# Curriculum

FOR

DIPLOMA PROGRAMME

IN

# Mechanical Engineering

## 2nd Year (i.e. 3rd & 4th Semester)

FOR THE STATE OF HIMACHAL PRADESH

(Implemented w.e.f. Session 2013-14)

Prepared by:-

**Composite Curriculum Development Centre**

Directorate of Technical Education,

Vocational & Industrial Training, Sundernagar(H.P.)

July, 2013

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**THIRD SEMESTER**



**FORTH SEMESTER**

## PREFACE

*India, in last two decades, has made significant progress in all major spheres of activity. Since 1947, the Technical Education System has grown into fairly large sized system, offering opportunities for education and training in vide variety of trades / disciplines at different levels. Needless to say that well trained technical manpower is the backbone of any growing economy in the era of fast industrialization. It has been the endeavor of the Technical Education Department to take decisive steps to enhance the capacities of technical institutions with major emphasis on quality and excellence in technical education .Our country is the only country in the world which has 50% population below the age of 25 years whereas America has 30% and China 40%.Working Age Population (WAP) is increasing in India whereas it is decreasing in other parts in the world. Challenge before us is to train this WAP for the world of work .Updated curriculum is one of the most powerful tools to improve the quality of training.*

*Curriculum Document is a comprehensive plan or a blue print for developing various curriculum materials and implementing given educational programme to achieve desired and formally pre-stated educational objectives. Moreover it (the document) is the output of exhaustive process of curriculum planning and design, undertaken by the implementers under the expert guidance of curriculum designer.*

*While working out the detailed contents and study and evaluation scheme, the following important elements have been kept in mind:*

*Major employment opportunities of the diploma holders.*

*Modified competency profile of the diploma holders with a view to meet the changing needs due to technological advancement and requirements of various employment sectors.*

*Vertical and horizontal mobility of diploma pass outs for their professional growth.*

*Pragmatic approach in implementing all the curricula of diploma programmes in engineering and technology in the state of H.P.*

*The document is an outcome of the feedback received from field organizations/ industry of different categories viz. small, medium and large scale which offer wage employment for the diploma pass outs. In every stage of planning and designing of this curriculum, suggestions and advice of experts representing industry, institutions of higher learning, research organizations etc. were sought and incorporated as per the requirement of curriculum . The document contains the study and evaluation scheme and detailed subject/course contents to enable the H.P. Polytechnics to implement revised curriculum and to achieve the desired objectives.*

*Time has specifically been allocated for undertaking extra-curricular activities. Emphasis has been laid on developing and improving communication skills in the students for which Communication Lab has been introduced during the first year itself.*

*We hope that this revision will prove useful in producing competent diploma holders in the state of Himachal Pradesh. The success of this curriculum depends upon its effective implementation and it is expected that the managers of polytechnic education system in Himachal Pradesh will make efforts to create better facilities, develop linkages with the world of work and foster conducive and requisite learning environment.*

**Er. L.R. Rana**
**Head(CCDC)**
Directorate of Technical Education,
Vocational & Industrial Training,
Sundernagar, Himachal Pradesh.

## 2nd YEAR OF THREE YEAR DIPLOMA PROGRAMME IN MECHNICAL ENGINEERING

## 1. SALIENT FEATURES

1) Name of the Programme : Three year Diploma Programme Mechanical Engineering
2) Duration of the Programme : Three years (06 Semesters)
3) Entry Qualification : As prescribed by H.P. Takniki Shiksha Board
4) Intake : As approved by H.P. Takniki Shiksha Board
5) Pattern of the Programme : Semester Pattern
6) Curriculum for : 2nd year of Three year Diploma Programme(Technical Stream)

7) **Student Centred Activities:**

A provision of 2-4 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. These activities will comprise of co-curricular & other activities such as expert lectures, games, seminars, declamation contests, educational field visits, NCC, NSS and cultural activities & hobby classes like photography, painting, singing etc.

8) **Industrial Training:-**

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of a minimum of 4 weeks duration to be organised during the semester break starting after second year i.e. after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 50 and external assessment of 50 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry.

Teachers and students are requested to see the footnote below the study and evaluation scheme of IV Semester for further details.

## 2. GUIDELINES

### 2.1 GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

**Distribution of 25 marks for SCA will be as follows:**

i. 5 Marks shall be given for general behaviour

ii. 5 Marks for attendance shall be based on the following distribution:

| | | |
|---|---|---|
| 1. | Less than 75% | Nil |
| 2. | 75-79.9% | 3 Marks |
| 3. | 80-84.9% | 4 Marks |
| 4. | Above 85% | 5 Marks |

iii. 15 Marks shall be given for the Sports/NCC/Cultural and Co-curricular activities/other activities after due consideration to the following points:

1. For participation in sports/NCC/Cultural/Co-curricular activities at National or above level, shall be rewarded with minimum of 10 marks
2. For participation in sports/NCC/Cultural/Co-curricular activities at Inter-polytechnic level, shall be rewarded with minimum of 08 marks
3. For participation in two or more of the listed activities, 5 extra marks should be rewarded

**Note:** *Head of Department shall ensure that these marks are conveyed to the H.P. Takniki Shiksha Board, Dharamsala at the end of semester along with sessional record.*

### 2.2 GUIDELINES FOR SESSIONAL ASSESSMENT

- The distribution of marks for Internal Assessment in theory subjects and drawing shall be made as per the following guidelines:
  i. 60% of internal assessment shall be based on the performance in the tests. At least three tests shall be conducted during the semester out of which at least one should be house test. 30% weightage shall be given to house test and 30% to class test(One best out of two).
  ii. 20% marks shall be given to home assignments, class assignments, seminars etc.
  iii. 20% marks shall be given for attendance/punctuality in the subject concerned.
- The distribution of marks for Internal/External Assessment in practical subjects shall be made as per the following guidelines:
  i. 60% marks shall be awarded for performance in practical.
  ii. 20% marks shall be given for Report/Practical book and punctuality in equal proportion.
  iii. 20% marks shall be for Viva-voce conducted during the practicals.
- The distribution of mark for internal assessment in drawing subjects shall be as per following guidelines:-
  i) 60% marks for sheets ii. 40% for test.

## STUDY AND EVALUATION SCHEME

## THIRD SEMESTER MECHANICAL ENGINEERING

| THIRD SEMESTER (MECHANICAL ENGINEERING) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SR NO | SUBJECT | 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 | Thermal Engineering-I | 3 | 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 | Hydraulics and Pneumatics | 4 | 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** |

| FOURTH SEMESTER (MECHANICAL ENGINEERING) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SR NO** | **SUBJECT** | **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 Material | 4 | 2 | 30 | 20 | 50 | 100 | 3 | 50 | 3 | 150 | 200 |
| 4.2 | Material Science | 4 | 2 | 30 | 20 | 50 | 100 | 3 | 50 | 3 | 150 | 200 |
| 4.3 | Thermal Engineering-II | 3 | 2 | 30 | 20 | 50 | 100 | 3 | 50 | 3 | 150 | 200 |
| 4.4 | Manufacturing Technology-II | 3 | 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** | | **18** | **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, types of force: Point force/concentrated force &Uniformly distributed force, effects of force, characteristics of a 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 (concept only)

[Simple problems on above topics]

### 3. Moment (12hrs)

3.1 Concept of moment

3.2 Moment of a force and units of moment

3.3 Varigon's theorem (definition only)

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 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, friction in simple screw jack

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 some 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 center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed

[Simple problems on the above topics]

**6. Simple Lifting Machines (12hrs)**

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

6.2. Simple and compound machine (Examples)

6.3. 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 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 ηof :
   (i) First system of pulleys
   (ii) Second system of pulleys
9. To find out center of gravity of regular lamina and irregular lemina.
10. To determine coefficient of friction between three pairs of given surface.

## RECOMMENDED BOOKS


1) *A Text Book of Applied Mechanics by S Ramamurtham, DhanpatRai 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; SChand 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:-** (05 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:-** (05 hrs)
   - 1.1 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:-** (12 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 Def 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 Flaming'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:-** (10 hrs)
   - 5.1 Types of AC motors and their applications
   - 5.2 Construction of three phase induction motors, comparison of sq. 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 & DOI, 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. **Basic Electronics:-** (10 hrs)
   - 7.1 Basic idea of semiconductor products, diode, Zener diode, Transistor, SCR and their applications.

## LIST OF PRACTICALS

1. Verification of Ohm's Law.
2. Series & parallel connection of resistances
3. Measurement of voltage, current & power and p.f. at various loads.
4. Measurement of transformation ratio of a single phase transformer.
5. Measurement of a cu & iron losses of transformer and to determine its efficiency by direct loading method .
6. Starting of three-phase sq. cage induction motor using star/delta starter and DOL starter.
7. Reversing the direction of three phase induction motor & single phase induction motors.
8. Measurement of terminal voltage of dc shunt generator as a function of load current and to plot the load-characteristic curve.
9. Use of multimeter for measurement of voltage & current (ac & dc both).

## INSTRUCTIONAL STATREGY

- *Students may be given an assignment to prepare a chart of various electrical gadgets, their specification, rates and applications including the motors.*
- *Arrange visit to some Electrical distribution/control room.*

## 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. | 15 | 20 |
| 4. | 08 | 15 |
| 5. | 12 | 18 |
| 6. | 07 | 12 |
| 7. | 10 | 15 |
| Total | 64 | 100 |

# 3.3 THERMAL ENGINEERING– I

L T P
3 - 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

### 1. Basic Concepts and Gas Laws (04 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 (10hrs)

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 polytropic processes, Throttling and free Expansion, work done under these processes.

### 3. Formation of Steam and its Properties (08 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** **(06 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 Introduction to modern boilers

**5. Nozzles and Steam Turbines** **(08hrs)**

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** **(06 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** **(06 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. Determination of Temperature by:
   - Thermocouple
   - Pyrometer
2. Study of constructional details and specifications of fire tube boiler and sketch.
3. Demonstration of mountings and accessories on a boiler for study and sketch.
4. To find out heat transfer by conduction
5. To find out heat transfer by convection and radiation
6. To verify Boltzman's law.
7. Study of steam turbine through models

RECOMMENDED BOOKS

1. Engineering Thermodynamics by P.K. Nag, Tata McGraw Hill, Delhi

2. Basic Engineering Thermodynamic by Roy choudhary; Tata McGraw Hill,Delhi.

3. Basic thermodynamics by P.B. Joshi, Pune VidyarthiGrahPrakashan

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.

## INSTRUCTIONAL STRATEGY

- An industrial visit may be planned to show equipment in working.

- An expert from industry maybe invited to deliver a lecture.

## SUGGESTED DISTRIBUTION OF MARKS

| Topic No | Time Allotted (Hrs) | Marks Allotted (%) |
|---|---|---|
| 1 | 4 | 10 |
| 2 | 10 | 20 |
| 3 | 8 | 15 |
| 4 | 6 | 15 |
| 5 | 8 | 15 |
| 6 | 6 | 15 |
| 7 | 6 | 10 |
| Total | 48 | 100 |

# 3.4 MANUFACTURING TECHNOLOGY– I

| | L | T | P |
|---|---|---|---|
| **RATIONALE** | **3** | **-** | **6** |

*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 (16hrs)

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

1.7 Lathe operations-Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading andknurling.

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 Types of lathes

1.12.1 Brief description of capstan and turret lathes.

1.12.2 High performance lathes

**2. Drilling** **(06 hrs)**

2.1 Principle of drilling

2.2 Classification of drilling machines and their description

2.3 Operations performed on drilling machines- drilling, reaming,counter boring, counter sinking, hole milling, tapping.

2.4 Speeds and feeds during drilling

2.5 Types of drills and their features

2.6 Drill holding devices.

**3. Boring** **(06 hrs)**

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, Planning and Slotting** **(08 hrs)**

4.1 Working principle of shaper, planer and slotter

4.2 Quick return mechanism applied to them

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 material

5.1.3 Pattern allowances

5.1.4 Coloring 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 used.

• Pit furnace

• Cupola

• Reverberatory

• Electric melting furnace

5.3.2 Closing and pouring of mould

5.4 Special casting methods

5.4.1 Introduction to die casting, investment, centrifugal casting.

**LIST OF PRACTICALS**

1. Two exercises on simple turning/step turning
2. Two exercises on composite job involving turning, taper turning.
3. Exercises in internal turning and threading.
4. Advanced exercises in the use of different types of tools on the lathe.
5. Marking and drilling practice on mild steel pieces.
6. Practice in drilling, reaming, counter boring and counter sinking.
7. Practice in grinding of drills to correct angles.
8. To prepare a rectangular block to required accuracy on a shaper.
9. To cut a bevel surface**/**V groove on one of the faces for Exercise 8

10. To cut a curved surface on the CI rectangular block.
11. Exercise in cutting a keyway slot.
12. Exercise in making a square hole.
13. Preparation of a job on a planning 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.
21. Prepare the cast iron casting of above mould.
22. Study of various furnaces used in foundry shop.

**INSTRUCTIONAL STATREGY**

Teacher should lay emphasis in making the students conversant with concepts,

Principles, procedures and practices related to various manufacturing processes through field visits to relevant industries.

***RECOMMENDED BOOKS***


1. *Workshop Technology by BS Raghuvanshi, DhanpatRai& 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 | 30 |
| 2 | 06 | 15 |
| 3 | 06 | 15 |
| 4 | 08 | 15 |
| 5 | 12 | 25 |
| Total | 48 | 100 |

# 3.5 MACHINE DRAWING – I

L T P

**RATIONALE** **- - 6**

*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

**1. Intersection of the following:** **2 sheets**

- 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 (detailed drawing)
   Plummer block (assembled drawing)
   Foot Step bearing

3. **Bracket** 1 sheet
   3.1 Wall Bracket
4. **Pulleys** 1 sheet
   4.1 Fast and loose pulley
   4.2 Stepped and V-belt pulley
5. **Pipe Joints** 2 sheets
   5.1 Flanged pipe joints, right angle bend
   5.2 Hydraulic pipe joints, Spigot and Socket joint
   5.3 Expansion pipe joint
   5.4 Practice of blue print reading on mechanical components.
6. **Lathe Parts** 3 sheets
   6.1 Tool post
   6.2 Tail stock
   6.3 Screw Jack

## INSTRUCTIONAL STATREGY

- *Drawings should cover tolerance, whenever feasible, roughness symbols andmaterial as per BIS / ISO.*
- *At least one sheet may be prepared tailing actual measurements and with CAD.*

## 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; SatyaPrakashan New Delhi*
*4. Machine drawing by N.D. Bhatt; Charotar Publishing House*

# 3.6 HYDRAULICS AND PNEUMATICS

**L T P**

**RATIONALE** **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: peizometer tube manometers - simple U-tube, differential single column, inverted U-tube, micromanometer including simple problems.

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

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

### 3. Flow of Fluids (08 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 (10 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'snumber 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 (12hrs)**

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 centrigual pump. Performance, efficiencies and specifications of a centrifugal pump.Trouble shooting and problems in centrifugal pumps and remedialmeasures, pitting, cavitation, priming.

6.5 Hydro potential in Himachal Pradesh.

**7. Components of Hydraulic Systems (08hrs)**

7.1 Basic components of hydraulic system, their symbols and function of each component in a hydraulic circuit.

7.2 Oil reservoirs, couplings, motors and pumps – definition and functions of the parts,

7.3 Filters- definition and purpose, classification

7.4 Seals and packing- classification of seals, sealing materials.

**8. Components of Pneumatic Systems (08hrs)**

8.1 Basic components – function of each component

8.2 Air compressors – type, working

8.3 Air cylinder – types, function, single acting, double acting, rotating, non-rotating, piston type, diaphragm type, tandem cylinder, double ended cylinder, duplex cylinder with symbols.

8.4 Air filter, regulator and lubricator – their necessity in pneumatic circuit.

8.5 Industrial application of Pneumatic systems.

**LIST OF PRACTICALS**

1. Measurement of pressure head by employing.
   i) Piezometer tube
   ii) Single and double column manometer
2. To find out the value of coefficient of discharge for a venturimeter.
3. Measurement of flow by using venturimeter.
4. Verification of Bernoulli's theorem.
5. To find coefficient of friction for a pipe (Darcy's friction).
6. To study hydraulic circuit of an automobile brake and hydraulic ram.
7. Study the working of a Pelton wheel and Francis turbine.
8. To study a single stage centrifugal pump for constructional details and its operation to find out its normal head and discharge.
9. To draw the characteristic curves for a single stage centrifugal pump.
   i) Head Vs Discharge
   ii) Power Vs Discharge
   iii) Efficiency Vs Discharge

**INSTRUCTIONAL STRATEGY**

*a. At least 50% teaching should be done by using Computer based teaching aids for effective teaching learning.*

*b. Stress on practical examples and acquaint the students with industrial practices.*

**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 | 8 | 15 |
| 4 | 10 | 15 |
| 5 | 8 | 10 |
| 6 | 12 | 15 |
| 7 | 6 | 10 |
| 8 | 8 | 10 |
| Total | 64 | 100 |

# 4.1 STRENGTH OF MATERIALS

L T P

**RATIONALE** 4 - 2

*Diploma holders in Mechanical Engineering are required to analyze 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** (16 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.

3.3. Laminated Spring(Semi elliptical type only)
3.3.1. Determination of number of plates
3.3.2. Maximum bending stress and deflection.

3.4. Combined direct and bending stresses
3.4.1. Simple cases of short columns of uniform section subjectedto eccentric loading with stress diagram

4. **Columns** (08 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. RankineGourdan formula

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. **Helical Springs** (08 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

**PRACTICAL EXERCISES**
1. Tensile test on bars of Mild steel and Aluminum.
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 test on specimens 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

**INSTRUCTIONAL STRATEGY**

1. *Plan assignments so as to promote problem solving abilities.*
2. *Link the instructions with real life problems, and practice of problem solving on above topics in the class room.*

**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 | 14 | 20 |
| 4 | 08 | 15 |
| 5 | 12 | 20 |
| 6 | 08 | 10 |
| Total | **64** | **100** |

# 4.2 MATERIAL SCIENCE

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 (06 hrs)**

1.1 Introduction to engineering materials.

1.2 Classification of materials

1.3 Thermal, chemical, electrical properties.

1.4 Selection criteria for use in industry.

**2. Structure of Metals and their Deformation (08hrs)**

2.1 Metal Structure - Relation of metal structure to its properties.

2.2 Arrangement of atoms in metals (Basic idea)

2.3 Crystalline Structure of metals

2.4 Crystal Imperfections

2.5 Deformation of metal

2.6 Impact of cold and hot working on metal structure

**3. Ferrous Materials (12hrs)**

3.1 Classification of iron and steel

3.2 Sources of iron ore and its availability.

3.3 Manufacture of pig iron, wrought iron, Cast iron and steel(Flow Diagrams only)

3.4 Types of Cast Iron: White, malleable, grey, mottled, modular and alloy and their usage.

3.5 Steels and alloy steel

3.5.1 Classification of steels

3.5.2 Different manufacturing methods of steel, open hearth, Bessemer & electric arc.

3.5.3 Availability, Properties and usage of steels.

3.5.4 Specification as per BIS and equivalent standards.

3.5.5 Effect of various alloying element like Cr,Ni, Co,V, ,Mo,Si, Mn,S on mechanical properties of steel.

3.5.6 Use of alloy steels(high speed steel stainless steel, spring steel, silicon steel.

**4. Non Ferrous Materials (08 hrs)**

4.1 Important ores and properties of aluminium, copper, zinc, tin, lead.

4.2 Properties and uses of Al alloys, Copper alloys, Bearing metals, solders.

**5. Composite, Ceramics and Plastics. (10 hrs)**

5.1 Definitions, sources.

5.2 Metal matrix composites, ceramic matrix composites, fibre reinforced composites, carbon – carbon composites.

5.3 Engineering ceramics, natural and artificial ceramics

5.4 Various trade name of engineering plastics, thermosetting and thermoplastic.

5.5 Plastic coatings

5.6 Fibers and their classification: inorganic and organic fibers.

5.7 Engineering application of composites, ceramics and plastics.

5.8 Introduction to smart/ intelligent materials

**6. Insulating Materials (04 hrs)**

6.1 Various heat insulating material and their usage like asbestos, glass wool, thermocole, cork, puf, china clay.

6.2 Various electrical insulating material and their use like China clay, leather, bakelite, ebonite, glass wool, rubber, felt.

**7. Testing of Metals and Alloys (02 hrs)**

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

**8. Fundamentals Of Heat Treatment (14 hrs)**

8.1 Purpose of heat treatment

8.2 Theory of solid solution

8.3 Iron-Carbon Diagram

8.4 TTT Curve in steels and its importance.

8.5 Basic idea about martensitic transformation

8.6 Various heat treatment processes-hardening, tempering, annealing, normalizing, case hardening (elementary idea)

8.7 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. Given a set of specimen of metals and alloys ( copper, brass, aluminium, cast iron, HSS,Gun metal) ; identify and indicate the various properties possesses by them.

3. a) Study of heat treatment furnace.

   b) Study of a thermocouple/ pyrometer.

4. Study of a metallurgical microscope and a diamond polishing machine.

5. 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 CI iv) Malleable CI v) Low carbon steel vi) High carbon steel vii) HSS

6. To anneal a given specimen and find out difference in hardness as a result of annealing.

7. To normalize a given specimen and to find out the difference in hardness as a result of normalizing.

8. To temper a specimen and to find out the difference in hardness due to tempering.

INSTRUCTIONAL STRATEGY

*Stress should be laid on identification, usage and ways and means of improving physical properties of each material. Visits to industry may also be planned to demonstrate use of various materials in industry.*

**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 | 06 | 10 |
| 2 | 08 | 15 |
| 3 | 12 | 15 |
| 4 | 08 | 10 |
| 5 | 10 | 10 |
| 6 | 04 | 10 |
| 7 | 02 | 05 |
| 8 | 14 | 25 |
| Total | 64 | 100 |

## 4.3 THERMAL ENGINEERING-II

| L | T | P |
|---|---|---|
| 3 | - | 2 |

**RATIONALE**

*Thermal energy is a major means of power in the world. Knowledge of thermal contrivances and related principles is very essential to the students of Mechanical Engineering. The subject presents sources of heat, thermodynamics principles and their applications to thermal contrivances.*

**DETAILED CONTENTS**

**1. Power Cycles (08 hrs)**

1.1 Concept of reversibility, Carnot cycle

1.2 Rankine cycle and its efficiency

1.3 Brayton cycle

1.4 Otto, Diesel and Dual Combustion cycle

**2. Principles of I.C. Engines:- (10 hrs)**

2.1 Introduction and classification of I.C. Engines.

2.2 Working principle of twostrokes and four strokes cycle by representing on PV and valve timing diagrams.

2.3 Petrol and diesel engines, their comparison and applications

2.4 Location and functions of various parts of I.C. engines and materials used for them

2.5 Concept of IC engine terms: Bore, stroke, dead centres, crank throw, compression ratio, clearance volume, piston displacement and piston speed. Familiarity with ISI specification for I.C. engine parts.

**3. Carburation and Ignition Systems of Petrol Engine:- (06 hrs)**

3.1 Concept of carburetion

3.2 Airfuel ratio

3.3 Simple carburettor and its limitations

3.4 Description of a battery coil and magneto ignitions system.

**4 Fuel System in Diesel Engines (06 hrs)**

4.1 Components of Fuel system

4.2 Description and working of fuel feed pump

4.3 Fuel injection pump

4.4 Injector

4.5 Multi Point Fuel Injection System

**5. Cooling and Lubrication (04 hrs)**

5.1 Necessity of Engine Cooling

5.2 Cooling systems: their main features

5.3 Thermostat

5.4 Defects in cooling system and their rectification

5.5 Function of lubrication

5.6 Types and properties of Engine lubricants

5.7 Lubrication systems of I.C. engine

5.8 ISI specification and brand names of Engine lubricants.

5.9 Fault in cooling and lubrication system and their remedial actions.

**6. I.C. Engine Testing (08 hrs)**

6.1 Engine power - indicated and Brake power.

6.2 Efficiency - Mechanical, Thermal, Relative and volumetric.

6.3 Methods of finding indicated and brake power.

6.4 Morse Test

6.5 Heat balance sheet

**7. Air Compressors (06 hrs)**

7.1 Industrial uses of compressed air

7.2 Classification - description of reciprocating and Rotary air compressors

7.3 Fans, Blowers and supercharger

7.4 Working principle of reciprocating single and two stage compressors,

7.5 Intercooling, volumetric efficiency.

7.6 Operation and Maintenance of reciprocating compressors.

## LIST OF PRACTICALS

1. *Dismantle a two stroke engine. Note the function and material of each part. Reassemble.*
2. *Dismantle a single cylinder diesel engine. Note the function of each part. Reassemble.*
3. *Dismantle solex and amal carburettors. Locate and note down the functions of various parts. Reassemble.*
4. *Study of battery ignition system of a multicylinder petrol engine, stressing on ignition timings, setting fixing order and contact breaker gap adjustment.*
5. *Study of cooling system of I.C. Engine and finding the fault in the cooling system.*
6. *Study of lubricating system of I.C. engine.*
7. *Determination of BHP by dynamometer and heat balance sheet.*
8. *Morse test on multicylinder petrol engine and heat balance sheet.*
9. *Determination of volumetric efficiency of air compressor*
10. *Testing of petrol engine ignition system, fault finding and remedial action.*

## INSTRUCTIONAL STRATEGY

*- Models of various components/parts to be demonstrated*
*- Audio-visual aids to demonstrate I-C engines, air compressor, turbines, nozzlesetc.*
*- Industrial visit to automobile workshop/thermal power plant.*

## RECOMMENDED BOOKS

*1. Elements of Heat Engine by Panday and Shah, Charotar Publishing Home*
*2. Thermal Engineering by A.S. Sarao, SatyaPrakashan*
*3. Thermal Engineering by P.L. BallaneyKhanna Publisher*
*4. Thermal Engineering by R.K. Prohit, Standard Publisher*
*5. Thermal Engineering by PK Nag*

## SUGGESTED DISTRIBUTION OF MARKS

| Topic No | Time Allotted (Hrs) | Marks Allotted (%) |
|---|---|---|
| 1 | 08 | 15 |
| 2 | 10 | 20 |
| 3 | 06 | 10 |
| 4 | 06 | 10 |
| 5 | 04 | 15 |
| 6 | 08 | 15 |
| 7 | 06 | 15 |
| **Total** | **48** | **100** |

# 4.4 MANUFACTURING TECHNOLOGY–II

| | L | T | P |
|---|---|---|---|
| **RATIONALE** | 3 | - | 6 |

*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:- (08 hrs)**

1.1. Principle of operation

1.2. Oxyacetylene flame

1.2.1. Types of flame

1.2.2. Combustion of flame

1.3. Welding Techniques

1.4. Filler rods and fluxes for gas welding

1.5. Gas welding equipment and accessories

1.5.1. Oxygen gas cylinders

1.5.2. Acetylene gas cylinders

1.5.3. Acetylene gas generator

1.5.4. Pressure Regulator

1.5.5. Oxygen and Acetylene Hoses

1.5.6. Welding Torch

**2. Electric arc Welding:- (04 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** **(06 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 - Brief description

4.7 Types of milling and welding fixtures (brief idea)

**5. Metal Forming Processes** **(06 hrs)**

5.1 General Idea of following processes:

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

5.2. Powder Metallurgy (brief idea)

**6. Grinding:-** **(06 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.

6.3. Shapes of grinding wheels

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 (06 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. (08 hrs)**

8.1. Electro discharge machining

8.2. Wire Cut EDM

8.3. Electric chemical machining

8.4. Chemical machining

8.5. Ultrasonic machining

8.6. Laser Beam machining.

8.7. Plasma arc machining

## LIST OF PRACTICALS

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. Demonstration of spinning process on ordinary lathe machine and spinning a bowl on a lathe machine.
9. To prepare a gear blank through turning and making hole using boring bar.
10. Cylindrical grinding exercise on lathe with tool post grinding attachment.
11. Exercise on thread cutting on lathe machine.
12. Storing and Maintenance of pattern.
13. Preparation of utility job by making patterns.
14. Preparation of a die ( simple type)
15. Preparation of a single ended spanner by hand forging.
16. Prepare a mould in three moulding boxes prepare the casting.
17. Casting of utility job of above pattern.
18. Mounting and balancing of grinding wheel.
19. Exercise on grinding of a rectangular block to size on surface grinding machine.
20. Practice on cylindrical and centreless grinding machines.
21. Exercise on hand lapping job to required accuracy.
22. Buffing practice.

**INSTRUCTIONAL STRATEGY**

*Teacher should lay emphasis in making students conversant with concepts, principles, procedures and practices related to various manufacturing processes.*

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 | 08 | 10 |
| 2 | 04 | 10 |
| 3 | 04 | 10 |
| 4 | 06 | 15 |
| 5 | 06 | 15 |
| 6 | 06 | 10 |
| 7 | 06 | 15 |
| 8 | 08 | 15 |
| Total | 48 | 100 |

# 4.5 MACHINE DRAWING –II

| | L | T | P |
|---|---|---|---|
| **RATIONALE** | - | - | 6 |

*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. Fixture ( Details and assembly) (01 Sheet)**

**7. Cams and Followers (02 Sheets)**

7.1 Profile of cams for imparting following motions with knife edge and roller followers:

7.1.1 Uniform motion

7.1.2 Simple harmonic motion

**8. Gears** **(01 Sheets)**

8.1 Use of different types of gears

8.2 Spur gears with actual profile of in volute teeth.

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

## INSTRUCTIONAL STATREGY

- *All the sheets should be working drawings complete with tolerances, types of fits and surface finish symbols.*
- *An expert from an industry may be invited to deliver expert lecture.*

## 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, SatyaPrakashan*
*4. Machine drawing by N.D. Bhatt, Charotar Publishing House.*

# 4.6 THEORY OF MACHINES

| | L | T | P |
|---|---|---|---|
| **RATIONALE** | 4 | - | - |

*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(with examples)

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 Screw jack ( Simplenumericals only)

2.3 Frictional clutches ( concept only )

2.4 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

**INSTRUCTIONAL STRATEGY**

1. Use teaching aids for class room teaching
2. Video films may be used to explain the working of mechanisms and machine
3. components like clutch, governors, brake etc.

**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 Dukkipati, 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 |