

## **Curriculum for**

### **Diploma Programme in**

# **MECHANICAL ENGINEERING**



# FOURTH SEMESTER PURAN MURTI CAMPUS

Website: <u>www.puranmurti.com</u> E-mail: <u>info@puranmurti.com</u>



#### FOURTH SEMESTER (MECHANICAL ENGINEERING)

	STUDY SCHEME			MARKS IN EVALUATION SCHEME					Total Marks of					
Sr. No.	SUBJECTS		Th	Pr	Credits	ASSE Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	Internal ·& External
4.1	*Computer Aided Drafti	ng	-	4	2	-	50	50	-	-	50	3	50	100
4.2	*Materials and Metallur	gy	4	2	5	25	25	50	100	3	50	3	150	200
4.3	*Hydraulics and Pneuma	atics	3	2	4	25	25	50	100	3	50	3	150	200
4.4	*Thermodynamics-II		3	2	4	25	25	50	100	3	50	3	150	200
4.5	*Industrial Engineering		3	Ċ	3	25	(-	25	100	3	-	-	100	125
4.6	*Workshop Technology	-11	4	-	4	25	·	25	100	3	-	-	100	125
4.7	*Workshop Practice-II		-	6	3	-	100	100	5	-	100	3	100	200
*Sof	t Skills -II	D		2	Ī	-	25	25	Ď		-	-	-	25
Tota	1	1	17	18	25	125	250	375	500		300	-	800	1175

\* Common with other Diploma programmes

#### Industrial Training

After examination of 4<sup>th</sup> Semester, the students shall go for training in a relevant industry/field organization for a minimum period of 8 weeks and will prepare a diary. It shall be evaluated during 5<sup>th</sup> semester by his/her teachers for 100 marks. The students shall also prepare a report at the end of training and shall present it in a seminar, which will be evaluated for another 100 marks. This evaluation will be done by HOD and lecturer incharge – training in the presence of one representative from Industry/Sector Skill Council/Training and Placement Officer/Subject Expert from other institution.

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#### **4.1 COMPUTER AIDED DRAFTING**

A diploma holder is expected to prepare and interpret CAD Drawings. Hence this subject.

#### LEARNING OUTCOMES

On completion of this course, students will be able to :

 $\hfill\square$  know the advantages of using CAD in comparison with conventional method.

- $\hfill\square$  draw and interpret CAD drawings using drawing, editing and viewing in CAD software.
- □ create easy and complex solids and assemblies using various tools in CAD software.
- □ Assemble various mechanisms using CAD software.

#### **DETAILED CONTENTS**

### 1. Introduction to Computer Aided Drafting (2D) commands of any one software (Auto CAD, ProE, Solid works, Unigraphics etc.)

1.1 Concept of AutoCAD, Tool bars in CAD software, coordinate system, snap, grid, and ortho mode (Absolute, Relative and Polar), setting of units and layout.

1.2 Drawing commands – point, line, arc, circle, ellipse,

- 1.3 Editing commands scale, erase, copy, stretch, lengthen and explode.
- 1.4 Dimensioning and placing text in drawing area
- 1.5 Sectioning and hatching
- 1.6 Inquiry for different parameters of drawing entity
- 1.7 Create layers within a drawing
- 1.8 Specifying Geometrical Dimensioning & tolerancing (GD&T) parameters in drawing

#### 2. Detail and assembly drawing of the following using Drafting Software (2D)

- 2.1 Plummer Block
- 2.2 Wall Bracket
- 2.3 Stepped pulley, V-belt pulley

2.4 Flanged coupling

- 2.5 Machine tool Holder (Three views)
- 2.6 Screw jack, joints, crank shaft and piston.

#### 3. Isometric Drawing by CAD using any part modeling Software (3D)

(one sheet)

(4 sheets)

Drawings of following on computer:

- Cone
- Cylinder
- Cube
- Spring
- Isometric view of objects

### 4. Introduction to any part modeling software(ProE, Solid works, AutoCAD, Uni Graphic , Catia etc.)

Introduction to Sketcher: Sketch Entities, Sketch Tools, Blocks, Dimensioning
4.1 Part modeling
Part Modeling Tools:(4 models)

- 4.1.1 Creating reference planes
- 4.1.2 Creating Extrude features Creating Revolve Creating Swept features
- 4.1.3 Creating Loft features
- 4.1.4 Creating Reference points, axis, coordinates
- 4.1.5 Creating curves
- 4.1.6 Creating Fillet features

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4.1.7 Inserting Hole types

4.1.8 Creating Chamfer

4.1.9 Creating Shell

4.1.10 Creating Rib

4.1.11 Environment& Utilities - Working with views and manipulating views.

4.1.12 Create parts e.g. Piston, Pin, Bolts and Nuts, Fixture, Jig parts, Washer, Rings, Gaskets, Machine parts etc.

#### 4.2 Assembly and Simulation

(2 sheets)

Assembly Modeling Tools:-

Introduction to Assembly Modeling & Approaches – Top down and Bottom up approach, Applying Standard Mates-Coincident, Parallel, Perpendicular, Tangent, Concentric, Lock, Distance, Angle. Assemble of any two Mechanism e.g. Crank slider mechanism, Piston and Cylinder assembly, Quick Return Mechanism (QRM), Machine vices, Crank Shaft, Bearing assembly, any other mechanism.

#### INSTRUCTIONAL STRATEGY

- 1. Teachers should show model or realia of the component/part whose drawing is to be made.
- 2. Emphasis should be given on cleanliness, dimensioning, & layout of sheet.
- 3. Teachers should ensure use of IS codes related to drawing.

#### MEANS OF ASSESSMENT

Drawings

- □ Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
- □ Software installation, operation, and viva-voce
- □ LIST OF RECOMMENDED BOOKS
- 1. Engineering Drawing with AutoCAD 2000 by T. Jeyapooran; Vikas Publishing House, Delhi.
- 2. AutoCAD for Engineering Drawing Made Easy by P. NageswaraRao; Tata McGraw Hill, New Delhi.
- 3. AutoCAD 2000 for you by UmeshShettigar and Abdul Khader; Janatha Publishers, Udupi.
- 4. Auto CAD 2000 by Ajit Singh, TMH, New Delhi.
- 5. Instruction Manual of the software used (AutoCAD, ProE, Solidwors, Unigraphic etc.)
- 6 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in



#### 4.2 MATERIALS AND METALLURGY

#### 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 this course 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 industries.

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#### LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Distinguish between metals and non metals and ferrous and non ferrous materials.
- Analyze microstructure and changes in microstructure due to heat treatment.
- Carryout various heat treatment processes such as annealing, normalizing, tempering and hardening.
- □ Draw and interpret iron-carbon diagram.
- Classify various types of plastics and rubber.
- Explain properties and applications of composites, ceramics and smart materials.
- □ Select suitable material to be used for various engineering applications.

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#### **DETAILED CONTENTS**

#### 1. Introduction

Material, Engineering materials, History/Timeline of Material Origin, Scope of Material Science, Overview of different engineering materials and applications, Importance, Classification of materials, Difference between metals and nonmetals, Physical and Mechanical properties of various materials, Present and future needs of materials, Various issues of Material Usage-Economical, Environment and Social, Overview of Biomaterials and semi-conducting materials.

#### 2. Crystallography

Fundamentals: Crystalline solid and amorphous solid, Unit Cell, Space Lattice, Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals, Number of atoms per unit Cell, Atomic Packing Factor, coordination number

(without derivation), Defects/Imperfections, types and effects in Solid materials.

Deformation: Overview of deformation behaviour and its mechanisms, Elastic and Plastic deformation, behaviour of material under load and stress-strain curve.

Failure Mechanisms: Overview of failure modes, fracture, fatigue and creep.

#### 3. Metallurgy:

Introduction, Cooling curves of pure metals, dendritic solidification of metals, effect of grain size on mechanical properties, Binary alloys, , Thermal equilibrium diagrams, Lever rule, Solid Solution alloys

#### 4. Metals And Alloys

Ferrous Metals: Different iron ores, Flow diagram for production of iron and steel, allotropic forms of iron-Alpha, Delta, Gamma. Basic process of manufacturing of pig iron and steel-making.

Cast Iron: Properties, types of Cast Iron, manufacture and their use.

Steels: Plain carbon Steels and alloy steel, Classification of plain carbon steels, Properties and application of different types of Plain Carbon Steels, Effect of various alloying elements on properties of steel, Uses of alloy steels (high speed steel, stainless steel, silicon steel, spring steel)

Non Ferrous Materials: Properties and uses of Copper, Aluminium and their alloys

#### 5. Heat Treatment

Definition and objectives of heat treatment, Iron carbon equilibrium diagram, different microstructures of iron and steel .. Formation and decomposition of Austenite, Martensitic Transformation. Various heat treatment processeshardening, tempering, , annealing, normalizing, surface hardening, carburizing, nitriding, cyaniding. Hardenability of Steels, Types of heat treatment furnaces (only basic idea), measurement of temperature of furnaces.

#### 6. Plastics

Importance of plastics, Classification-thermoplastic and thermoset, plastic and their uses, Various trade names of plastics, Plastic coatings, food grade plastics. Applications of plastics in automobile and domestic use. Rubber classification - Natural and synthetic. Selection of rubber

#### 7. Advanced Materials

Heat Insulating materials- Asbestos, glasswool, thermocole. Ceramics-Classification, properties, applications Refractory materials –Dolomite, porcelain. Glass – Soda lime, borosil. Joining materials/Adhesives – Classification, properties and applications Abrasive materials Composites-Classification, properties, applications Materials for bearing metals Materials for Nuclear Energy Smart materials- properties and applications. (12 Hours)

(06 Hours)

#### (03 Hours)

(18 Hours)

(09 Hours)

#### (08 Hours)

(08 Hours)





#### LIST OF PRACTICALS

- 1. Classification of about 25 specimens of materials/machine 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 possessed by them.

3. a) Study of heat treatment furnace.

b) Study of a thermocouple/pyrometer.

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

5. To prepare specimens of following materials for microscopic examination and to Examine the microstructure of the specimens of following materials At least any two) i) Brass ii) Copper iii) Cast Iron , iv) Mild Steel v) HSS, vi) Aluminium

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

#### INSTRUCTIONAL STRATEGY

While imparting instructions, teacher should show various types of engineering materials to the students. Students should be asked to collect samples of various materials available in the market. Visits to industry should be planned to demonstrate use of various types of materials or Heat Treatment Processes in the industry.

#### MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

#### **RECOMMENDED BOOKS**

- 1. Text book of Material Science by R.K. Rajput; Katson Pubs, Ludhiana
- 2. Text book of Material Science by V.K. Manchanda and GBS Narang; Khanna Publishers, New Delhi
- 3. Introduction to Material Science by A.R. Gupta, Satya Prakashan, New Delhi.
- 4. Material Science by Hazra, Chaudhary
- 5. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

#### Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1.	08	12
2.	08	12
3.	03	05
4.	18	30
5.	09	15
6.	06	10
7.	12	16



Total

100

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#### 4.3 HYDRAULICS AND PNEUMATICS

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#### RATIONALE

Diploma holders in this course are required to deal with properties of fluid and use of hydraulics and pneumatics in power generation and industries. 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.

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#### LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Explain fluid properties, their units and conversion.
- Use and Maintain different types of pressure gauges.
- □ Calculate velocity and discharge of various liquids.
- □ Apply Bernoulli's theorem for calculating pipe diameter and height of pipe from ground.
- □ Calculate pipe friction and losses in pipelines.
- □ Specify hydraulic machines for different applications.
- □ Select maintain and resolve troubles in pumps.
- □ Apply Pascal's law in practical applications.
- □ Maintain hydraulic and pneumatic system.

#### DETAILED CONTENTS

#### 1. Introduction

Introduction to Hydraulics and Pneumatics. 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. Simple numeric problems related to properties of fluids.

#### 2. Pressure and its Measurement

2.1 Concept of pressure, Intensity of pressure, static pressure and pressure head.

Types of Pressure (Atmospheric Pressure, Gauge Pressure, Absolute Pressure).

2.2. Pressure measuring devices: Manometers and Mechanical Gauges

Manometers: Piezometer, Simple U- tube Manometer, Micromanometer, Differential U-tube Manometer, Inverted Utube, Manometers Construction, working and application, including simple numerical problems.

Mechanical Gauges: Bourdon Tube pressure gauge, Diaphragm Pressure Gauge, Dead weight pressure gauge. Construction, working and application.

2.3 Statement of Pascal's law and its applications.

#### 3. Flow of Fluids

3.1 Types of fluid flow – Steady and Unsteady, Uniform and Non-uniform, Laminar and Turbulent; Rate of flow (Discharge) and its units; Continuity Equation of Flow; Hydraulic Energy of a flowing fluid ; Total head ; Bernoulli's Theorem statement (without proof) and its applications. Discharge measurement with the help of Venturimeter, Orifice meter, Pitot-tube, limitations of Bernoulli's theorem, simple numerical problems on above topics. 3.2 Pipe and 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), Reynold's number and its effect on pipe friction; Water hammer.

Simple numerical problems on pipe friction.

3.3 Nozzle - definition, velocity of liquid flowing through the nozzle, power developed.

#### 4. Hydraulic Machines

Description, operation and application of – hydraulic press, hydraulic jack, hydraulic accumulator, hydraulic brake ,hydraulic ram, hydraulic door closer.

#### 5. Pumps and Water Turbines

5.1 Concept of hydraulic pump. Classification of pumps.

5.2 Construction, operation and application of Single acting reciprocating pump, vane, screw and gear pumps.

5.3 Construction, operation and application of centrifugal pump. Trouble shooting and problems in centrifugal pumps and remedial measures, pitting, cavitation, priming.

5.4 Concept of a turbine, classification of turbines, types of turbines - impulse and reaction type (concept only), difference between them. Construction and working of pelton wheel, Francis turbine and Kaplan turbines.

#### 6. Oil power Hydraulic and Pneumatic systems

6.1 Introduction to oil power hydraulics and pneumatic system. Relative Merits and Demerits as oil power hydraulic and pneumatic system.

6.2 Industrial applications of oil power hydraulic and pneumatic system.

6.3 Basic components of hydraulic system, definition and functions of each component in a hydraulic circuit. Hydraulic oils- Classification and their properties. Seals and packing- classification of seals, sealing materials.

6.4 Maintenance of hydraulic system: common faults in hydraulic system, simple visual checks of oil, causes of contamination, preventive measures.

6.5 Basic Components of Pneumatic Systems , definition and functions of each component in a Pneumatic circuit. Necessity of Filter, Regulator and Regulator(FLR).

6.6 Common problems in pneumatic systems. Maintenance schedule of pneumatic systems.



(10 Hours)

(6 Hours)

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#### (07 Hours)

(03 Hours)

(vi nours)

(12 Hours)



#### LIST OF PRACTICALS

1. Measurement of pressure head by employing.

#### i) Piezometer tube

- ii) Simple U-tube manometer
- iii) Bourdon.s tube pressure gauge
- 2. Verification of Bernoulli's theorem.
- 3. Measurement of flow by using venturimeter.
- 4. To find out the value of coefficient of discharge for a venturimeter.
- 5. To find coefficient of friction for a pipe (Darcy's equation).

6. To study a single stage centrifugal pump and reciprocating pump for constructional details with the help of cut section models.

- 7. Study the working of Pelton wheel, Francis and Kaplan turbine with the help of working model.
- 8. Study of hydraulic circuit of any available machine or working model
- 9. Study of pneumatic circuit of any available machine or working model

#### INSTRUCTIONAL STRATEGY

- 1. Use computer based learning aids for effective teaching-learning
- 2. Expose students to real life problems
- 3. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

#### MEANS OF ASSESSMENT

- □ Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
- □ Actual laboratory and practical work, model/prototype making, and viva-voce

#### **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. Hydraulic and Pneumatic Control by K Shammuga Sundaram, S. Chand & Co. Ltd., New Delhi
- 6. Hydraulics and Hydraulic Machinery by Dr. Jagadish Lal; Metropolitan Book Company Ltd., Delhi.

7. Hydraulic and Pneumatic Power and Control Design, Performance and Application by Yeaple, McGraw Hill, New York..

8. Pneumatic Controls by Festo Didactic; Bangalore.

#### 9. Pneumatics Control: An Introduction to the Principles by Werner Deppert and



Kurt Stoll;Vogel – Verlag.

10. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	03	06
2	07	16
3	12	24
4	06	14
5	10	20
6	10	20
Total	48	100

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#### 4.4 THERMODYNAMICS-II

#### RATIOANLE

A diploma holder in this course is supposed to know about testing of IC Engines, fuel supply, ignition system, cooling and lubrication of engines and gas turbines. Hence this subject

#### Learning Outcomes

After undergoing this course, the students will be able to:

- Explain the working of IC engine.
- Diagnose and rectify simple problems in fuel supply and ignition system.
- Explain the functioning of different components of fuel supply of diesel engine.
- □ Explain the working of lubrication and cooling system in IC engine.
- □ Assist in testing an IC engine.
- Explain the functioning of steam turbine, gas turbine and jet propulsion.

#### DETAILED CONTENTS

#### 1. IC Engines (07 Hours)

1.1 Introduction

1.2 Working principle of two stroke and four stroke cycle, SI engines and CI engines, Otto cycle, diesel cycle and dual cvcle

1.3 Location and functions of various parts of IC engines and materials used for them

#### 2. Fuel Supply and Ignition System in Petrol Engine

- 2.1 Concept of carburetion
- 2.2 Air fuel ratio
- 2.3 Simple carburetor and its limitations and application.
- 2.4 Description of battery coil and electro ignition system, fault finding/ and remedial action in ignition system
- 2.5 Description of petrol injection system

#### 3. Fuel System of Diesel Engine

- 3.1 Components of fuel system
- 3.2 Description and working of fuel feed pump
- 3.3 Fuel injection pump, Common rail direct injection (CRDI)
- 3.4 Injectors

#### 4. Cooling and Lubrication

- 4.1 Function of cooling system in IC engine
- 4.2 Air cooling and water cooling system, use of thermostat and radiator.
- 4.3 Function of lubrication
- 4.4 Types and properties of lubricant
- 4.5 Lubrication system of engine
- 4.6 Fault finding in cooling and lubrication and remedial action

#### 5. Testing of IC Engines

- 5.1 Engine power indicated and brake power
- 5.2 Efficiency mechanical, thermal. relative and volumetric
- 5.3 Methods of finding indicated and brake power
- 5.4 Morse test for petro1 engine
- 5.5 Heat balance sheet, simple numerical problems

(07 Hours)

(06 Hours)

(04 Hours)

(07 Hours)

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5.6 Concept of pollutants in SI and CI engines, pollution control, norms for two or four wheelers - EURO - 1, EURO -

2, Bharat methods of reducing pollution in IC engines, alternative fuels like CNG, LPG, Hydrogen

#### 6. Steam Turbines and Steam Condensers

- 6.1 Function and use of steam turbine
- 6.2 Steam nozzles types and applications
- 6.3 Steam turbines impulse, reaction, simple and compound, construction and working principle
- 6.4 Governing of steam turbines
- 6.5 Function of a steam condenser, elements of condensing plant
- 6.6 Classification jet condenser, surface condenser
- 6.7 Cooling pond and cooling towers

#### 7. Gas Turbines and Jet Propulsion

7.1 Classification, open cycle gas turbine and closed cycle gas turbine, comparison of gas turbines with reciprocating IC engines, applications and limitations of gas turbine

- 7.2 Open cycle constant pressure gas turbines general layout, PV and TS diagram and working of gas turbine
- 7.3 Closed cycle gas turbines, PV and TS diagram and working
- 7.4 Principle of operation of ram-jet engine and turbo jet engine application of jet engines
- 7.5 Rocket engine its principle of working and applications
- 7.6 Fuels used in jet propulsion



(08 Hours)

(09 Hours)



#### LIST OF PRACTICALS

1. Dismantle an IC engine and note down the condition of various parts, removal and fitting of piston, rings, measuring of bore size, crank shaft ovality and assemble it.

- 2. Dismantle a carburetor
- 3. Servicing of petrol injection system
- 4. Valve servicing, grinding, lapping and fitting mechanism and tappet adjustment.

5. Inspection of ignition system of a multi-cylinder engine stressing ignition timings, setting, fixing order and contact breaker; gap adjustment, spark plug cleaning.

- 6. Service of cooling & lubrication system of IC engine and note down the functioning/testing of various components.
- 7. Determination of BHP by dynamometer.
- 8. Morse test on multi-cylinder petrol engine.
- 9. Draw layout of modern automobile workshop and note down the special tools and equipments in each shop.
- 10. Local visit to roadways or private automobile workshop.

#### **INSTRUCTIONAL STRATEGY**

- 1. Use computer based learning aids for effective teaching-learning
- 2. Expose students to real life problems
- 3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

#### MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

□ Actual laboratory and practical work, model/prototype making, and viva-voce

#### **RECOMMENDED BOOKS**

- 1. Elements of Heat Engines by Pandey and Shah; Charotar Publishing House, Anand.
- 2. Thermal Engineering by PL. Ballaney; Khanna Publishers, New Delhi.
- 3. Engineering Thermodynamics by Francis F Huang; McMillan Publishing Company, Delhi.
- 4. Engineering Thermodynamics by CP. Arora; Tata McGraw Hill Publishers, New Delhi.
- 5. Thermal Engineering by RK Purohit; Standard Publishers Distributors, New Delhi.
- 6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

#### Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	07	15
2	06	12



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3	04	10
4	07	15
5	07	15
6	08	15
7	09	18
Total	48	100

#### **4.5 INDUSTRIAL ENGINEERING**

#### RATIONALE

A diploma holder in this course will have to conduct time and motion study to improve the methods/system. For this, knowledge and related skills in method study and work measurement are essential. In addition, knowledge of production planning and control and estimating and costing is required. Hence this subject.

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#### Learning Outcomes

After undergoing this course, the students will be able to:

- Use industrial engineering concepts to improve productivity
- Use resources optimally and economically.
- □ Apply work study techniques for improving production
- Explain various incentive plans
- □ Solve planning, scheduling and sequencing problems for shop floor
- Interpret different kinds of production systems
- Prepare break-even analysis and Gantt chart.
- □ Locate suitable plant location and draw plant layout for different production system.
- □ Maintain inventory optimally and classify different types of inventory

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### **DETAILED CONTENTS**

1. Productivity (04 Hours) Introduction to productivity, factors affecting productivity, practical measurement of productivity, difference between production and productivity, causes of low productivity and methods to improve productivity, contribution of standardization in improving productivity.

#### 2. Work Study

Definition and scope of work study; factors for selection of work study job, uses and limitations of work study, Interrelation between method study and work measurement; Human aspects of work study; Role of work study in improving productivity.

#### 3. Method Study

Definition, Objectives and procedure for Method study analysis; Information collection and recording techniques through various diagrams.

#### 4. Motion Analysis

Principles of Motion analysis; Therbligs and SIMO charts; Normal work area (Principle of motion economy), design and arrangement of work place. Ergonomics, design of tools and equipments.

#### 5. Work Measurement

Objectives; work measurement techniques, stop watch time study; principle, equipment used and procedure; systems of performance rating; standard elements of time, calculation of basic times; various allowances; guide for rest allowance in Indian conditions, calculation of standard time, work sampling, standard data and its usage. Work sampling.

#### 6. Wages and Incentive Schemes

Introduction to wages, Wage payment for direct and indirect labour, wage payment plans and incentives, various incentive plans, incentives for indirect labour.

#### 7. Production Planning and Control

Production and its types- job order, batch type and continuous type of productions. Objectives and components (functions) of P.P.C, Advantages of production planning and Production Control, stages of P.P.C, process planning, routing, scheduling, dispatching and follow up, routing purpose, route sheets, scheduling - purpose, machine loading chart, dispatching - purpose, and procedure, follow up - purpose and procedure. Structure and function of Production, Planning Department, Gantt chart. CPM/PERT technique, drawing of simple networks and critical time calculation. Production Control in job order, batch type and continuous type of productions. Difference between these controls.

#### 8. Stores Management:

Different Layout and structures of stores, Inventory control, calculation of EOQ, Bin cards and various forms required in stores for documentation. Purchase procedures.

#### LIST OF CLASSROOM EXERCISES:

- 1. Stop watch time study on any machine like lathe, drilling machine or milling machine
- 2. Method improvement Assembly of bolt, nut and 3 washers
- 3. Determination of standard time for assembly of electrical switch
- 4. Preparation of flow process chart

Campus:

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Puran Murti Campus Kami Road, Sonepat (Delhi-NCR), Haryana - 131001, India Contact: 7438900900

### (08 Hours)

(06 Hours)

### (04 Hours)

#### (04 Hours)

(8 Hours)

### (10 Hours)

(04 Hours)



- 5. Preparation of SIMO chart
- 6. Preparation of flow diagram

#### **INSTRUCTIONAL STRATEGY**

1. Teacher should use models and encourage students to develop some other suitable model.

2. The teacher should observe and redress the difficulties faced by students in performing the work while working on ergonomically good and poorly designed workstation.

3. The teacher should show them real forms to be filled from stores and record keeping.

#### MEANS OF ASSESSMENT

□ Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making, Viva-voce

#### **RECOMMENDED BOOKS**

- 1. Work Study and Ergonomics by S Dalela and Sourabh
- 2. Industrial Engineering and Management by O.P. Khanna, Dhanpat Rai and Sons, Delhi.
- 3. Industrial Engineering and Management by M. Mahajan; Dhanpat Rai and Sons, New Delhi.
- 4. Introduction to Work Study, ILO Publication
- 5. Production and costing by GBS Narang; Khanna Publishers, New Delhi.
- 6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

#### Websites for Reference:

http://swayam.gov.in

SUGGESTED	Time Allotted	Marks Allotted
DISTRIBUTION	(Hours)	(%)
OF MARKS		
Topic No.		
1	4	8
2	10	20
3	4	10
4	6	14
5	8	16
6	4	8
7	8	16
8	4	8
Total	48	100



#### 4.6 WORKSHOP TECHNOLOGY-II

#### RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various machining processes, modern machining methods, tools, jigs and fixtures is required to be imparted. Hence the subject of workshop technology.

#### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- □ Perform turning, step turning, taper turning, threading and knurling operation on lathe machine.
- □ Resharpen/grind single point tool.
- □ Select material and tool geometry for cutting tools on lathe.
- □ Perform drilling, reaming, counter boring, counter sinking and tapping operations on drilling machine.
- Explain the nomenclature of a drill
- Perform filing, cutting, fitting and die tapping operations
- □ Perform keyway cutting and angular/step surface shaping on shaper.
- Explain geometry of single point tools, various types of lathe tools and tool materials.
- □ Explain uses of lathe accessories and different types of lathes.
- □ Explain boring operation, features of boring machine and boring tool.
- Explain the uses and features of jigs, fixtures, locating devices and clamping devices.
- □ Select cutting fluid for different materials and operations.
- □ Describe the features of various types of broaching machines.



#### DETAILED CONTENTS

#### 1. Cutting Tools and Cutting Materials

1.1. Cutting Tools - Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, Cutting speed, feed and depth of cut and their effect

1.2 Cutting Tool Materials - Properties of cutting tool material, Study of various cutting tool materials viz. High-speed steel, tungsten carbide, cobalt steel cemented carbides, stellite, ceramics and diamond.

#### 2. Drilling

2.1 Principle of drilling.

2.2 Classification of drilling machines and their description.

2.3 Various operation performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping.

- 2.4 Speeds and feeds during drilling, impact of these parameters on drilling, machining time.
- 2.5 Types of drills and their features, nomenclature of a drill
- 2.6 Drill holding devices.
- 2.7 Types of reamers.

#### 3. Lathe

2.1 Principle of turning

- 2.2 Description and function of various parts of a lathe
- 2.3 Classification and specification of various types of lathe
- 2.4 Drives and transmission
- 2.5 Work holding devices
- 2.6 Lathe tools: Parameters/Nomenclature and applications

2.7 Lathe operations :- Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling, form turning, spinning.

2.8 Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time.

2.9 Speed ratio, preferred numbers of speed selection.

2.10 Lathe accessories:- Centers, dogs, different types of chucks, collets, face plate, angle plate, mandrel, steady rest, follower rest, taper turning attachment, tool post grinder, milling attachment, Quick change device for tools. 2.11 Brief description of capstan and turret lathe, comparison of capstan/Turret lathe, work holding and tool guiding devices in capstan and turret lathe.

#### 4. Boring

- 4.1 Principle of boring
- 4.2 Classification of boring machines and their brief description.
- 4.3 Specification of boring machines.
- 4.4 Boring tools, boring bars and boring heads.
- 4.5 Description of jig boring machine.

#### 5. Shaping and Planing

Campus: Puran Murti Campus Kami Road, Sonepat (Delhi-NCR), Haryana - 131001, India Contact: 7438900900 (06 Hours)

(10 Hours)

(08 Hours) ool geometry.

(08 Hours)

(12 Hours)



5.1 Working principle of shaper and planer

5.2 Type of shapers

5.3 Type of planers

5.4 Quick return mechanism applied to shaper and planer machine.

5.5 Work holding devices used on shaper and planer

- 5.6 Types of tools used and their geometry.
- 5.7 Specification of shaper and planer .

5.8 Speeds and feeds in above processes.

#### 6. Broaching

6.1 Introduction

6.2 Types of broaching machines – Single ram and duplex ram horizontal type, vertical type pull up, pull down, push down.

6.3 Elements of broach tool, broach tooth details - nomenclature, types, and tool material.

7. Jigs and Fixtures	(08 Hours)
7.1 Importance and use of jigs and fixture	
7.2 Principle of location	
7 3 Locating devices	
7.4 Clamping devices	
7.5 Types of ligs Drilling ligs bushes template iig plate iig channel iig leaf iig	
7.5 Types of sigs – Drining ligs, busiles, template lig, plate lig, challef lig, leaf lig.	
7.6 Fixture for mining, turning, weiding, grinding	
7.7 Advantages of jigs and fixtures	
8. Cutting Fluids and Lubricants	(06 Hours)
8.1 Function of cutting fluid	· · · ·
8.2 Types of cutting fluids	
8.3 Difference between cutting fluid and lubricant	
8.4 Selection of cutting fluids for different materials and operations	
5.5 Common methods of unrelent matching to all	
8.5 Common methods of lubrication of machine tools.	

1. Teachers should lay emphasis in making students conversant with concepts and principles of manufacturing processes.

2. Focus should be on preparing jobs using various machines in the workshop.

3. Foreman Instructor should conduct classes of each workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practicals.

#### MEANS OF ASSESSMENT

□ Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

#### **RECOMMENDED BOOKS**

6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Sons; Delhi

7. Elements of Workshop Technology by SK Choudhry and Hajra; Asia Publishing House

8. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi

### 4 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR. **Websites for Reference:**

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	08	12

#### (06 Hours)



Affiliated to Haryana State Board of Technical Education, Panchkula

2	08	14
3	12	22
4	06	08
5	10	16
6	06	08
7	08	12
8	06	08
Tot1al	64	100

#### 4.7 WORKSHOP PRACTICE-II

#### RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, skills related to various machining processes, modern machining methods, and use of tools, jigs and fixtures are required to be developed. Hence the subject of workshop practice.

#### PRACTICAL EXERCISES

#### **Turning Shop**

- Job 1. Grinding of single point turning tool with demonstration of all angles.
- Job 2. Exercise of simple turning and step turning.
- Job 3. A composite job involving, turning, taper turning, external thread cutting and knurling.

#### Advance Fitting Shop

- Job 1. Exercise on drilling, reaming, counter boring, counter sinking and taping
- Job 2. Dove tail fitting in mild steel
- Job 3. Radius fitting in mild steel
- Job 4. Pipe threading with die and assemblage of same.

#### Machine Shop

- Job 1. Prepare a V-Block up to ± 0.5 mm accuracy on shaper machine
- Job 2. Exercise on key way cutting and spline cutting on shaper machine.

#### **INSTRUCTIONAL STRATEGY**

1) Focus should be on preparing jobs using various machines in the workshop.

2) Foreman Instructor should conduct classes of each workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practicals.

#### MEANS OF ASSESSMENT

□ Workshop jobs

Report writing, presentation and viva-voce

#### **RECOMMENDED BOOKS**

- 1. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Sons; Delhi
- 2. Elements of Workshop Technology by SK Choudhry and Hajra; Asia Publishing House
- 3. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi



4 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference: http://swayam.gov.in

SOFT SKILLS - II

L T P - - 2

#### RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. The diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market.

#### LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Develop Communication Skills
- $\hfill\square$  Work in a team
- □ Learn to resolve conflict by appropriate method
- □ Identify leadership traits and learn self motivation
- □ Follow ethics

#### DETAILED CONTENTS

- □ Concept of team building, behavior in a team
- Developing Interpersonal Relations- empathy, sympathy
- Communication skills improving non-verbal communication
- Conflict Management
- Motivation
- Leadership
- □ Professional Ethics and Values
- □ Health, Hygiene, Cleanliness and Safety

In addition, the students must participate in the following activities to be organized in the institute

- Sports
- □ NCC/NSS
- □ Camp Environment awareness
- Cultural Event

Note : Extension Lectures by experts may be organized. There will be no examination for this subject.





Industrial training 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. For this purpose, students at the end of fourth semester need to be sent for industrial training for a minimum of 6 weeks upto 8 weeks duration to be organized during the semester break starting 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 teacher may guide a group of 4-5 students. 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 100 and external assessment of 100 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 behavior, 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. The components of evaluation will include the following.

- a) Punctuality and regularity 15%
- b) Initiative in learning new things 15%
- c) Relationship with workers 15%
- d) Industrial training report 55%



