

CURRICULUM
for
DIPLOMA PROGRAMME
in
MECHANICAL ENGINEERING
2nd Year (3rd & 4th Semester)
FOR THE STATE OF HIMACHAL PRADESH



Prepared by

**National Institute of Technical Teachers Training & Research
Sector-26, Chandigarh-160019, India.**

June, 2018

STUDY AND EVALUATION SCHEME
THIRD SEMESTER MECHANICAL ENGINEERING

THIRD SEMESTER (MECHANICAL ENGINEERING)												
SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		MARKS IN EVALUATION SCHEME								Total Marks
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
3.1	*Applied Mechanics	4	2	30	20	50	100	3	50	3	150	200
3.2	*Electrical Technology	4	2	30	20	50	100	3	50	3	150	200
3.3	Engineering Materials	4	2	30	20	50	100	3	50	3	150	200
3.4	Manufacturing Technology-I	3	6	30	50	80	100	3	70	3	170	250
3.5	Machine Drawing-I	-	6	-	50	50	100	4	-	-	100	150
3.6	Metrology & Instrumentation	3	2	30	20	50	100	3	50	3	150	200
3.7	SCA	-	2	-	25	25	-	-	-	-	-	25
	Total	18	22	150	205	355	600		270		870	1225

*common with Diploma in Automobile Engineering

STUDY AND EVALUATION SCHEME
FOURTH SEMESTER MECHANICAL ENGINEERING

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		MARKS IN EVALUATION SCHEME								Total Marks
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
				Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
4.1	Strength of Materials	4	2	30	20	50	100	3	50	3	150	200
4.2	Hydraulics and Pneumatics	4	2	30	20	50	100	3	50	3	150	200
4.3	Thermal Engineering -I	4	2	30	20	50	100	3	50	3	150	200
4.4	Manufacturing Technology-II	4	6	30	50	80	100	3	70	3	170	250
4.5	Machine Drawing-II	-	6	-	50	50	100	4	-	-	100	150
4.6	Theory of Machines	4	-	50	-	50	100	3	-	-	100	150
4.7	SCA	-	2	-	25	25	-	-	-	-	-	25
	Total	20	20	170	185	355	600		220		820	1175

Industrial Training: After examinations of 4th semester the students shall go on training in a relevant Industry in house training should be provided for a minimum period of 4 weeks and shall prepare a dairy. It shall be evaluated during 5th semester by his/her teachers for 50 marks. The students shall prepare a report at the end of training & shall present it in a seminar which will be evaluated for another 50 marks. This evaluation will be done by HOD and lecturer (incharge training) in the 5th semester.

3.1 APPLIED MECHANICS

RATIONALE

L T P

4 - 2

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

DETAILED CONTENTS

1. Introduction

(08hrs)

- 1.1 Concept of engineering mechanics (Applied Mechanics), definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields.
- 1.2 Definition of mass and weight basic quantities and derived Quantities of basic units and derived units
- 1.3 Concept of rigid body, scalar and vector quantities

2. Laws of forces

(12hrs)

- 2.1 Definition of force, measurement of force in SI units, its representation, Point force, concentrated force & Uniformly distributed force, characteristics of a force, effects of force
- 2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position
- 2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
- 2.4 Free body diagram
- 2.5 Equilibrant force and its determination
- 2.6 Lami's theorem

[Simple numerical problems on above topics]

3. Moment

(12hrs)

- 3.1 Concept of moment
- 3.2 Moment of a force and units of moment
- 3.3 Varignon's theorem
- 3.4 Principle of moment and its applications (Levers – simple and compound, balance steel yard, safety valve, reaction at support)

3.5 Parallel forces (like and unlike parallel force), calculating their resultant

3.6 Concept of couple, its properties and effects

3.7 General conditions of equilibrium of bodies under coplanar forces

3.8 Position of resultant force by moment

[Simple numerical problems on the above topics]

4. Friction (12hrs)

4.1 Definition and concept of friction, types of friction, force of friction

4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction

4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane

4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:

a) Acting along the inclined plane horizontally

b) At an angle with the inclined plane

5. Centre of Gravity (08hrs)

5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies

5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion

5.3 Determination of centre of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed

[Simple numerical problems on the above topics]

6. Simple Lifting Machines (12hrs)

6.1. Definition of effort, velocity ratio, mechanical advantage and efficiency of a simple machine and their relationship, law of machines. Examples of Simple and compound machines

6.2. Definition of ideal machine, reversible and self-locking machine

6.4. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency

6.5. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency

6.6. Working principle and application of inclined plane, wheel and axle, different pulley blocks, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application

[Simple numerical problems on the above topics]

LIST OF PRACTICALS

1. Verification of the following laws:
 - a) Parallelogram law of forces
 - b) Triangle law of forces
 - c) Polygon law of forces
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
5. To find the mechanical advantage (M.A), velocity ratio (V.R) and efficiency (η) of a screw jack.
6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
7. To find mechanical advantage, velocity ratio and efficiency of single purchase winch crab.
8. To find M.A, V.R, and η of :
 - (i) First system of pulleys
 - (ii) Second system of pulleys
9. To find center of gravity of regular lamina and irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

RECOMMENDED BOOKS

- 1) *A Text Book of Applied Mechanics* by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.
- 2) *Applied Mechanics* By, Col. Harbhajan Singh, TL Singla and Parmod Kumar Singla Published By Abhishek Publication,
- 3) *A Text Book of Engineering Mechanics (Applied Mechanics)* by RK Khurmi; S Chand and Co. Ltd., New Delhi.
- 4) *Text Book of Applied Mechanics* by Birinder Singh, Kaption Publishing House, New Delhi.
- 5) *Engineering Mechanics* by Parsad, Standard Publications, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No	Time Allotted (Hrs)	Marks Allotted (%)
1	8	10
2	12	22
3	12	18
4	12	18
5	8	10
6	12	22
Total	64	100

3.2 ELECTRICAL TECHNOLOGY

L T P
4 - 2

RATIONALE

Basic knowledge of Electrical and Electronics Engineering is essential for diploma holders in Mechanical Engineering for the purpose of understanding applications of these subject areas on the shop floor and in handling machines and equipment. This subject imparts basic concepts, principles and applications to enable students to apply these principles in real live situations, may it be production, quality control or repair and maintenance.

DETAILED CONTENTS

- 1. General Introduction (06 hrs)**
 - 1.1 Types of elect. Engg. materials; conducting semi-conducting & insulating materials and their application.
 - 1.2 Applications for electricity and Advantages of Elect. Energy over other types of energy.
 - 1.3 Concept of voltage current power and energy and their units

- 2. DC Circuits (06 hrs)**
 - 2.1 Resistance factors affecting the resistance of conducting metals resistivity and their units.
 - 2.2 Resistances in series & parallel.
 - 2.3 Ohm's Law,
 - 2.4 Faraday's Laws,
 - 2.5 Len's Law.

- 3.Principles of AC Circuits (14 hrs)**
 - 3.1 Concept of voltage generation advantages of three phase generation over single phase generation. Three phase star & delta connections voltage & current relationship (no derivation)
 - 3.2 Definition of cycle, frequency time period instantaneous value rms & max value of sinusoidal wave (relation between rms & max value), form factor & peak factor.
 - 3.3 Concept of phase & phase difference.
 - 3.4 Concept of resistance, inductance, capacitance and impedance in ac circuits.
 - 3.5 Power factor(concept of lead, lag & unity p.f.),its importance and improvement.
 - 3.6 Measurement of three phase power using two voltmeter method.
 - 3.7 Determination of true power, current & p. f. in simple ac series circuits (simple problems)

- 4. DC Machines (08 hrs)**
 - 1.1 Construction & principle of working of dc motor & generator.
 - 1.2 Fleming's Rules
 - 1.3 Starting of dc motors (three-point starter) & speed control.
 - 1.4 Reversing the direction of rotation of dc motors.

5.AC Machines

(12 hrs)

- 5.1 Types of AC motors and their applications
- 5.2 Construction of three phase induction motors, comparison of squirrel cage and slip-ring induction motors
- 5.3 Working principle of single phase & three-phase induction motors.
- 5.4 Reversing the direction of rotation of single phase & three phase induction motors.
- 5.5 Starting of three phase induction motors using star/delta & DOL, starters, starting single phase split phase motors.

6. Transformer

(06 hrs)

- 6.1 Construction & working principle.
- 6.2 Transformation ratio, emf equation, losses & efficiency.
- 6.3 Auto transformer,
- 6.4 Cooling of transformers.

7. Electrical Safety

(04 hrs)

Electrical shock and precautions against shock, treatment of electric shock, concept of fuses and their classification, selection and application, concept of earthing and various types of earthing, applications of MCBs and ELCBs

8. Basic Electronics

(08 hrs)

Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications, transistor – PNP and NPN, their characteristics and uses. Characteristics and applications of a thyristor, characteristics and applications of stepper motors and servo motors in process control.

LIST OF PRACTICALS

1. Use of multimeter for measurement of voltage & current (ac & dc).
2. Measurement of voltage, current, power and power factor of a motor at various loads.
3. Measurement of transformation ratio of a single phase transformer.
4. Measurement of a copper & iron losses of transformer and to determine its efficiency by direct loading method.
5. Starting of three-phase squirrel cage induction motor using star/delta starter and DOL starter and reversing the direction of three phase induction motor
6. Measurement of terminal voltage of dc shunt generator as a function of load current and plot the load-characteristic curve.
7. To draw V-I characteristics of a (i) NPN transistor (ii) thyristor (SCR)
8. Study of different types of fuses, MCBs and ELCBs
9. Study of zener diode as a constant voltage source and to draw its V-I characteristics
10. Study and testing of workshop equipment for earthing.
11. Troubleshooting in domestic wiring and distribution board.

RECOMMENDED BOOKS

1. *Electrical Technology* by B.L Theraja, S Chand and Co. New Delhi.
2. *Basic Electrical and Electrical Engineering* by S.K Sahadev, Dhanpat Rai and Sons.
3. *Principles of Electrical Engineering* by B.R Gupta, S Chand and Co.
4. *Basic Electrical Engineering* by JB Gupta, SK Kataria and Sons.
5. *Basic Electricity* by B.R. Sharma, Satya Prakashan, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	Time Allotted (hrs)	Marks Allotted (%)
1.	06	10
2.	06	10
3.	14	22
4.	08	12
5.	12	16
6.	06	10
7.	04	08
8.	08	12
Total	64	100

3.3 ENGINEERING MATERIALS

L T P
4 - 2

RATIONALE

Lot of development has taken place in the field of materials. New materials are being developed and it has become possible to change the properties of materials to suit the requirements. Diploma holders in Mechanical Engineering are required to make use of different materials for various applications. For this purpose, it is necessary to teach them basics of metal structure, properties, usage and testing of various ferrous and non ferrous materials and various heat treatment processes. This subject aims at developing knowledge about the characteristics, testing and usage of various types of materials used in Mechanical Engineering industry.

DETAILED CONTENTS

1. General (05 hrs)

- 1.1 Introduction to engineering materials
- 1.2 Classification of materials
- 1.3 Properties of engineering materials- mechanical, thermal and electrical
- 1.4 Selection criteria for use in industry

2. Ferrous Materials (15 hrs)

- 2.1 Classification of iron and steel
- 2.2 Sources of iron ore and its availability
- 2.3 Manufacture of pig iron, wrought iron, Cast iron and steel (Flow Diagrams only)
- 2.4 Types of Cast Iron: White, malleable, grey, mottled, modular and alloy and their usage
- 2.5 Steels and alloy steel
 - 2.5.1 Classification of steels
 - 2.5.2 Different manufacturing methods of steel, open hearth, Bessemer & electric arc.
 - 2.5.3 Availability, Properties and usage of steels.
 - 2.5.4 Specification as per BIS and equivalent standards.
 - 2.5.5 Effect of various alloying element like Cr, Ni, Co, V, Mo, Si, Mn, S on mechanical properties of steel.
 - 2.5.6 Use of alloy steels (high speed steel stainless steel, spring steel, silicon steel.

3. Non Ferrous Materials (06 hrs)

- 3.1 Important ores and properties of aluminium, copper, zinc, tin, lead.
- 3.2 Properties and uses of Al alloys, Copper alloys, Bearing metals, solders.

4. Composite, Ceramics and Plastics. (10 hrs)

- 4.1 Definitions, sources.
- 4.2 Metal matrix composites, ceramic matrix composites, fibre reinforced composites, carbon – carbon composites.
- 4.3 Engineering ceramics, natural and artificial ceramics
- 4.4 Various trade name of engineering plastics, thermosetting and thermoplastic
- 4.5 Plastic coatings
- 4.6 Fibers and their classification: inorganic and organic fibers.
- 4.7 Engineering application of composites, ceramics and plastics.
- 4.8 Introduction to smart/ intelligent materials

5. Insulating Materials (06 hrs)

- 5.1 Various heat insulating material and their usage like asbestos, glass wool, thermocole, cork, puf, china clay.
- 5.2 Various electrical insulating material and their use like China clay, leather, bakelite, ebonite, glass wool, rubber, felt.

6. Testing of Metals and Alloys (02 hrs)

- 6.1 Identification tests: appearance, sound, spark, weight, magnetic, band microstructure, filing.

7. Fundamentals of Heat Treatment (20 hrs)

- 7.1 Purpose of heat treatment
- 7.2 Theory of solid solution
- 7.3 Impact of cold and hot working on metal structure
- 7.4 Iron-Carbon Diagram
- 7.5 TTT Curve in steels and its importance.
- 7.6 Basic idea about martensitic transformation
- 7.7 Various heat treatment processes-hardening, tempering, annealing, normalizing, case hardening
- 7.8 Types of heat treatment furnaces

PRACTICAL EXERCISES

- 1. Classification of about 25 specimens of materials/parts into
 - i) Metals and non-metals

- ii) Metals and alloys
 - iii) Ferrous and non-ferrous metals
 - iv) Ferrous and non-ferrous alloys
2.
 - a) Study of heat treatment furnace.
 - b) Study of a thermocouple/ pyrometer.
 3. Study of a metallurgical microscope and a diamond polishing machine.
 4. To prepare specimens of following materials for microscopic examination and to examine the microstructure of the specimens of following materials:
 - i) Brass ii) Copper iii) Grey C iv) Malleable CI v) Low carbon steel vi) High carbon steel vii) HSS
 5. To anneal a given specimen and find out difference in hardness as a result of annealing.
 6. To normalize a given specimen and to find out the difference in hardness as a result of normalizing.
 7. To temper a specimen and to find out the difference in hardness due to tempering.
 8. To harden a specimen and to find out the difference in hardness due to hardening.

RECOMMENDED BOOKS

1. Material Sciences by R.K Rajput
2. Advances in material sciences by R.K Dogra
3. Material sciences and metallurgy by D.S. Nat
- 4 Manufacturing Engineering and Technology by Kalpakjian Pearson and Co. Ltd.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No	Time Allotted (Hrs)	Marks Allotted (%)
1	05	08
2	15	24
3	06	10
4	10	15
5	06	10
6	02	05
7	20	28
Total	64	100

3.4 MANUFACTURING TECHNOLOGY– I

L T P
3 - 6

RATIONALE

Diploma holders in Mechanical Engineering are responsible for supervising production processes with a view to adhere to the specifications, optimum utilization of resources and achieving desired production targets. They are also to handle specialized machines and equipment including CNC machines. For this purpose, knowledge and skills about various manufacturing processes are required to be imparted for enabling them to perform above functions. This subject aims at development of knowledge and skills regarding various production processes, tools and equipment including use of high tech machines for increased productivity and quality. Due to the vastness of this subject, it has been divided into three parts. The second and third part entitled Manufacturing Processes II and III will be continued in 4th and 5th semesters respectively

DETAILED CONTENTS

1. Turning

(16 hrs)

- 1.1 Principles of turning
- 1.2 Description and function of main parts of lathe
- 1.3 Specification of lathe
- 1.4 Drives and transmission
- 1.5 Work holding devices
- 1.6 Lathe tools, tool signature, Single point cutting tool geometry
- 1.7 Lathe Operations-Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling.
- 1.8 Cutting parameters-speed, feed and depth of cut
- 1.9 Speed ratio, preferred numbers of speed selection
- 1.10 Cutting fluid- its purpose and types
- 1.11 Lathe accessories (Steady rest, taper turning attachment, tool post grinder)
- 1.12 Brief description and applications of capstan and turret lathes.

2. Drilling

(06 hrs)

- 2.1 Principle of drilling
- 2.2 Classification of drilling machines and their description
- 2.5 Types of drills and their features
- 2.3 Operations performed on drilling machines- drilling, reaming, counter boring, counter sinking, tapping.
- 2.4 Speeds and feeds in drilling and other operations.
- 2.6 Drill holding and work holding devices.

3. Boring

(06hrs)

- 3.1 Principle of boring
- 3.2 Classification of boring machines and their description
- 3.3 Specification of boring machine
- 3.4 Boring tools
- 3.5 Boring bars and boring heads
- 3.6 Alignment of bores and its importance

4. Shaping, Planing and Slotting

(08 hrs)

- 4.1 Working principle of shaper, planer and slotter
- 4.2 Quick return mechanism
- 4.3 Types of tools used and their geometry
- 4.4 Specifications of shaper, planer and slotting machine
- 4.5 Speeds and feeds in above processes.

5. Foundry Practices

(12 hrs)

- 5.1 Pattern making
 - 5.1.1 Types of patterns
 - 5.1.2 Pattern materials
 - 5.1.3 Pattern allowances
 - 5.1.4 Colour coding of patterns
 - 5.1.5 Introduction to cores
 - 5.1.6 Core materials and types of cores.
- 5.2 Moulding
 - 5.2.1 Introduction to moulding
 - 5.2.2 Types of moulding sand and additives, their properties
 - 5.2.3 Sand mixing and mould preparation
 - 5.2.4 Casting defects - causes and their remedies
- 5.3 Melting and pouring
 - 5.3.1 Types of melting furnaces -: Pit furnace, Cupola, Reverberatory and Electric melting furnace
 - 5.3.2 Closing and pouring of mould
- 5.4 Special casting methods
 - 5.4.1 Introduction to die casting, investment casting, centrifugal casting.

LIST OF PRACTICALS

Note:- Demonstration of all machines should be given before starting the practical. The instructor should explain parts of machine, work & tool holding devices, different types of cutting tools and safety measures.

1. Job on facing and turning.
2. Job on step turning and grooving on job number 1.
3. Job on taper turning and chamfering on job number 1.
4. Job on internal turning and threading on job number 1.
5. Job on marking and drilling practice on mild steel pieces.
6. Job on drilling, reaming, counter boring and counter sinking.
8. Prepare a rectangular block to required accuracy on a shaper machine (C.I tolerance +/- 0.1 mm)
9. To cut a bevel surface/V groove on one of the faces for Job number 8
11. Job on cutting a keyway slot on shaper machine.
12. Job on making a square hole on slotter machine.
13. Preparation of a job on a planing machine.
14. Preparing pattern for open floor and split pattern.
15. Prepare an open floor mould of a simple solid pattern.
16. Prepare a floor mould of a solid pattern using cope.
17. Prepare a mould of a split pattern in cope and drag.
18. Pouring a mould with Aluminium.
19. Preparing the mould of loose piece pattern and preparing Aluminium casting.
20. Preparing the mould of a step pulley and also preparing the core for the same.
22. Study of various furnaces used in foundry shop.

RECOMMENDED BOOKS

1. *Workshop Technology* by BS Raghuvanshi, Dhanpat Rai & Sons, Delhi
2. *Elements of Workshop Technology* by SK Chaudhary & Hajra, Asia Publishing House, Delhi
3. *A textbook of Manufacturing Science and Technology* by Dr. A. Manna, Prentice Hall of India.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No	Time Allotted (Hrs)	Marks Allotted (%)
1	16	32
2	06	12
3	06	12
4	08	16
5	12	28
Total	48	100

3.5 MACHINE DRAWING – I

L T P
- - 6

RATIONALE

Diploma holders in Mechanical Engineering are required to read and interpret drawings and therefore, it is essential that they have skills of preparing drawings and sketches of various components, tools, jigs and fixtures. For this purpose, knowledge and skills for preparing drawings of couplings, bearings, bracket, pulleys, pipe joint, lathe parts, boiler parts and I.C. Engine parts and tool holders, are required to be imparted for enabling them to work in the field of Mechanical Engineering - be it manufacturing, testing or work in other function areas. This subject aims at development of drawing competencies in the students. While preparing drawings, stress should be laid on layout, cleanliness, conceptualization, dimensions and specifications.

DETAILED CONTENTS

Note:- All the sheets to be made in first angle projection system.

- | | |
|--|-----------------|
| 1. Intersection of the following: | 2 sheets |
| <ul style="list-style-type: none">- Cylinder with cylinder (equal and different diameters) axis at right angle.- Cylinder with cylinder (axis inclined).- Cylinder with cone (Axis at right angle and inclined)- Practice exercises on intersection of different surfaces such as cylinder, cone and prism. | |
| 2. Detail drawing of the following with complete dimensioning, tolerances, material and surface finish specifications: | |
| Arbor | 1 sheet |
| Universal couplings: | 1 sheet |
| Bearings | 3 sheets |
| Simple bushed bearing | |
| Ball bearing and roller bearing | |
| Plummer block (assembled drawing) | |
| Foot Step bearing | |
| 3. Bracket | 1 sheet |
| 3.1 Wall Bracket | |
| 4. Pulleys | 2 sheets |
| 4.1 Fast and loose pulley | |
| 4.2 Stepped and V-belt pulley | |
| 5. Lathe Parts | 3 sheets |
| 6.1 Tool post | |
| 6.2 Tail stock | |
| 6.3 Screw Jack | |

RECOMMENDED BOOKS

1. *Machine drawings* by P.S Gill; SK. Kataria
2. *Machine drawing* by R. K Dhawan; S. Chand and Company Delhi
3. *Machine drawing* by R.B Gupta; Satya Prakashan New Delhi
4. *Machine drawing* by N.D. Bhatt; Charotar Publishing House

SUGGESTED DISTRIBUTION OF MARKS	
Topic No	Marks Allotted (%)
1	18
2	30
3	10
4	12
5	30
Total	100

3.6 METROLOGY AND INSTRUMENTATION

L T P
3 - 2

RATIONALE

Metrology is the science of measurement. Diploma holders in Mechanical Engineering are responsible for ensuring process control and quality control by making measurements and inspection of various parameters. For this purpose, knowledge and skills about various measuring instruments is required. Hence this subject. The aim of this subject is to develop knowledge and skills regarding various measuring instruments amongst the students.

DETAILED CONTENTS

- 1. Introduction** (03 hrs)
- 1.1 Meaning of metrology
 - 1.2 Precision and accuracy
 - 1.3 Interchangeability
- 2. Linear Measurements** (10 hrs)
- 2.1 Working principle and constructional details of:-
 - 2.2 Engineering scale
 - 2.3 Vernier Caliper
 - 2.4 Micrometer
 - 2.5 Height gauge and depth gauge
 - 2.6 Radius gauge and feeler gauge
 - 2.7 Dial indicator
 - 2.8 Comparators
 - 2.9 Slip Gauges
- 3. Angular Measurements** (08 hrs)
- Construction & working Principles of the following:-
- 3.1 Combination set
 - 3.2 Vernier bevel protractor

- 3.3 Sine bar
- 3.4 Taper measurement by rollers
- 4. Surface Measurements** (02 hrs)
 - 4.1 Straight edge
 - 4.2 Try square
 - 4.3 Surface plate and Angle plate
- 5. Limit Gauges** (04 hrs)
 - 5.1 Types and applications of gauges
 - 5.2 GO and NO GO gauges
- 6. Thread Measurements** (04 hrs)
 - 6.1 Measurement of thread elements of external and internal threads
 - 6.2 Screw pitch gauge
 - 6.3 Screw thread Micrometer
 - 6.4 Thread limit Gauges
- 7. Surface Finish Measurements** (04 hrs)
 - 7.1 Roughness and Waviness Various roughness values-CLA value, RMS Value, Mean value.
 - 7.2 Surface roughness measuring instrument- principle of working
- 8. Other Measuring Instruments** (08 hrs)
 - 8.1 Gear Tooth Vernier
 - 8.2 Autocollimator
 - 8.3 Tool maker's Microscope
 - 8.4 Profile Projector
 - 8.5 Coordinate Measuring Machine
- 9. Instrumentation** (06 hrs)
 - 9.1 Measurement of Mechanical quantities such displacement vibrations frequency, pressure, temperature, humidity by electromechanical transducers of resistance, capacitance and inductance type.

LIST OF PRACTICALS

1. Use of linear measuring instruments like vernier calliper and micrometer.
2. Use of height gauge and depth gauge.
3. Measurements with the help of combination set and bevel protractor.
4. Angle measurement by use of sine bar and slip gauges.
5. Measurement of centre distance between two pins using slip gauges.
6. Checking of flatness using Dial indicator.
7. Measurement of taper by standard balls and rollers.
8. Measurement of thread parameters by using Tool makers microscope.
9. Measurement of gear elements by using gear tooth vernier.
10. Measurement of profile by profile projector.
11. Measurement of surface roughness of a surface.

RECOMMENDED BOOKS

1. *Engineering Metrology* by R.K. Jain, Khanna Publishers
2. *A Text Book of Production Engineering* by P.C Sharma
3. *Engineering Metrology* by R.K. Rajput; S.K. Kataria & Sons

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	02	05
2	10	15
3	08	10
4	02	10
5	04	10
6	04	10
7	04	10
8	08	15
9	06	15
Total	48	100

FOURTH SEMESTER
MECHANICAL ENGINEERING

FOURTH SEMESTER (MECHANICAL ENGINEERING)												
SR. NO	SUBJECTS	STUDY SCHEME Hrs/Week		MARKS IN EVALUATION SCHEME								Total Marks
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
4.1	Strength of Materials	4	2	30	20	50	100	3	50	3	150	200
4.2	Hydraulics and Pneumatics	4	2	30	20	50	100	3	50	3	150	200
4.3	Thermal Engineering -I	4	2	30	20	50	100	3	50	3	150	200
4.4	Manufacturing Technology-II	4	6	30	50	80	100	3	70	3	170	250
4.5	Machine Drawing-II	-	6	-	50	50	100	4	-	-	100	150
4.6	Theory of Machines	4	-	50	-	50	100	3	-	-	100	150
4.7	SCA	-	2	-	25	25	-	-	-	-	-	25
	Total	20	20	170	185	355	600		220		820	1175

Industrial Training: After examinations of 4th semester the students shall go on training in a relevant Industry in house training should be provided for a minimum period of 4 weeks and shall prepare a dairy. It shall be evaluated during 5th semester by his/her teachers for 50 marks. The students shall prepare a report at the end of training & shall present it in a seminar which will be evaluated for another 50 marks. This evaluation will be done by HOD and lecturer (incharge training) in the 5th semester.

4.1 STRENGTH OF MATERIALS

L T P
4 - 2

RATIONALE

Diploma holders in Mechanical Engineering are required to analyse reasons for failure of different components and select the required material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts, columns and springs. Hence this subject. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

DETAILED CONTENTS

- 1. Stresses and Strains (12 hrs)**
- 1.1 Concept of load, stresses and strain
 - 1.2 Tensile compressive and shear stresses and strains
 - 1.3 Concept of Elasticity, Elastic limit and limit of proportionality.
 - 1.3.1 Hook's Law
 - 1.3.2 Young Modulus of elasticity
 - 1.3.3 Nominal stress
 - 1.3.4 Yield point, plastic stage
 - 1.3.5 Strain hardening
 - 1.3.6 Ultimate strength and breaking stress
 - 1.3.7 Percentage elongation
 - 1.3.8 Proof stress and working stress
 - 1.3.9 Factor of safety
 - 1.3.10 Shear modulus
 - 1.3.11 Strain energy due to direct stresses
 - 1.3.12 Proof resilience and modulus of resilience
 - 1.3.13 Stresses due to gradual, sudden and falling load
 - 1.4 Longitudinal and circumferential stresses in seamless thin walled cylindrical shells (derivation of these formulae not required).
- 2. Moment of Inertia (10 hrs)**
- 2.1. Concept of moment of inertia and second moment of area
 - 2.2. Radius of gyration
 - 2.3. Second moment of area of common geometrical sections: Rectangle, Triangle, Circle (without derivation), Second moment of area for L, T and I section
 - 2.4. Section modulus
- 3. Beams and Bending Stress (12 hrs)**
- 3.1. Bending and shearing force
 - 3.1.1. Concept of beam, form of loading
 - 3.1.2. Concept of end supports Roller, hinged and fixed
 - 3.1.3. Concept of bending moment and shearing force
 - 3.1.4. B.M. and S.F. Diagram for cantilever and simply supported beams with and without overhang subjected to concentrated and U.D.L.
 - 3.2. Bending stresses
 - 3.2.1 Concept of Bending stresses
 - 3.2.2 Bending Equation
 - 3.2.3 Theory of simple bending
 - 3.2.4 Use of the equation $f/y = M/I = E/R$
 - 3.2.5 Concept of moment of resistance
 - 3.2.6 Bending stress diagram

3.2.7 Calculation of maximum bending stress in beams of rectangular, circular, I and T section.

3.2.8 Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.

4. Columns (10 hrs)

- 4.1. Concept of column, modes of failure
- 4.2. Types of columns
- 4.3. Buckling load, crushing load
- 4.4. Slenderness ratio
- 4.5. Factors effecting strength of a column
- 4.6. End restraints
- 4.7. Effective length
- 4.8. Strength of column by Euler Formula
- 4.9. Rankine Gourdan formula
- 4.10 Combined direct and bending stresses
 - 4.10.1 Simple cases of short columns of uniform section subjected to eccentric loading with stress diagram

5. Torsion (10 hrs)

- 5.1. Concept of torsion- difference between torque and torsion, Torsion equation.
- 5.2. Use of torque equation for circular shaft
- 5.3. Comparison between solid and hollow shaft with regard to their strength and weight.
- 5.4. Power transmitted by shaft
- 5.5. Concept of mean and maximum torque

6. Springs (10 hrs)

- 6.1. Closed coil helical springs subjected to axial load and impact load
- 6.2. Stress deformation
- 6.3. Stiffness and angle of twist and strain energy
- 6.4. Proof resilience
- 6.5. Laminated Spring (Semi elliptical type only)
 - 6.5.1 Determination of number of plates
 - 6.5.2 Maximum bending stress and deflection

PRACTICAL EXERCISES

1. Tensile test on bars of Mild steel and Aluminium.
2. Shear test on specimen of two different metals.
3. Bending tests on a steel bar or a wooden beam.
4. Impact test on metals:
 - Izod test
 - Charpy test
5. Torsion between on specimen of different metals for determining the angle of twist for a given torque.
6. To determine the stiffness of a helical spring and to plot a graph between load and extension.
7. Hardness test on metal and finding the Brinell, Rockwell hardness

RECOMMENDED BOOKS

1. *Strength of Materials* by RS Khurmi; S Chand & Co., New Delhi.
2. *Elements Strength of Materials* by DR Malhotra and HC Gupta, SatyaPrakashan, New Delhi.
3. *Strength of Materials* by Birinder Singh; Katson Publishing House, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No	Time Allotted (Hrs)	Marks Allotted (%)
1	12	20
2	10	15
3	12	20
4	10	15
5	10	20
6	10	10
Total	64	100

4.2 HYDRAULICS AND PNEUMATICS

RATIONALE

L T P
4 - 2

Diploma holders in this course are required to deal with problems of fluid and use of hydraulics and pneumatics in power generation. For this purpose, knowledge and skills about fluid mechanics and machinery, hydraulics and pneumatics systems are required to be imparted for enabling them to perform above functions.

DETAILED CONTENTS

1. Introduction (04 hrs)

Fluid, types of fluid; properties of fluid viz mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility, surface tension, kinematic viscosity and dynamic viscosity and their units.

2. Pressure and its Measurement (08hrs)

2.1 Concept of pressure (Atmospheric Pressure, gauge pressure, absolute pressure)

2.2 Pressure measuring devices: piezometer tube manometers - simple U-tube, differential single column, inverted U-tube, micro manometer including simple problems.

2.3 Bourdon pressure gauge, Diaphragm pressure gauge, dead weight pressure gauge

2.4 Concept of static pressure, Dalton's Law of partial pressure, Pascal's law, intensity of pressure and pressure head, Total pressure on a plane surface and centre of pressure.

3. Flow of Fluids (10 hrs)

Types of fluid flow – steady and unsteady, uniform and non-uniform, laminar and turbulent; rate of flow and their units; continuity equation of flow; potential energy of a flowing fluid; total head; Bernoulli's theorem (statement and proof) and its applications. Discharge measurement with the help of venturi-meter, orifice meter, pitot-tube, limitations of Bernoulli's theorem, simple problems on measurement of flow.

4. Flow through Pipes (12 hrs)

4.1 Definition of pipe flow, wetted perimeter, hydraulic mean depth, hydraulic gradient; loss of head due to friction; Chezy's equation and Darcy's equation of head loss (without proof), Reynolds's number and its effect on pipe friction.

4.2 Loss of head in pipes due to sudden enlargement, sudden contraction, obstruction on flow path, change of direction and pipe fittings (without proof) including simple problems

5. Hydraulic Machines (08hrs)

Description, operation and application of hydraulic machines – hydraulic ram, hydraulic jack, hydraulic brake, hydraulic accumulator, hydraulic door closer, hydraulic press, selection of specification of above machines for different applications.

6. Hydro-Power, Water Turbines and Pumps

(12 hrs)

- 6.1 Advantages of hydropower, basic elements, dams, head works.
- 6.2 Concept of a turbine, types of turbines –impulse and reaction type (concept only), difference between them. Construction and working of pelton wheel, Francis turbine, Propeller and Kaplan turbines. Unit speed, unit power, unit discharge, specific speed of turbines, selection of turbines based on specific speed.
- 6.3 Concept of hydraulic pump, single acting reciprocating pump (construction and operation only), vane, screw and gear pumps.
- 6.4 Construction, working and operation of centrifugal pump. Performance, efficiencies and specifications of a centrifugal pump. Trouble shooting and problems in centrifugal pumps and remedial measures, pitting, cavitation, priming.

7. Hydraulic Systems

(05hrs)

- 7.1 Basic components of hydraulic system, their symbols and function of each component in a hydraulic circuit.
- 7.2 Industrial application of Hydraulic systems.

8. Pneumatic Systems

(05hrs)

- 8.1 Basic components – function of each component
- 8.2 Air cylinder – types, function, single acting, double acting, rotating, non-rotating, piston type, diaphragm type, tandem cylinder, double ended cylinder, duplex cylinder with symbols.
- 8.3 Industrial application of Pneumatic systems.

LIST OF PRACTICALS

- 1. Measurement of pressure head by employing.
 - i) Piezometer tube
 - ii) U- tube manometer
 - iii) Differential U- tube Manometer.
- 2. Verification of Bernoulli's theorem.
- 3. To find out rate of flow and coefficient of discharge for a venturimeter.
- 4. To find out rate of flow and coefficient of discharge for a orifice meter.
- 5. To find coefficient of friction for a pipe (Darcy's friction).
- 6. To study and find out the efficiency of hydraulic ram.
- 7. Study the working of a Pelton wheel and Francis turbine.
- 8. To study a single acting reciprocating pump.
- 9. To study a single stage centrifugal pump and draw its characteristic curves for.
 - i) Head Vs Discharge
 - ii) Power Vs Discharge
 - iii) Efficiency Vs Discharge
- 10. Study of components of hydraulic and pneumatic system

RECOMMENDED BOOKS

1. *Fluid Mechanics* by KL Kumar; S Chand and Co Ltd., Ram Nagar, New Delhi.
2. *Hydraulics and Fluid Mechanics Machine* by RS Khurmi ;S.Chand& Co. Ltd., New Delhi.
3. *Fluid Mechanics through Problems* by RJ Garde; Wiley Eastern Ltd., New Delhi.
4. *Fluid Mechanics* by Dr AK Jain, Khanna Publishers, New Delhi.
5. *Hydraulics and hydraulic Machinery* by Dr.JagadishLal; Metropolitan Book Company Ltd., Delhi.
6. *Hydraulic and Pneumatic Power and Control Design, Performance and Application* by Yeaple, McGraw Hill, New York..
7. *Pneumatic Controls* by Festo Didactic; Bangalore.
8. *Pneumatics Control: An Introduction to the Principles* by Werner Deppert and Kurt Stoll; Vogel – Verlag.
9. *Fluid mechanics* by R.K Bansal.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No	Time Allotted (Hrs)	Marks Allotted (%)
1	4	10
2	8	15
3	10	15
4	12	15
5	8	10
6	12	15
7	5	10
8	5	10
Total	64	100

4.3 THERMAL ENGINEERING– I

L T P
4 - 2

RATIONALE

A diploma holder in Mechanical Engineering is supposed to maintain steam generators, turbines and other power plant equipment. In addition, he is required to maintain various types of automobiles. Therefore, it is essential to teach him concepts, principles and applications of basic thermodynamics, steam generators, steam turbine and other power plant equipment; non-conventional energy sources and about IC engines.

DETAILED CONTENTS

Note- use of Steam table and mollier chart are allowed in the examination

1. Basic Concepts and Gas Laws (06 hrs)

- 1.1 Gas laws: Boyle's law, Charle's law, Avogadro's Law and Gay Lussacs Law
- 1.2 Characteristics equation, Gas constant, Universal gas constant.
- 1.3 Thermodynamics, property (system open and closed), surroundings, Heat and work, specific heats and their relationship,

2. Laws of Thermodynamics (14hrs)

- 2.1 Explanation of the Zeroth law of thermodynamics.
- 2.2 Explanation of First Law of Thermodynamics.
- 2.3 Concept of enthalpy, internal energy, specific heat, work and heat.
- 2.4 Clausius and Kelvin Plank statements of second law of thermodynamics.
- 2.5 Concept of Entropy
- 2.6 Constant Volume, Constant pressure, Isothermal, adiabatic and polytrophic processes, Throttling and free Expansion, work done under these processes.

3. Formation of Steam and its Properties (10 hrs)

- 3.1 Steam Formation
- 3.2 Wet steam, dry steam and saturated steam; dryness fraction with simple numericals
- 3.3 Super-heated steam; degree of super heat.
- 3.4 Latent heat of vaporization
- 3.5 Enthalpy of steam
- 3.6 Entropy; entropy increase during evaporation.
- 3.7 Temperature Entropy diagram
- 3.8 Mollier Diagram (H-S diagram) with simple numerical

4. Steam Generator (08 hrs)

- 4.1 Uses of steam
- 4.2 Classification of boilers
- 4.3 Boiler mounting and accessories
- 4.4 Comparison of fire tube and water tube boilers.
- 4.5 Constructional features of Nestler boiler, Babcock and Wilcox boiler.
- 4.6 Modern boilers-: Benson boiler, La-mont boiler

5. Nozzles and Steam Turbines (10hrs)

- 5.1 Energy equation as applied to a nozzle
- 5.2 Description of various types of turbines
- 5.3 Methods of reducing rotor speed in impulse turbines
- 5.4 Governing of steam turbines

6. Non-Conventional Sources of Energy (08 hrs)

- 6.1 Need of non-conventional energy sources
- 6.2 Solar Energy
- 6.3 Sun and solar radiation
- 6.4 Solar constant
- 6.5 Solar collectors-flat plate collectors and focusing collectors
- 6.6 Solar heating-solar cooker, solar power generation and Solar cooling
- 6.7 Photo voltaic cells
- 6.8 Industrial and agricultural application of a solar energy
- 6.9 Economic consideration for use of solar energy.
- 6.10 Other Non-Conventional Energy Sources:
- 6.11 Wind Power
- 6.12 Geothermal energy

7. Elements of Heat Transfer (08 hrs)

- 7.1 Conduction
- 7.2 Convection
- 7.3 Radiation

7.4 Stefan Boltzman's law

Simple problems of heat transfer on conduction and radiation only.

LIST OF PRACTICALS

1. Study of constructional details and specifications of fire tube boiler and sketch.
2. Demonstration of mountings and accessories on a boiler for study and sketch.
3. To find out thermal conductivity of a metal rod in a steady state conduction.
4. To find out convective heat transfer coefficient by natural convection.
5. To verify Boltzman's law.
6. Study of steam turbine through models
7. Study of solar water heating.
8. Study of generation of power by solar panel.

RECOMMENDED BOOKS

1. Engineering Thermodynamics by P.K. Nag, Tata McGraw Hill, Delhi
2. Basic Engineering Thermodynamic by Roy Choudhury; Tata McGraw Hill, Delhi.
3. Basic thermodynamics by P.B. Joshi, Pune Vidyarthi Grah Prakashan
4. Basic Thermodynamic by C.P Arora; Tata McGraw Hill, Delhi.
5. A Treatise on Heat Engineering by V.P. Vasandani and D.S. Kumar; Metropolitan Book company.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No	Time Allotted (Hrs)	Marks Allotted (%)
1	6	10
2	14	20
3	10	15
4	8	15
5	10	15
6	8	15
7	8	10
Total	64	100

4.4 MANUFACTURING TECHNOLOGY-II

L T P
4 - 6

RATIONALE

Diploma holders in Mechanical Engineering are responsible for supervising production process with a view to adhere to the specifications, optimum utilization of resources and achieving desired production targets. For this purpose, knowledge and skills about welding, jigs and fixture, metal forming processes, grinding and metal finishing processes are required to be imparted for enabling them to perform above functions.

DETAILED CONTENTS

1. Gas Welding (10 hrs)

- 1.1. Principle of operation
- 1.2. Oxyacetylene flame
 - 1.2.1. Types of flame
- 1.3. Welding Techniques
- 1.4. Filler rods and fluxes for gas welding
- 1.5. Gas welding equipment and accessories
- 1.6. Acetylene gas generator

2. Electric arc Welding (08 hrs)

- 2.1 Introduction to arc welding with procedures, equipment and applications.
- 2.2 Types of arc
- 2.3 Types of electrode used
- 2.4 Specifications of electrodes

3. Resistance Welding (04 hrs)

- 3.1 Spot welding
- 3.2 Seam welding
- 3.3 Projection welding
- 3.4 Percussion welding

4. Jigs and Fixtures (08 hrs)

- 4.1 Importance and use of Jigs and fixtures.
- 4.2 Principles of Location
- 4.3 Locating Devices
- 4.4 Purpose of Clamping elements
- 4.5 Types of clamps

4.6 Types of drilling jigs

4.7 Types of milling and welding fixtures

5. Metal Forming Processes

(08 hrs)

5.1 General Idea of following processes:

- Die stamping
- Drawing
- Spinning
- Rolling
- Extruding
- Forging
- Tube drawing
- Powder Metallurgy

6. Grinding

(08 hrs)

6.1. Purpose of grinding

6.2. Types of grinding machines and their working- Cylindrical, surface, centre less, tool and cutter grinder, Jig Grinder.

6.4. Various elements of grinding wheel - abrasive, grade, structure, bond.

6.5. Codification of grinding wheel

6.6. Selection of grinding wheel

6.7. Dressing, truing, balancing and mounting of wheel.

6.8. Wheel and work speeds and feeds.

6.9. Defects and remedies in grinding.

7. Metal Finishing Processes

(08 hrs)

7.1 Purpose of finishing surfaces

7.2 Surface roughness- Definition and units.

7.3 Honing Process: its applications

7.4 Description of hones

7.5 Brief idea of honing machines

7.6 Lapping Process; its application

7.7 Description of lapping compounds and tools.

7.8 Brief idea of lapping machines.

7.9 Super finishing process; its applications.

7.10 Use of super finishing attachment on Centre lathe

7.11 Polishing

7.12 Buffing

8. Modern Machining Methods: -Principle, process details, advantages limitations and applications of the following processes (10 hrs)

8.1. Electro discharge machining

8.2. Wire Cut EDM

8.3. Electric chemical machining

8.4. Chemical machining

8.5. Ultrasonic machining

8.7. Laser Beam machining.

8.8. Plasma arc machining

8.6 Additive Manufacturing

LIST OF PRACTICALS

Note:- Demonstration of all machines should be given before starting the practical. The instructor should explain parts of machine, work & tool holding devices, different types of cutting tools and safety measures.

1. Study of various gas cutting and welding equipment.
2. Practice of gas welding and gas cutting (manually and by cutting machine).
3. Practice of arc cutting.
4. Practice of spot and seam welding.
5. Study of welding defects.
6. Inspection and testing of welded joints
7. Practice of welding pipes and pipe joints
8. To prepare a gear blank on lathe machine.
9. Cylindrical grinding on lathe with tool post grinding attachment.
10. Storing and Maintenance of pattern.
11. Preparation of utility job by making patterns.
12. Preparation of a die (simple type)
13. Preparation of a single ended spanner by hand forging.
14. Prepare a mould in three moulding boxes prepare the casting.
15. Casting of utility job of above pattern.
16. Mounting and balancing of grinding wheel.
17. Exercise on grinding of a rectangular block to size on surface grinding machine.
18. Practice on cylindrical and centreless grinding machines.
19. Exercise on hand lapping job to required accuracy.
20. Buffing practice.

RECOMMENDED BOOKS

1. *Elements of workshop Technology* by SK Choudhary and Hazra, Asia Publishing House
2. *Workshop Technology* by BS Raghuwanshi, DhanpatRai and Sons Delhi
3. *Workshop Technology Vol. I, II & III* by Chapman; Standard Publishers & Distributors, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No	Time Allotted (Hrs)	Marks Allotted (%)
1	10	10
2	08	10
3	04	10
4	08	15
5	08	15
6	08	10
7	08	15
8	10	15
Total	64	100

4.5 MACHINE DRAWING –II

L T P
- - 6

RATIONALE

Mechanical diploma holders are required to read and interpret the machine parts drawing therefore it is essential that they become competent in preparing, and drawing various free hand sketches of machine parts.

Note:

1. *1st Angle projection is to be followed*
2. *SP 46-1988 should be followed*
3. *Instruction relevant to various drawings may be given along with appropriate demonstration before assigning drawing practice to the students*
4. *The drawing should include dimensions with tolerances wherever necessary and material list as per BIS/ISO specifications.*

DETAILED CONTENTS

Introduction to drawing office equipment and drawing office practice through visit of modern organizations/offices. Introduction to the principles of working drawings, reading and interpretation of working drawings specific to industry.

- | | |
|---|--------------------|
| 1. Boiler Parts | (02 Sheets) |
| 1.1. Steam stop valve | |
| 1.2. Blow off cock | |
| 2. I.C. Engine Parts | (02 Sheets) |
| 2.1 Piston with connecting rod assembly. | |
| 2.2 Crankshaft and fly wheel assembly (Car Engine) | |
| 3. Lathe Tool Holder | (01 Sheet) |
| 4. Vices | (02 Sheets) |
| 4.1 Bench Vice (details/ assembly) | |
| 4.2 Machine Vice (details/assembly) | |
| 5. Drill Jig (Details and assembly) | (01 Sheet) |
| 6. Cams and Followers | (02 Sheets) |
| 6.1 Profile of cams for imparting following motions with knife edge and roller followers: | |
| 6.1.1 Uniform motion | |
| 6.1.2 Simple harmonic motion | |

7. Gears

(01 Sheet)

7.1 Use of different types of gears

7.2 Spur gears with actual profile of involute teeth.

7.3 Conventional representation of bevel gear, worm and worm wheel.

RECOMMENDED BOOKS

- 1. Machine Drawing by P.S. Gill, S.K. Kataria & Sons*
- 2. Machine drawing by R.K. Dhawan, S. Chand and Co.*
- 3. Machine drawing by R.B. Gupta, Satya Prakashan*
- 4. Machine drawing by N.D. Bhatt, Charotar Publishing House.*

4.6 THEORY OF MACHINES

L T P

4 - -

RATIONALE

A diploma holder in Mechanical Engineering is required to assist in the design and development of prototype and other components. For this, it is essential that he is made conversant with the principles related to design of components and machines and application of these principles for designing. Hence this subject. The aim of the subject is to develop knowledge and skills about various aspects related to design of machine components.

DETAILED CONTENTS

1. Simple Mechanisms (08 hrs)

- 1.1 Introduction to link, kinematic pair, lower and higher pair, Kinematic chain, mechanism, Inversions.
- 1.2 Different types of mechanisms
- 1.3 Mechanical advantage of a linkage
- 1.4 Cams and followers: Terminology and classification

2. Friction (12 hrs)

- 2.1 Frictional torque in screws, both for square and V threads
- 2.2 Introduction to frictional clutches
- 2.3 Friction in journal bearing
- 2.5 Different types of bearings and their applications

3. Power Transmission (12 hrs)

- 3.1 Power transmission through screw and efficiency
- 3.2 Flat belt and V belt drives :-(Ratio of tensions; Power transmitted, centrifugal tension, Condition for maximum power)
- 3.3 Chain drive, different types of chains and their applications
- 3.4 Gear and its nomenclature, types of gears and their applications; simple and compound gear trains; power transmitted by simple and compound gear trains.

(with simple numerical)

4. Flywheel (08 hrs)

- 4.1 Principle and applications of flywheel.
- 4.2 Turning moment diagram of flywheel for different engines
- 4.3 Fluctuation of speed and fluctuation of energy

(with simple numerical)

5. Governor**(08 hrs)**

5.1 Principle of governor

5.2 Construction and working of Watt, Porter and Hartnel Governor.

*(with simple numerical)***6. Balancing****(08 hrs)**

6.1 Concept of balancing

6.2 Introduction to balancing of rotating masses *(with simple numerical)*

6.3 Concept of gyroscope.

7. Vibrations**(08 hrs)**

7.1 Vibrations, its type and damping, causes of vibrations in machines, their harmful effects and remedies

RECOMMENDED BOOKS

1. *Theory of Mechanism and Machine* by A. Ghosh and A.. Malik, East West Press
2. *Theory of Machines* by R.S. Khurmi and J.K. Gupta, S. Chand and company Ltd.
3. *Theory of Machine* by S.S. Rattan, Tata McGraw Hill
4. *Mechanisms and Machine Theory* by JS Rao and Dukupati, Wiley Eastern, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No	Time Allotted (Hrs)	Marks Allotted (%)
1	08	12
2	12	20
3	12	20
4	08	12
5	08	12
6	08	12
7	08	12
Total	64	100