill
02	R.K.Jain	Machine Design	Khanna Publication
03	Pandya & Shah	Machine design	Dhanpat Rai & Son

04	Joseph Edward Shigley	Mechanical Engg. Design	Mc- Graw Hill
05	PSG Coimbtore	Design Data Book	PSG Coimbtore
06	Abdulla Shariff	Hand Book of Properties of Engineering Materials & Design Data for Machine Elements	Dhanpat Rai & Sons
07	Hall, Holowenko, Laughlin	Theory and Problems of Machine Design	Mc- Graw Hill

2. IS/ International Codes

- a) IS 4218: 1967 ISO Metric Threads
- b) IS 2693: 1964 Cast Iron Flexible Couplings
- c) IS 2292: 1963 Taper keys & Keyways
- d) IS 2293: 1963 Gib Head Keys & Keyways
- e) IS 2389: 1963 Bolts, Screws, Nuts & Lock Nuts
- f) IS 4694: 1968 Square threads
- g) IS 808: 1967 Structural Steel
- h) SKF Catalogue for Bearings

3. Software Recommended:

- 1) Think 3 CAD Software developed by Acebrain System & Software Pvt. Ltd., Pune.
Website: www.acebrain.co.in
- 2) E – Yantra Software, developed by FEAST Software Pvt. Ltd., Powai, Mumbai.
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