

**GOVERNMENT POLYTECHNIC,PUNE**  
**'120 – NEP' SCHEME**

<b>PROGRAMME</b>	<b>DIPLOMA IN CE/ME/MT</b>
<b>PROGRAMME CODE</b>	<b>01/04/05</b>
<b>COURSE TITLE</b>	<b>ENGINEERING MECHANICS</b>
<b>COURSE CODE</b>	<b>AM21201</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>NA</b>

**I. LEARNING & ASSESSMENT SCHEME**

Course Code	Course Title	Course Type	Learning Scheme						Credits	Paper Duration	Assessment Scheme										Total Marks
			Actual Contact Hrs./Week			SLH	NLH	Theory			Based on LL & TSL				Based on SL						
			CL	TL	LL			FA-TH			SA-TH	Total		FA-PR		SA-PR		SLA			
												Max	Min	Max	Min	Max	Min	Max	Min		
AM21201	ENGINEERING MECHANICS	DSC	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175	

**Total IKS Hrs for Term: 2 Hrs**

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, #- External Assessment,\*# - Online Examination,@\$ - Internal Online Examination

**Note:**

**FA-TH** represents an average of two class tests of 30 marks each conducted during the semester.

- If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
- If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit SLA work.
- Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. \* 15 Weeks**
- 1 credit** is equivalent to **30 Notional hours**.
- \* Self-learning hours shall not be reflected in the Timetable.
- \*Self-learning includes micro-projects/assignments/other activities.

**II. RATIONALE:**

To find solutions to various practical problems, it is essential to study and get acquainted with the various aspects in Statics and Dynamics. Thus, this course gives the scope to understand fundamental concepts of laws of mechanics and their applications to different engineering problems. The fundamental concepts to be studied in this course are required for study of strength of materials, Mechanics of Structures and other course of Mechanical & Civil Engineering to be studied at higher level.

**III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)**

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

**CO1:** Identify the force systems for given conditions by applying the basics of mechanics.

**CO2:** Select the relevant simple lifting machine(s) for given purposes.

**CO3:** Determine unknown force(s) of different engineering systems.

**CO4:** Check the stability of various force systems.

**CO5:** Apply the principles of friction in various conditions for useful purposes.

**CO6:** Find the centroid and centre of gravity of various components in engineering systems.

## IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I MECHANICS AND FORCE SYSTEM (CL Hrs-04, Marks-06)</b>				
1.	TLO 1.1 Explain concepts of the given terms. TLO 1.2 . Use the relevant units of various quantities in the given situations. TLO 1.3 Explain effects of a force on the given object. TLO 1.4 Identify the force system for the given situation.	<b>1.1</b> Introduction <b>1.2</b> Derived unit, system of unit, Scalar and Vector quantity, <b>1.3</b> Definition of Applied Mechanics, Statics, Dynamics, Kinematics, and Kinetics. <b>1.4</b> Definition of Gravity, Mass, Weight, Inertia Newton's law of Gravitation and Newton's laws of motion.	Direct Instruction & Model Demonstration	CO1
<b>UNIT-II SIMPLE MACHINES (CL Hrs-07, Marks-12)</b>				
2	TLO2.1: Describe the components of the given lifting machine. TLO2.2: Differentiate the working principle of the given two types of simple lifting machines. TLO 2.3: Determine velocity ratio, efficiency and law of the given simple lifting machine. TLO 2.4: Calculate effort required and load lifted by the given simple lifting machine. TLO 2.5: Interpret the graphs after drawing them with the given data. TLO 2.6: Select the relevant simple lifting machine required for the given purpose with justification.	2.1 Definition of simple machine, mechanical advantage, velocity ratio, efficiency. Relation between them, friction in machines, effort lost in friction (Pf). 2.2 Reversibility, law of machine, max MA and max efficiency. Numerical on general simple lifting machines. 2.3 Study of machine - differential axle and wheel, simple screw jack, worm & worm wheel, single purchase crab only. Numerical to determine V.R, Pf, M.A., and efficiency	Direct Instruction & Model Demonstration	CO2
<b>UNIT-III RESOLUTION AND COMPOSITION OF FORCES (CL Hrs-10, Marks-14)</b>				
3	TLO 3.1 Resolve the given single force. TLO3.2 Calculate the resultant of the given force system analytically. TLO3.3 Determine graphically the resultant of the given force system. TLO 3.4 Find the resultant of the given force system using law of triangle and law of parallelogram.	3.1 Concept of force, unit force, graphical representation of force, Principle of transmissibility. 3.2 Systems of forces, coplanar, non-coplanar, concurrent non-concurrent, Parallel. 3.3 Resolution of a force, resolved parts, orthogonal and non-orthogonal. Components of a force. 3.4 Concept of composition & resultant of Forces. 3.5 Law of Parallelogram of forces, Triangle law of forces,	Direct Instruction & Model Demonstration	CO1, CO3

		<p>Polygon law of forces. Moment of a force, Varignon's theorem of moments, couple &amp; characteristics of couple</p> <p>3.6 Composition of Coplanar forces-Concurrent, parallel (like and unlike) non concurrent forces by analytical methods.</p>		
<b>UNIT- IV EQUILIBRIUM (CL Hrs-10, Marks-14)</b>				
4	<p>TLO 4.1: Draw free body diagram for the given condition.</p> <p>TLO 4.2: Determine unknown force in the given situation using and Free body diagram, Analytical and graphical conditions of equilibrium.</p> <p>TLO 4.3: . Identify the types of beams required for the given situation.</p> <p>TLO 4.4: Determine reactions in the given type of beam analytically and graphically.</p>	<p><b>4.1</b> Concepts of equilibrium, equilibrant, Relation between resultant &amp; equilibrant. Analytical conditions.</p> <p><b>4.2</b> Equilibrium of coplanar concurrent forces, Lami's theorem, and its applications.</p> <p><b>4.3</b> Equilibrium of coplanar parallel and non-concurrent forces.</p> <p><b>4.4</b> Beams reactions - simply supported beams subjected to concentrated and uniformly distributed loads. Beam supported on roller and hinge supports.</p>	Direct Instruction & Model Demonstration	<b>CO1,CO3, CO4</b>
<b>UNIT –V FRICTION (CL Hrs-07, Marks-12)</b>				
5	<p>TLO 5.1: Friction and coefficient of Friction for the given condition.</p> <p>TLO 5.2: Describe the conditions for Friction for the give situation.</p> <p>TLO 5.3: Determine friction force in the given situation.</p> <p>TLO 5.4: Identify the various forces plane acting on a ladder for the given conditions using free body diagram.</p>	<p>5.1 Introduction to Friction.</p> <p>5.2 Types of friction, laws of static friction, coefficient of friction, angle of friction and angle of repose.</p> <p>5.3 Equilibrium of body on horizontal &amp; inclined planes.</p> <p>5.4 Ladder friction. (Numerical with smooth wall and Flooring rough or smooth to be only covered in theory.)</p>	Direct Instruction & Model Demonstration	<b>CO1, CO3, CO5</b>
<b>UNIT –VI CENTROID AND CENTRE OF GRAVITY (CL Hrs-07, Marks-12)</b>				
6	<p>TLO 6.1: Determine the centroid of geometrical plane figures and centre of gravity of the given simple solid.</p> <p>TLO 6.2: Calculate centroid of the given composite plane lamina.</p> <p>TLO 6.3: Determine centre of gravity of the given solids.</p> <p>TLO 6.4: Determine centre of gravity of the given composite solid.</p>	<p><b>6.1</b> Concept of Centre of Gravity &amp; Centroid.</p> <p><b>6.2</b> Centroid of regular plane areas (triangular, circular, rectangular only) &amp; compound areas consisting of maximum three regular plane areas.</p> <p><b>6.3</b> Centroid of hollow objects such as hollow cylinder, hollow cone, hollow sphere. (No</p>	Direct Instruction & Model Demonstration	<b>CO1, CO6</b>

	numerical to be set on hollow objects in theory paper.) <b>6.4</b> Centre of gravity of simple solids-cylinder, cone, sphere, and C.G of compound solid objects made up of any two solids.		
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**V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL /TUTORIAL EXPERIENCES.**

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO1: Verification of Resolution and composition of Forces	1. To verify Law of polygon of Forces	2	CO1
2	LLO2 : Verification of Equilibrium of Forces	2. To verify Law of Moments. 3. To verify Lami's Theorem 4. To determine Beam Reactions 5. Graphic Statics: On Graph papers solve graphically two problems each on resultant of concurrent and parallel forces 6. Graphic statics- On Graph papers solve graphically Two problems on beam reactions	2 2 2 6 6	CO1, CO2, CO3, CO4
3	LLO3: Determine the Coefficient of Friction for various surfaces	7. To Determine coefficient of friction for different surfaces in contact .(Minimum two different surfaces to be studied )	2	CO5
4	LLO4: Application of Law of machine for Lifting Machines	8. To study various lifting machines –To plot graphs for load Vs effort ,load Vs Efficiency and obtain law of machine for Differential axle and wheel, Worm and worm wheel, simple screw jack, Single purchase crab	2	CO2
5	LLO5: Practical Application of Knowledge of Applied Mechanics	9. Complete a micro project based on guidelines provided in Experiment No. 07	2	CO1, CO2, CO3, CO4, CO5, CO6

**VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)****Micro project**

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. She ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PLOs, and TLOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 15 (Fifteen) student engagement hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that she contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty

- A. Types of Forces: Prepare chart showing real-life examples indicating various types of forces
- B. Lifting Machine Collect photographs of specific simple lifting machine and relate these machines with the machines being studied and prepare models of simple lifting machines using simple tools.
- C. Types of support: Prepare chart showing actual and corresponding schematic diagram of various type of support
- D. Beams: Prepare models of beam subjected to point loads, uniformly distributed loads simply supported, overhang and cantilever type beam.
- E. Friction: Prepare chart regarding type of friction in various field conditions.

**Assignment**

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- a. Collect five different photographs indicating concurrent, parallel, general force system in equilibrium.
- b. Prepare a table of type of machine and relevant industrial application.
- c. Collect five different situations where law of moment plays an important role.
- d. Prepare models representing various types of supports (hinged, roller and fixed)
- e. Illustrate situations wherein friction is essential and not essential.
- f. Prepare models in the form of geometrical figures and solids and locate centroid and centre of gravity of them.

**VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Worm & worm wheel	1, 4
2	Single Purchase crab	1, 4
3	Differential Axle & wheel	1, 4
4	Parallel Forces Apparatus	2
5	Simple Screw Jack Indian makes.	4
6	Cast Iron weights and hangers	1, 2
7	Brass/Steel weights and Hangers	1, 2
8	Aluminum pulley with Bracket ,smoothly rotating	3
9	Combined Inclined Plane & friction slide ordinary	3
10	Law of moments apparatus	1, 2
11	Universal Force Table	1, 2
12	Sundry items like measuring scale, mirrors, thread, spirit levels, caliper.	1

**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE  
(Specification Table)**

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Mechanics and force system	CO1	4	2	2	2	6
2	II	Simple Machines	CO2	7	2	4	6	12
3	III	Resolution and composition of Forces	CO1,CO3	10	2	4	8	14
4	IV	Equilibrium	CO1,CO3, CO4	10	2	2	10	14
5	V	Friction	CO1,CO3, CO5	7	2	4	6	12
6	VI	Centroid and Centre of Gravity	CO1, CO6	7	2	2	8	12
<b>Grand Total</b>				<b>45</b>	<b>12</b>	<b>18</b>	<b>40</b>	<b>70</b>

**IX.ASSESSMENT METHODOLOGIES/TOOLS**

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Rubrics for COs 3. Assignment 4. Self-Learning 5. Term Work	1. End Term Exam 2. Micro-project

## X. SUGGESTED COs-POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	3	2	2	1	--	1	--	--	--
CO2	3	3	2	1	2	--	1	--	--	--
CO3	3	2	2	2	3	--	1	--	--	--
CO4	2	2	2	2	--	--	1	--	--	--
CO5	1	2	2	2	1	--	1	--	--	--
CO6	2	1	2	3	--	--	1	--	--	--

**Legends:- High:03, Medium:02, Low:01, No Mapping: -**

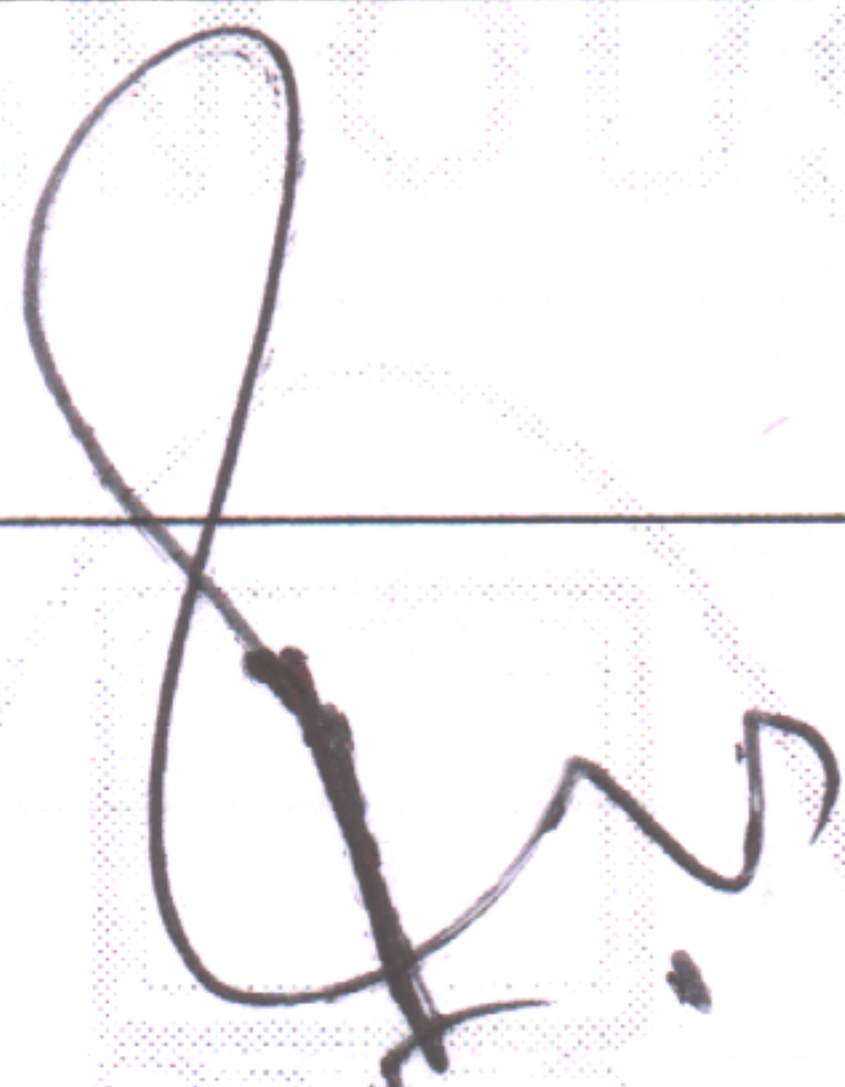


\*PSOs are to be formulated at the institute level

## XI.SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	Khurmi, R.S	Applied Mechanics	S.Chand & Co. Publication New Delhi 2014 , ISBN 9788121916431
2	Ramamrutham, S. S	Engineering Mechanics	S.Chand & Co. New Delhi 2008 ISBN 9788187433514
3	Ram, H. D., Chauhan, A. K	Foundations and Applications of Applied Mechanics	Cambridge University Press, Thomson Press India Ltd. New Delhi, 2015. ISBN: 9781107499836
4	Meriam, J. L Kraige, L.G	Engineering Mechanics- Statics, Vol. 1	Wiley Publication, New Delhi ISBN 978-81-265-4396

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	<a href="http://giacr.ac.in">http://giacr.ac.in</a>	Lecture notes on engineering mechanics.
2.	<a href="http://www.coursera.org">www.coursera.org</a>	Modules provided for engineering mechanics
3.	<a href="http://www.youtube.com">www.youtube.com</a> for videos regarding machines and applications, friction	Videos regarding simple machines and applications and also friction are available
4.	<a href="http://www.nptel.ac.in">www.nptel.ac.in</a>	Mechanics demo lectures of different topics are available on this site.

<p><b>Name &amp; Signature:</b></p>  <p><b>Shri. Hanumant P. Naiknavare</b> Lecturer in Applied Mechanics (Course Experts)</p>	
<p><b>Name &amp; Signature:</b></p>  <p><b>Smt. N.S. Kadam</b> (Programme Head)</p>	<p><b>Name &amp; Signature:</b></p>  <p><b>Shri. S.B. Kulkarni</b> (CDC In-charge)</p>



**GOVERNMENT POLYTECHNIC, PUNE**  
**'120 – NEP' SCHEME**

<b>PROGRAMME</b>	<b>DIPLOMA IN CE/EE/ET/ME/MT/CM/IT/DDGM</b>
<b>PROGRAMME CODE</b>	<b>01/02/03/04/05/06/07/08</b>
<b>COURSE TITLE</b>	<b>FUNDAMENTALS OF ICT</b>
<b>COURSE CODE</b>	<b>CM21201</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>NA</b>

**I. LEARNING & ASSESSMENT SCHEME**

Course Code	Course Title	Course Type	Learning Scheme						Credits	Paper Duration	Assessment Scheme										Total Marks
			Actual Contact Hrs./Week			SLH	NLH	Theory			Based on LL & TSL				Based on SL						
			CL	TL	LL			FA-TH			SA-TH	Total	Practical		SLA						
						FA-PR	SA-PR						Max	Min	Max	Min	Max	Min			
CM21201	FUNDAMENTALS OF ICT	SEC	1	-	2	1	4	2	--	--	--	--	--	25	10	25@	10	25	10	75	

**Total IKS Hrs for Term: 0 Hrs**

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, # - External Assessment,\*# - Online Examination,@\$ - Internal Online Examination

**Note:**

**FA-TH** represents an average of two class tests of 30 marks each conducted during the semester.

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- Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. \* 15 Weeks**
- 1 credit** is equivalent to **30 Notional hours**.
- \* Self-learning hours shall not be reflected in the Timetable.
- \* Self-learning includes micro-projects/assignments/other activities.

**II. RATIONALE:**

In any typical business set up to carry out routine tasks related to creating business documents, performing data analysis and its graphical representations and making electronic slide show presentations, the student needs to learn various software such as office automation tools like word processing applications, spreadsheets and presentation tools. They also need to use these tools for making their project reports and presentations. The objective of this course is to develop the basic competency in students for using these office automation tools to accomplish the job. This course also presents an overview of emerging technologies so that students of different disciplines can appraise the applications of these technologies in their respective domains.

**III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)**

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

- CO1: Use a computer system and its peripherals for a given purpose.
- CO2: Prepare Business documents using a Word Processing Tool.
- CO3: Analyze Data and represent it graphically using Spreadsheet.
- CO4: Prepare professional Slide Show presentations.
- CO5: Explain the concept and application of emerging technology.

## IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I INTRODUCTION TO COMPUTER SYSTEM (CL Hrs-2, Marks-NIL )</b>				
1.	<p><b>TLO 1.1</b> Explain the functions of components in the block diagram of the computer system.</p> <p><b>TLO 1.2</b> Classify the given type of software.</p> <p><b>TLO 1.3</b> Explain the characteristics of the given type of network.</p> <p><b>TLO 1.4</b> Describe the application of the given type of network connecting device.</p> <p><b>TLO 1.5</b> Describe the procedure to manage a file /folder in the given way.</p>	<p><b>1.1 Basics of Computer System:</b> Overview of Hardware and Software: block diagram of Computer System, Input/output unit CPU, Control Unit, Arithmetic logic Unit (ALU), Memory Unit.</p> <p><b>1.2 Internal components:</b> processor, motherboards, random access memory (RAM), read-only memory (ROM), video cards, sound cards and internal hard disk drives).</p> <p><b>1.3 External Devices:</b> Types of input/output devices, types of monitors, keyboards, mouse, and printers: Dot matrix, Inkjet and LaserJet, plotter and scanner, external storage devices CD/DVD, Hard disk and pen drive.</p> <p><b>1.4 Application Software:</b> word processing, spreadsheet, database management systems, control software, measuring software, photo-editing software, video-editing software, graphics manipulation software System Software compilers, linkers, and device drivers.</p> <p><b>1.5 Network environments:</b> network interface cards, hubs, switches, routers and modems, the concept of LAN, MAN, WAN, WLAN, Wi-Fi and Bluetooth.</p> <p><b>1.6 Working with Operating Systems:</b> Creating and managing files and folders, Copying a file, renaming and deleting files and folders, Searching files and folders, application installation, and creating shortcuts of applications on the desktop.</p>	Hands-on Demonstration Presentations	CO1

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-II WORD PROCESSING (CL Hrs-3, Marks-NIL )</b>				
2	<p><b>TLO 2.1</b> Write the steps to create the given text document.</p> <p><b>TLO 2.2</b> Explain the given feature for document editing.</p> <p><b>TLO 2.3</b> Explain the given page setup features of a document.</p> <p><b>TLO 2.4</b> Write the given table formatting feature.</p> <p><b>TLO 2.5</b> Write the steps to set the given type of document layout</p>	<p><b>2.1 Word Processing:</b> Overview of Word processor Basics of Font type, size, colour, Effects like Bold, italic, underline, Subscript and superscript, Case changing options, Previewing a document, Saving a document, Closing a document and exiting the application.</p> <p><b>2.2 Editing a Document:</b> Navigate through a document, Scroll through text, Insert and delete text, Select text, Undo and redo commands, Use drag and drop to move text, Copy, cut and paste, Use the clipboard, Clear formatting, Format and align text, Formatting.</p> <p><b>2.3 Changing the Layout of a Document:</b> Adjust page margins, Change page orientation, Create headers and footers, Set and change indentations, and Insert and clear tabs.</p> <p><b>2.4 Inserting Elements to Word Documents:</b> Insert and delete a page break, Insert page numbers, Insert the date and time, Insert special characters (symbols), Insert a picture from a file, and Resize and reposition a picture.</p> <p><b>2.5 Working with Tables:</b> Insert a table, Convert a table to text, Navigate and select text in a table, Resize table cells, Align text in a table, Format a table, Insert and delete columns and rows, Borders and shading, repeat table headings on subsequent page.</p> <p><b>2.6 Working with Columned Layouts and Section Breaks:</b> Columns, Section breaks, Creating columns, Newsletter style columns, changing part of a document layout or formatting, Remove section breaks, Adding columns to the remainder of a document, Column widths.</p>	Hands-on Demonstration Presentations	CO2
<b>UNIT-III SPREADSHEETS (CL Hrs-03, Marks-NIL)</b>				
3	<p><b>TLO 3.1</b> Write the steps to create the given spreadsheet.</p> <p><b>TLO 3.2</b> Explain the given formatting feature of a worksheet.</p> <p><b>TLO 3.3</b> Write steps to insert formulas and functions in the given worksheet.</p> <p><b>TLO 3.4</b> Write steps to create charts for the given data set.</p> <p><b>TLO 3.5</b> Explain steps to perform data filter,</p>	<p><b>3.1 Working with Spreadsheets:</b> Overview of workbook and worksheet, Create Worksheet Entering sample data, Save, Copy Worksheet, Delete Worksheet, Close and open Workbook.</p> <p><b>3.2 Editing Worksheet:</b> Insert and select data, adjust row height and column width, delete, move data, insert rows and columns, Copy and Paste, Find and Replace, Spell Check, Zoom In-Out, Special Symbols, Insert Comments, Add Text Box, Undo Changes, - Freeze</p> <p><b>3.3 Formatting Cells and sheet:</b> Setting Cell Type, Setting Fonts, Text options, rotating cells, Setting Colors, Text Alignments, Merge and Wrap, applying Borders and Shades, Sheet Options, Adjust Margins, Page Orientation, Header and Footer, Insert Page Breaks.</p>	Hands-on Demonstration Presentations	CO3

	<p>sort and validation operations on the given data set.</p> <p><b>TLO 3.6</b> Write steps to set up and print a spreadsheet.</p>	<p><b>3.4 Working with Formula:</b> Creating Formulas, Copying Formulas, Common spreadsheet Functions such as sum, average, min, max, date, In, And, or, mathematical functions such as sqrt, and power, applying conditions using IF.</p> <p><b>3.5 Working with Charts:</b> Introduction to charts, an overview of different types of charts, Bar, Pie, and Line charts, creating and editing charts. Use chart options: chart title, axis title, legend, data labels, Axes, grid lines, and moving chart in a separate sheet.</p> <p><b>3.6 Advanced Operations:</b> Conditional Formatting, Data Filtering, Data Sorting, Using Ranges, Data Validation, Adding Graphics, Printing Worksheets, print area, margins, header, footer and other page setup options.</p>		
<b>UNIT- IV PRESENTATION TOOL (CL Hrs-04, Marks-NIL)</b>				
4	<p><b>TLO 4.1:</b> Write the steps to create the given slide presentation.</p> <p><b>TLO 4.2:</b> Write the steps to insert multiple media in the given presentation.</p> <p><b>TLO 4.3:</b> Explain the method of including animation, and transition effects in a slide show.</p> <p><b>TLO 4.4:</b> Write steps to apply table features in the given presentation</p> <p><b>TLO 4.5:</b> Write steps to manage charts in the given presentation.</p>	<p><b>4.1 Creating a Presentation:</b> Outline an effective presentation, identify the elements of the User Interface, Create New Presentation Files, Create a Basic Presentation, Work with textboxes, Apply Character Formats, and Format Paragraphs.</p> <p><b>4.2 Inserting Media Elements:</b> Adding and Modifying Graphical Objects to a Presentation - Insert Images into a Presentation, insert audio clips, video/animation, Add Shapes, Add Visual Styles to Text in a Presentation, Edit Graphical Objects on a Slide, Format.</p> <p><b>4.3 Working with Tables:</b> Insert a Table in a Slide, Format Tables, and Import Tables from Other Office Applications.</p> <p><b>4.4 Working with Charts:</b> Insert Charts in a Slide, Modify a Chart, and Import Charts from Other Office Applications.</p>	Hands-on Demonstration Presentations	CO4

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT –V BASICS OF INTERNET AND EMERGING TECHNOLOGIES (CL Hrs-04, Marks-NIL)</b>				
5	<p><b>TLO 5.1</b> Explain the use of the given setting option in browsers.</p> <p><b>TLO 5.2</b> Explain the given option used for effective searching in search engine</p> <p><b>TLO 5.3</b> Explain the features of the given web service.</p> <p><b>TLO 5.4</b> Explain concepts and applications of emerging technologies</p> <p><b>TLO 5.5</b> Use various elementary cloud-based tools</p>	<p><b>5.1 World Wide Web:</b> Introduction, Internet, Intranet, Cloud, Web Sites, web pages, URL, web servers, basic settings of web browsers- history, extension, default page, default search engine, creating and retrieving bookmarks, use search engines effectively.</p> <p><b>5.2 Web Services:</b> e-Mail, Chat, Video Conferencing, e-learning, e-shopping, e-Reservation, e-Groups, Social Networking.</p> <p><b>5.3 Emerging Technologies:</b> IoT, AI and ML, Drone Technologies, 3D Printing.</p> <p><b>5.4 Tools:</b> Docs, Drive, forms, quiz, Translate and other Apps.</p>	Hands-on Demonstration Presentations	<b>CO5</b>

#### V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/ TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	<p>LLO 1.1 Identify various Input/output devices, connections and peripherals of the computer system.</p> <p>LLO 1.2 Work with Computer systems, Input/output devices, and peripherals to manage files and folders for data storage.</p>	<p>a) Work with Computer Systems, Input/output devices, and peripherals.</p> <p>b) Work with files and folders</p>	2	CO1
2	<p>LLO 2.1 Create and manage Word document.</p> <p>LLO 2.2 Apply formatting features on text at line, paragraph and page level.</p>	<p>Work with document files:</p> <p>a) Create, edit and save documents in Word Processing.</p> <p>b) Text, lines and paragraph-level formatting</p>	2	CO2
3	LLO 3.1 Insert and edit images, and shapes in a document file.	Work with Images and Shapes in Word Processing.	2	CO2
4	LLO 4.1 Insert table and apply various table formatting features on it.	Work with tables in Word Processing.	2	CO2
5	<p>LLO 5.1 Apply page layout features in word processing.</p> <p>LLO 5.2 Print a document by applying various print options</p> <p>LLO 5.3 Use mail merge in word processing</p>	<p>Working with layout and printing a) Document page layout, Themes, and printing. b) Use of mail merge with options.</p>	2	CO2

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
6	LLO 6.1 Enter and format data in a worksheet. LLO 6.2 Insert and delete cells, rows and columns LLO 6.3 Apply alignment feature on cell	Create, open and edit Worksheet.	2	CO3
7	LLO 7.1 Create formula and "IF" condition on cell data LLO 7.2 Apply various functions and named ranges in the worksheet.	Formulas and functions in Worksheet.	2	CO3
8	LLO 8.1 Implement data Sorting, Filtering and Data validation features in a worksheet.	Sort, Filter and validate data in Spreadsheet.	2	CO3
9	LLO 9.1 Create charts using various chart options in a spreadsheet.	Charts for Visual Presentation in Spreadsheet.	2	CO3
10	LLO 10.1 Print the worksheet by applying various print options for the worksheet	Worksheet Printing.	2	CO3
11	LLO 11.1 Apply design themes to the given presentation. LLO 11.2 Insert pictures text/images/shapes in slide LLO 11.3 Use pictures text/images/shapes editing options.	Make Slide Show Presentation.	2	CO4
12	LLO 12.1 Add tables and charts in the slides. LLO 12.2 Run slide presentation in different modes LLO 12.3 Print slide presentation as handouts/notes	Use Tables and Charts in Slide	2	CO4
13	LLO 13.1 Apply animation effects to the text and slides LLO 13.2 Add/set audio and video files in the presentation.	a) Insert Animation effects into Text and Slides. b) Insert Audio and Video files in the presentation	2	CO4
14	LLO 14.1 Configure internet connection on a computer system LLO 14.2 Use different web services on the internet	a) Internet connection configuration b) Use Internet and Web Services.	1	CO5
15	LLO 15.1 Configure different browser settings LLO 15.2 Use browsers for the given purpose	Working with Browsers.	1	CO5
16	LLO 16.1 Create web forms for surveys using different options.	Prepare Web Forms for Survey.	1	CO5
17	LLO 17.1 Create web forms for Quiz using different options	Prepare Web Forms for Quiz	1	CO5

## VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

### Self-Learning

Following are some suggestive self-learning topics:

- 1) Use ChatGPT/any other AI tool to explore information.
- 2) Use Calendar to Schedule and edit activities.
- 3) Use the Translate app to translate the given content from one language to another.
- 4) Use a cloud-based storage drive to store and share your files.

### Micro project

The micro project has to be industry application-based, internet-based, workshop-based, laboratory-based or field-based as suggested by the Teacher.

- 1) Perform a survey on various inputs and output devices available in the market and make its report.
- 2) Prepare a table, Prepare Notes on Technical Topics, Reports, and Bio data with a cover letter (The subject teacher shall assign a document to be prepared by each student)
- 3) Prepare slides with all Presentation features such as classroom presentation, presentation about the department, and presentation of Technical Topics. (The subject teacher shall assign a presentation to be prepared by each student).
- 4) Student Mark sheet, Prepare Pay bills, tax statements, and student assessment records using a spreadsheet. (The teacher shall assign a spreadsheet to be prepared by each student).
- 5) Carry out Surveys on different web browsers.
- 6) Generate resumes for different job profiles, and survey reports of any industry using Chat GPT/any other AI tool.

### Assignment

Prepare a journal of practicals performed in the laboratory.

## VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	a) Computer System with all necessary Peripherals and Internet connectivity. b) Any Office Software c) Any Browser (Any General Purpose Computer available in the Institute )	ALL

## VIII.SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to Computer System	CO1	2	--	--	--	--
2	II	Word Processing	CO2	3	--	--	--	--
3	III	Spreadsheets	CO3	3	--	--	--	--
4	IV	Presentation Tool	CO4	4	--	--	--	--
5	V	Basics of Internet and Emerging Technologies	CO5	3	--	--	--	--
<b>Grand Total</b>				<b>15</b>	--	--	--	--

**IX. ASSESSMENT METHODOLOGIES/TOOLS**

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Lab performance, Assignment, Self-learning and Seminar/Presentation	Lab. Performance, viva voce

**X. SUGGESTED COS- POS MATRIX FORM**

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	-	-	-	-	-	1	2	-	-
CO2	-	-	-	3	-	-	1	-	-	1
CO3	-	2	1	3	-	-	1	-	3	1
CO4	-	-	-	3	-	-	1	-	-	1
CO5	1	-	-	3	-	-	3	2	-	1

**Legends:- High:03, Medium:02, Low:01, No Mapping: -**  
\*PSOs are to be formulated at the institute level

**XI.SUGGESTED LEARNING MATERIALS/BOOKS**

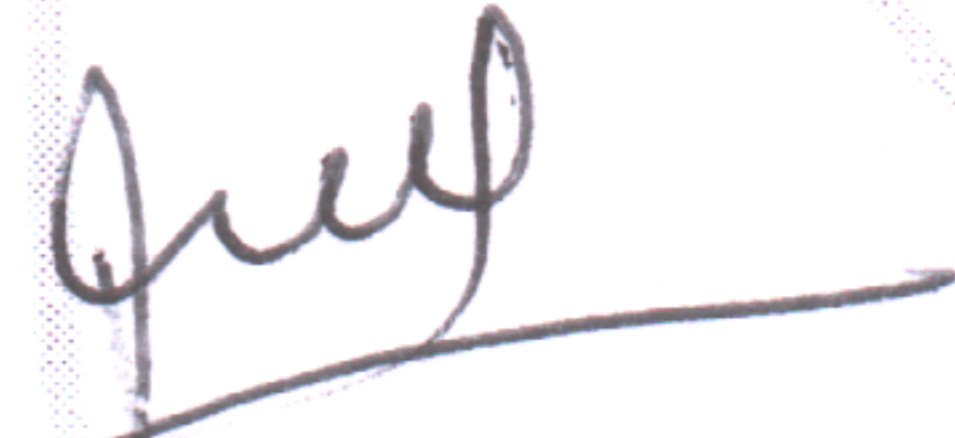

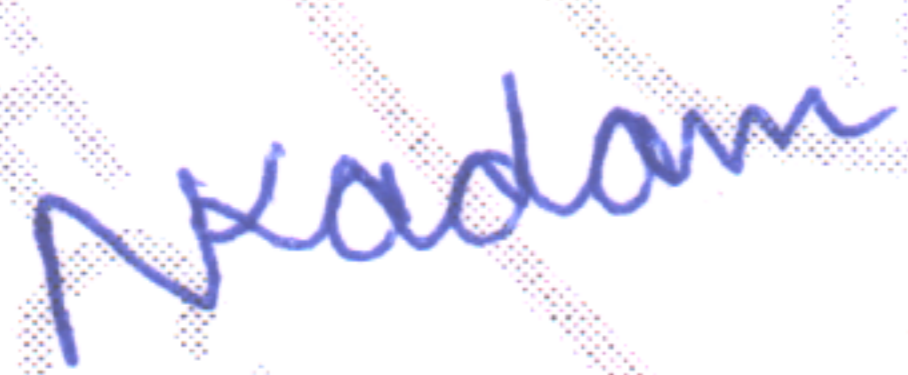

Sr.No	Author	Title	Publisher
1	Goel, Anita	Computer Fundamentals	Pearson Education, New Delhi, 2014, ISBN-13: 978-8131733097
2	Miller, Michael	Computer Basics Absolute Beginner's Guide, Windows 10	QUE Publishing; 8th edition August 2015, ISBN: 978-0789754516
3	Alvaro, Felix	Linux: Easy Linux for Beginners	CreateSpace Independent Publishing Platform- 2016, ISBN-13: 978-1533683731
4	Johnson, Steve	Microsoft Office 2010: On Demand	Pearson Education, New Delhi India, 2010. ISBN:9788131770641
Sr.No	Author	Title	Publisher
5	Schwartz, Steve	Microsoft Office 2010 for Windows: Visual Quick Start	Pearson Education, New Delhi India, 2012, ISBN: 9788131766613
6	Leete, Gurdy, Finkelstein Ellen, Mary Leete	OpenOffice.org for Dummies	Wiley Publishing, New Delhi, 2003 ISBN : 978-0764542220

**XIII. LEARNING WEBSITES & PORTALS**

Sr.No	Link/Portal	Description
1.	<a href="https://www.microsoft.com/en-in/learning/office-training.aspx">https://www.microsoft.com/en-in/learning/office-training.aspx</a>	Office
2.	<a href="http://www.tutorialsforopenoffice.org/">http://www.tutorialsforopenoffice.org/</a>	Open Office



3.	<a href="https://s3-ap-southeast-1.amazonaws.com/r4ltue295xy0d/Special_Edition_Using_StarOffice_6_0.pdf">https://s3-ap-southeast-1.amazonaws.com/r4ltue295xy0d/Special_Edition_Using_StarOffice_6_0.pdf</a>	Open Office
4.	<a href="https://ashishmodi.weebly.com/uploads/1/8/9/7/18970467/computer_fundamental.pdf">https://ashishmodi.weebly.com/uploads/1/8/9/7/18970467/computer_fundamental.pdf</a>	Computer Fundamental
5.	<a href="http://www.tutorialsforopenoffice.org/">http://www.tutorialsforopenoffice.org/</a>	Open Office
6.	<a href="https://www.tutorialspoint.com/computer_fundamentals/index.htm">https://www.tutorialspoint.com/computer_fundamentals/index.htm</a>	Computer Fundamental
7.	<a href="https://www.tutorialspoint.com/word/">https://www.tutorialspoint.com/word/</a>	Word Processing
8.	<a href="https://www.javatpoint.com/ms-word-tutorial">https://www.javatpoint.com/ms-word-tutorial</a>	Word Processing
9.	<a href="https://support.microsoft.com/en-au/office/word-for-windows-training-7bcd85e6-2c3d-4c3c-a2a5-5ed8847">https://support.microsoft.com/en-au/office/word-for-windows-training-7bcd85e6-2c3d-4c3c-a2a5-5ed8847</a>	Word Processing
10.	<a href="https://www.javatpoint.com/excel-tutorial">https://www.javatpoint.com/excel-tutorial</a>	Spreadsheet
11.	<a href="https://support.microsoft.com/en-au/office/excel-video-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb">https://support.microsoft.com/en-au/office/excel-video-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb</a>	Spreadsheet
12.	<a href="https://www.javatpoint.com/powerpoint-tutorial">https://www.javatpoint.com/powerpoint-tutorial</a>	Powerpoint Presentation
13.	<a href="https://support.microsoft.com/en-au/office/powerpoint-for-windows-training-40e8c930-cb0b-40d8-82c4-b">https://support.microsoft.com/en-au/office/powerpoint-for-windows-training-40e8c930-cb0b-40d8-82c4-b</a>	Powerpoint Presentation
14.	<a href="https://www.geeksforgeeks.org/ms-dos-operating-system/">https://www.geeksforgeeks.org/ms-dos-operating-system/</a>	Operating System

Name & Signature:	
 <b>Mrs. Priyanka L Sonwane</b> Lecturer in Information Technology <b>(Course Experts)</b>	 <b>Mrs. Aafiya A Shaikh</b> Lecturer in Computer Engineering
Name & Signature:	Name & Signature:
 <b>Smt. N.S.Kadam</b> (Programme Head)	 <b>Shri. S.B. Kulkarni</b> (CDC In-charge)

**GOVERNMENT POLYTECHNIC, PUNE**  
**'120 – NEP' SCHEME**

<b>PROGRAMME</b>	<b>DIPLOMA IN CE/EE/ET/ME/MT/CM/IT/DDGM</b>
<b>PROGRAMME CODE</b>	<b>01/02/03/04/05/06/07/08</b>
<b>COURSE TITLE</b>	<b>COMMUNICATION SKILLS (ENGLISH)</b>
<b>COURSE CODE</b>	<b>HU11201</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>NA</b>

**I. LEARNING & ASSESSMENT SCHEME**

Course Code	Course Title	Course Type	Learning Scheme						Credits	Paper Duration	Assessment Scheme									
			Actual Contact Hrs./Week			SLH	NLH	Theory			Based on LL & TSL				Based on SL		Total Marks			
			CL	TL	LL			FA-TH			SA-TH	Total	Practical							
													FA-PR	SA-PR	SLA					
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min											
<b>HU 11201</b>	<b>COMMUNICATION SKILLS (ENGLISH)</b>	<b>AEC</b>	<b>03</b>	<b>-</b>	<b>02</b>	<b>01</b>	<b>06</b>	<b>03</b>	<b>03</b>	<b>30</b>	<b>70</b>	<b>100</b>	<b>40</b>	<b>25</b>	<b>10</b>	<b>--</b>	<b>--</b>	<b>25</b>	<b>10</b>	<b>150</b>

**Total IKS Hrs for Term: 0 Hrs**

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, #- External Assessment, \*# - Online Examination, @\$ - Internal Online Examination

**Note:**

**FA-TH** represents an average of two class tests of 30 marks each conducted during the semester.

- If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
- If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit SLA work.
- Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. \* 15 Weeks**
- 1 credit** is equivalent to **30 Notional hours**.
- \* Self-learning hours shall not be reflected in the Timetable.
- \* Self-learning includes micro-projects/assignments/other activities.

**II. RATIONALE:**

The most commonly used medium to express oneself is language. English is a global language used in all spheres of human life i.e. personal, professional and social. English Language proficiency focuses on strong reading, writing, speaking and listening skills. It will include grammar, vocabulary, comprehension and describing skills to enhance overall language proficiency. English for professional purposes aim to equip the students with the necessary language skills required for Public Speaking, presentation and negotiation. English for academic purposes will include academic writing skills and critical thinking considering the need of students to communicate in the engineering domain.

**III. COURSE-LEVEL LEARNING OUTCOMES (COS)**

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

- CO1: Construct grammatically correct sentences in English.
- CO2: Compose paragraphs and dialogues on given situations.
- CO3: Comprehend passages correctly.
- CO4: Use contextual words in English appropriately.
- CO5: Deliver effective presentations in English using appropriate body language.

## IV.THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT 1 VOCABULARY (CL Hrs. -10, Marks-12)</b>				
1.	<p>TLO 1.1 Use transcription to pronounce words correctly.</p> <p>TLO 1.2 Use prefixes and suffixes for flexibility and precision in language.</p> <p>TLO 1.3 Employ synonyms and antonyms to express similarity and contrast between words.</p> <p>TLO 1.4 Use Homophones to expand their vocabulary.</p> <p>TLO 1.5 Make use of the collocations correctly.</p>	<p>1.1 Phonetics: Vowels (12), Consonants (24), Diphthongs (8)</p> <p>1.2 Prefix &amp; Suffix: Definition &amp; Examples, List of common prefixes and suffixes</p> <p>1.3 Synonyms &amp; Antonyms: Vocabulary expansion, context &amp; Usage</p> <p>1.4 Homophones: Identifying Homophones, Meaning &amp; Context, Vocabulary Expansion</p> <p>1.5 Collocations: Definition &amp; identification, types of collocations.</p>	<p>Language Lab Drill, Classroom learning, Reference Books &amp; NPTEL.</p>	<b>CO1</b>
<b>UNIT II PARAGRAPH AND DIALOGUE WRITING (CL Hrs. -06, Marks-12)</b>				
2.	<p>TLO 2.1 Formulate paragraphs with Synchronized sentence structure on the given situation/topic.</p> <p>TLO 2.2 Develop dialogues to practice language skills in a structured and meaningful way.</p>	<p><b>2.1 Types of paragraphs:</b> Technical, Descriptive and Narrative</p> <p><b>2.2 Dialogue Writing:</b> i. Greetings ii. Development iii. Closing Sentence.</p>	<p>Classroom learning Skit, Language Lab, YouTube &amp; videos</p>	<b>CO2</b>
<b>UNIT III COMPREHENSION - SEEN AND UNSEEN PASSAGES (CL-Hrs. - 16, Marks-24)</b>				
3.	<p>TLO 3.1 Respond to the given questions of the specified passage.</p> <p>TLO 3.2 Formulate sentences using new words</p> <p>TLO 3.3 Use correct syntax to construct meaningful sentences for the given situation.</p> <p>TLO 3.4 Interpretation of passages in written and Spoken Form.</p>	<p>3.1 Passages from MSBTE workbook</p> <p>1. Say No to Plastic bags</p> <p>2. Interview of Dr. APJ Abdul Kalam</p> <p>3. Maximum Achievements</p> <p>4. Be Remarkable</p> <p>5. Arunima Sinha: A Biography</p> <p>6. Roses of Gratitude</p> <p>3.2 Importance of Comprehension</p> <p>3.3 Unseen Passages</p> <p>3.4 Interpretation of passages in written and Spoken Form.</p>	<p>Classroom learning, interactive sessions &amp; discussion</p>	<b>CO3</b>

UNIT- IV COMMUNICATIVE LANGUAGE (CL-Hrs. -07, Marks-14)			
<b>4.</b>	<p>TLO 4.1 Describe technical objects with specifications.</p> <p>TLO 4.2 Explain the given picture in grammatically correct language.</p> <p>TLO 4.3 Diary Entry on situations.</p> <p>TLO 4.4 Translate from English to Marathi/Hindi- and vice versa.</p>	<p>4.1 Technical objects: i. Heading ii. Description of Technical objects.</p> <p>4.2 Picture Description: i. Situational picture. ii. Describe in your own words</p> <p>4.3 Diary Entry : i. Date ii. Content iii. Name of the writer</p> <p>4.4 Translation of paragraph from English to Marathi/Hindi-Vice versa (Question not to be asked on Translation in Theory Examination)</p>	<b>CO4</b>

UNIT- V PRESENTATION SKILLS (CL Hrs. - 06, Marks- 08)			
<b>5.</b>	<p>TLO 5.1 Cultivate/Develop the habit of being presentable</p> <p>TLO 5.2 Formulate speeches for occasions</p> <p>TLO 5.3 Prepare PowerPoint presentation</p> <p>TLO 5.4 Use appropriate body language for effective communication</p>	<p>5.1 Dressing &amp; Grooming : i. Dressing for the occasion, ii. Proper grooming</p> <p>5.2 Speech Writing: i. Situation ii. Salutations iii. Introduction of the topic iv. Description/Body v. Conclusion</p> <p>5.3 PowerPoint Presentation: i. Layout ii. Font size iii. Colour combination</p> <p>5.4 Kinesics : i. Facial expressions ii Eye contact iii Postures iv Gestures</p>	<b>CO5</b>

**V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/ TUTORIAL EXPERIENCES.**

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Use transcription in the correct form. LLO 1.2 Learn to differentiate vowels, diphthongs and consonants.	Write 20 words using phonetic transcription.	2	CO1
2	LLO 2.1 Learn the correct pronunciation by using headphones in the language lab.	Practice pronunciation as per IPA using language lab.	2	CO1

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
3	LLO 3.1 Enhance the understanding of word formation. LLO 3.2 Enrich word power. LLO 3.3 Construct words with the specific meanings.	Formulate 20 words using Prefix and Suffix.	2	CO1
4	LLO 4.1 Use words and phrases effectively. LLO 4.2 Enrich vocabulary. LLO 4.3 Develop overall language skills.	Construct sentences using 20 collocations.	2	CO1
5	LLO 5.1 Articulate ideas clearly and effectively. LLO 5.2 Improve grammar and punctuation.	Write two paragraphs of 75 words each.	2	CO3
6	LLO 6.1 Add depth to narratives. LLO 6.2 Form grammatically correct sentences.	Compose situational dialogues. (Any Two)	2	CO3
7	LLO 7.1 Promote the development of effective communication skills. LLO 7.2. Improve non-verbal communication Skills. LLO 7.3 Enhance interpersonal skills. LLO 7.4 Build confidence.	Enact Role Plays as per situation and context.	2	CO5
8	LLO 8.1 Acquire the ability to convey complex ideas clearly and concisely. LLO 8.2 Expand technical vocabulary. LLO 8.3 Enhance the written communication Skills.	Describe any three technical objects using correct grammar.	2	CO1 CO3
9	LLO 9.1 Develop storytelling skills. LLO 9.2 Connect with the audience.	Narrate anecdotes of various situations in English.	2	CO5
10	LLO 10.1 Notice and articulate specific elements, colours, shapes, & other visual aids. LLO 10.2 Express observations & interpretations clearly and concisely. LLO 10.3 Enhance vocabulary.	Describe a given picture. (Any Two)	2	CO1 CO4
11	LLO 11.1 Express information coherently and engagingly. LLO 11.2 Build confidence.	Introduce oneself and others.	2	CO5

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
12	LLO 12.1 Present complex information in a clear & concise manner. LLO 12.2 Develop public speaking skills and presentation skills.	Prepare a PowerPoint presentation on a given topic.	2	CO5
13	LLO 13.1 Improve language skills & expand vocabulary.	Translate paragraph --English to Marathi/Hindi (vice -Versa) (Any4)	2	CO1 CO3
14	LLO 14.1 Reflect on thoughts, feelings, and experiences.	Write your experience in 50 words on ( Four) given situations (Diary Entry)	2	CO3 CO5
15	LLO 15.1 Develop language acquisition.	Respond to the questions based on the given passages.	2	CO2
16	LLO 16.1 Build confidence in public speaking. LLO 16.2 Enhance the skills in planning and prioritization.	Deliver oral presentations using correct grammar and appropriate body language.	2	CO5

**Note:** Any 12 out of 16 practical's are compulsory.

## VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

### Micro project

- Report different types of episodes/anecdotes.
- Seminar preparation and presentations.
- Make a Podcast episode based on Indian Freedom Fighters.
- Summarize the editorial columns of English newspapers.
- Summarize the content of an eminent person's biography/autobiography. Write a review on the following: Short stories, Novels and Films.
- Prepare a booklet on the contribution of eminent Indian scientists.
- Prepare a podcast referring to Bhagwat Geeta.
- Prepare blogs, podcasts, vlogs.
- Prepare a questionnaire & conduct interviews of Industry Personnel, social workers, and entrepreneurs  
Prepare and participate in debates and extempore speeches.

## VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Language Lab with relevant software and Computer system with all necessary components like; motherboard, random access memory (RAM), Read-only memory (ROM), Graphics cards, sound cards, internal hard disk drives, DVD drive, network interface card	All
2	LCD Projector with document reader	All
3	Smart Board with networking	All

**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE  
(Specification Table)**

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Vocabulary	CO1	10	2	4	6	12
2	II	Paragraph and Dialogue Writing	CO2	6	2	4	6	12
3	III	Comprehension (Seen and Unseen Passages)	CO3	16	5	6	13	24
4	IV	Communicative Language	CO4	7	2	4	8	14
5	V	Presentation Skills	CO5	6	2	2	4	8
<b>Grand Total</b>				<b>45</b>	<b>13</b>	<b>20</b>	<b>37</b>	<b>70</b>

**IX. ASSESSMENT METHODOLOGIES/TOOLS**

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Rubrics for COs 3. Assignment 4. Midterm Exam 5. Self-Learning 6. Term Work 7. Seminar/Presentation	1. End Term Exam 2. Micro-project 3. Tutorial Performance

**X. SUGGESTED COS- POS MATRIX FORM**

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	1	-	-	-	2	1			
CO2	1	1	-	-	-	2	1			
CO3	1	1	-	-	-	2	1			
CO4	1	1	-	-	-	2	1			
CO5	1	1	-	-	-	2	1			

**Legends:- High:03, Medium:02, Low:01, No Mapping: -**

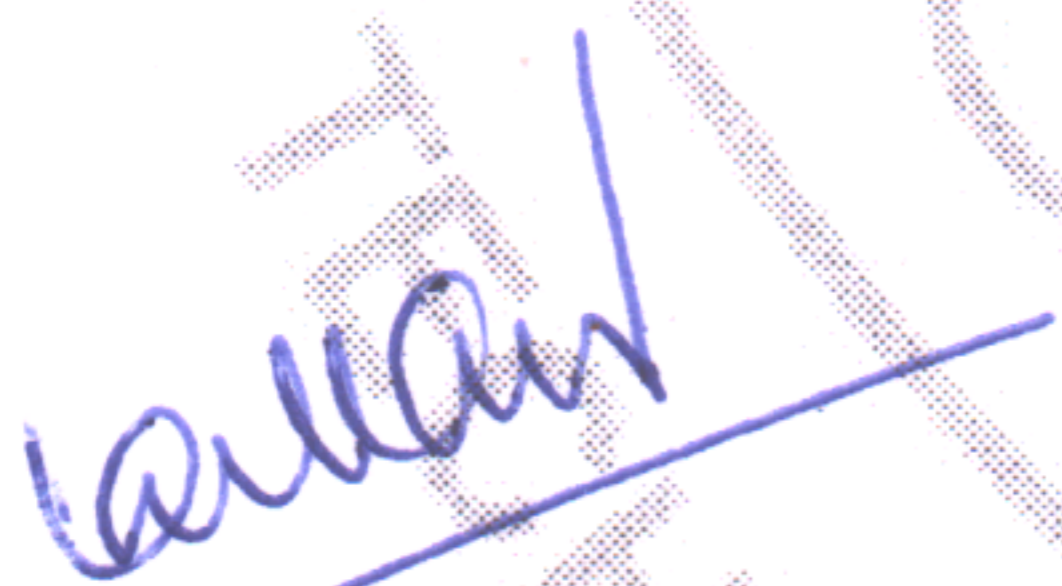
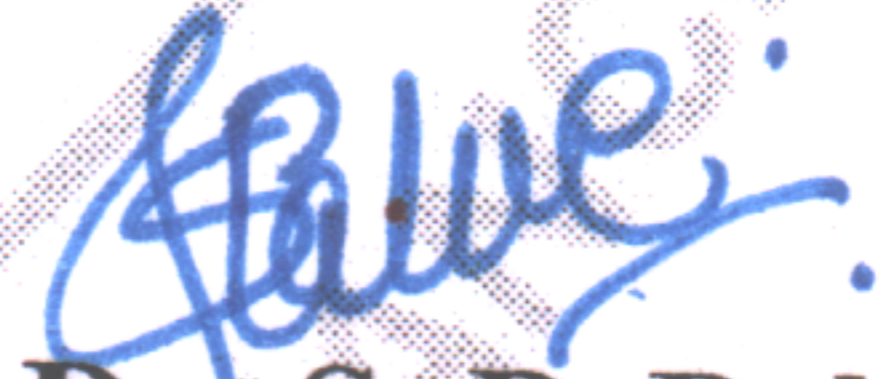


\*PSOs are to be formulated at the institute level

**XI.SUGGESTED LEARNING MATERIALS/BOOKS**

Sr. No	Author	Title	Publisher
1	MSBTE	Spectrum, G Scheme and I-Scheme	MSBTE
2	Kumar, E. Suresh, Sreehari, P. Savitri	Effective English with CD	Pearson Education
3	Gnanamurli	English Grammar at a Glance	S. Chand
4	CBSE	English Communicative (class X)	Golden
5	Dr. Anjana Tiwari	Communication Skills in English	Khanna Publishers, New Delhi

**XIII. LEARNING WEBSITES & PORTALS**

Sr. No	Link/Portal	Description
1.	<a href="http://nptel.ac.in/courses/106102064/1">http://nptel.ac.in/courses/106102064/1</a>	Online Learning Initiatives by IITs and IISc
2.	<a href="http://www.scilab.org/-SCILab">www.scilab.org/-SCILab</a>	Signal processing, statistical analysis, and image enhancement.
3.	<a href="http://www.mathworks.com/product/matlab/-MATLAB">www.mathworks.com/product/matlab/-MATLAB</a>	Applications of concepts of Mathematics to coding.
4.	Spreadsheet Applications	Use of Microsoft Excel, Apple Numbers, and Google Sheets.
5.	<a href="https://ocw.mit.edu/">https://ocw.mit.edu/</a>	MIT Courseware

Name & Signature:	
 <b>Shri. V.V. Kulkarni</b> Lecturer in English	 <b>Dr. S. P. Palve</b> Lecturer in English
<b>(Course Experts)</b>	
Name & Signature:	Name & Signature:
 <b>Smt. N.S. Kadam</b> (Programme Head)	 <b>Shri. S.B. Kulkarni</b> (CDC In-charge)



**GOVERNMENT POLYTECHNIC, PUNE**  
**'120 – NEP' SCHEME**

<b>PROGRAMME</b>	<b>DIPLOMA IN CE/EE/ET/ME/MT/CM/IT/DDGM</b>
<b>PROGRAMME CODE</b>	<b>01/02/03/04/05/06/07/08</b>
<b>COURSE TITLE</b>	<b>YOGA AND MEDITATION</b>
<b>COURSE CODE</b>	<b>HU21201</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>NA</b>

**I. LEARNING & ASSESSMENT SCHEME**

Course Code	Course Title	Course Type	Learning Scheme					Credits	Paper Duration	Assessment Scheme										
			Actual Contact Hrs./Week			SLH	NLH			Theory			Based on LL & TSL				Based on SL		Total Marks	
			CL	TL	LL					FA-TH	SA-TH	Total	Practical				SLA			
													FA-PR	SA-PR	Max	Min		Max		Min
HU21201	YOGA AND MEDITATION	VEC	-	-	1	1	2	1	-	-	-	-	-	25	10	-	-	25	10	50

**Total IKS Hrs for Term: 1Hr**

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, # - External Assessment, \*# - Online Examination, @\$ - Internal Online Examination

**Note:**

**FA-TH** represents an average of two class tests of 30 marks each conducted during the semester.

- If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
- If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
- Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. \* 15 Weeks**
- 1 credit** is equivalent to **30 Notional hours**.
- \* Self-learning hours shall not be reflected in the Timetable.
- \* Self-learning includes micro-projects/assignments/other activities.

**II. RATIONALE:**

Diploma Graduate needs a sound body and mind to face the challenging situations in a career as an employee or as an entrepreneur. Yoga and Meditation bring about the holistic development of an individual and equip him with the necessary balance to handle the challenges. The age of polytechnic students is appropriate to get introduced to yoga practice as this will help them in their studies as well as their professional lives. Moreover, Yoga inculcates discipline in all walks of the life of students. Pranayama practice regulates the breathing practices of the student to improve stamina and resilience.

Meditation empowers a student to focus and keep calm to get peace of mind. World Health Organization (WHO) has also emphasized the role of yoga and meditation as stress prevention measures. National Education Policy 2020 highlights the importance of yoga and meditation amongst students of all ages. Therefore, this course for Diploma students is designed for the overall well-being of the student and aims to empower students to adopt and practice "Yoga" in daily life.

**III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)**

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

**CO1** - Practice basic Yoga and Pranayama in daily life to maintain physical and mental fitness.

**CO2** - Practice meditation regularly to improve concentration and better handling of stress and anxiety.

**CO3** - Follow a healthy diet and hygienic practices for maintaining good health.

**IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT**

**NOT APPLICABLE**

**V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.**

<b>Sr. No</b>	<b>Practical/Tutorial/Laboratory Learning Outcome (LLO)</b>	<b>Laboratory Experiment / Practical Titles /Tutorial Titles</b>	<b>Number of hrs.</b>	<b>Relevant COs</b>
<b>1</b>	LLO 1.1 Practice warming up for Yoga.	Introduction:- Presentations on Introduction to Yoga and its History. Lab Exp: 1. Perform warming-up exercises to prepare the body from head to toe for Yoga.	<b>5</b>	<b>CO1</b>
<b>2</b>	LLO 2.1 Practice Surya Namaskar	Lab Exp: 2. Perform all the postures of Surya Namaskar one by one at a very slow pace, after warm-up. Lab Exp 3. Perform multiple Surya Namaskar ( Starting with three and gradually increasing it to twelve) in one go. Experiments 2 to 4 must be followed by Shavasana for self-relaxation.	<b>7</b>	<b>CO1, CO2</b>
<b>3</b>	LLO 3.1 Practice basic Asanas	Lab Exp: 4 Perform Sarvangasna, Halasana, Kandharasana (setubandhasana) Lab Exp: 5 Perform Bhujangasana, Naukasana, Mandukasana Lab Exp: 6 Perform Paschimottasana, Baddhakonasana, Bharadwajasana. Lab Exp: 7 Perform Veera Bhadrasana, Vrukshasana, Trikonasana. Follow-up experiments 5 to 7 with Shavasana for self-relaxation	<b>8</b>	<b>CO2</b>
<b>4</b>	LLO 4.1 Practice basic Pranayama	Lab Exp: 8 Perform Bhastrika, Anulom Vilom Pranayam Kriya Lab Exp: 9 Practice Kapalbhati Pranayam Kriya Lab Exp: 10 Practice Bhramary Pranayam.	<b>5</b>	<b>CO3</b>

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
5	LLO 5.1 Practice Meditation	Lab Exp: 11 Perform sitting in Dhyana Mudra and meditating. Start with five minutes and slowly increasing to higher durations. The trainer will explain the benefits of Meditation before practice	5	CO3

**Note :**

1. The start and end of each session can be with appropriate Yoga prayers and chanting of Omkar.
2. Trainers can add similar asanas in practical sessions.
3. Students are to be instructed to practice the experiment performed at least twice a week as part of self learning practices.
4. A live demonstration by the trainer needs to be carried out during practical hours. Yogic Videos can be used as well.

**VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)**

**Micro project**

- Maintain a diary indicating date-wise practice done by the student with a photograph of self in yogic posture.

**Assignment**

- Prepare a Diet and nutrition chart for Self.

**Learning**

- Practice at least thrice a week.
- Read books on different methods to maintain health, and wellness and to enhance mood.
- Watch videos on Yoga Practices.

**VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Yoga and Meditation kits : Yoga Mats, Yoga Rollers, Yoga Blocks, Aero Yoga Clothing Blankets, Cloth Straps, Bolsters Wheels	ALL

**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)**

**NOT APPLICABLE**

**IX.ASSESSMENT METHODOLOGIES/TOOLS**

<b>Formative assessment (Assessment for Learning)</b>	<b>Summative Assessment (Assessment of Learning)</b>
Lab performance, Self-learning and Terms work	Actual Practical Performance

**X. SUGGESTED COS- POS MATRIX FORM**

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	-	-	-	-	3	-	-			
CO2	-	-	-	-	3	-	-			
CO3	-	-	-	-	3	-	-			
CO4	-	-	-	-	3	-	-			
CO5	-	-	-	-	3	-	-			


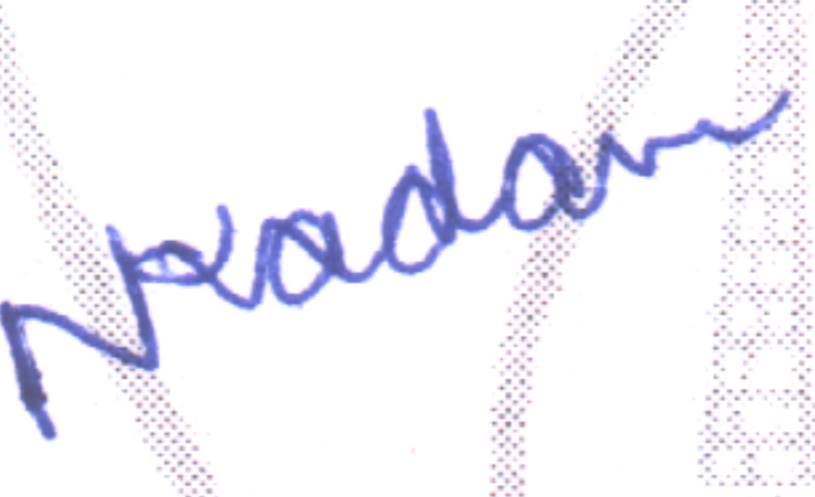
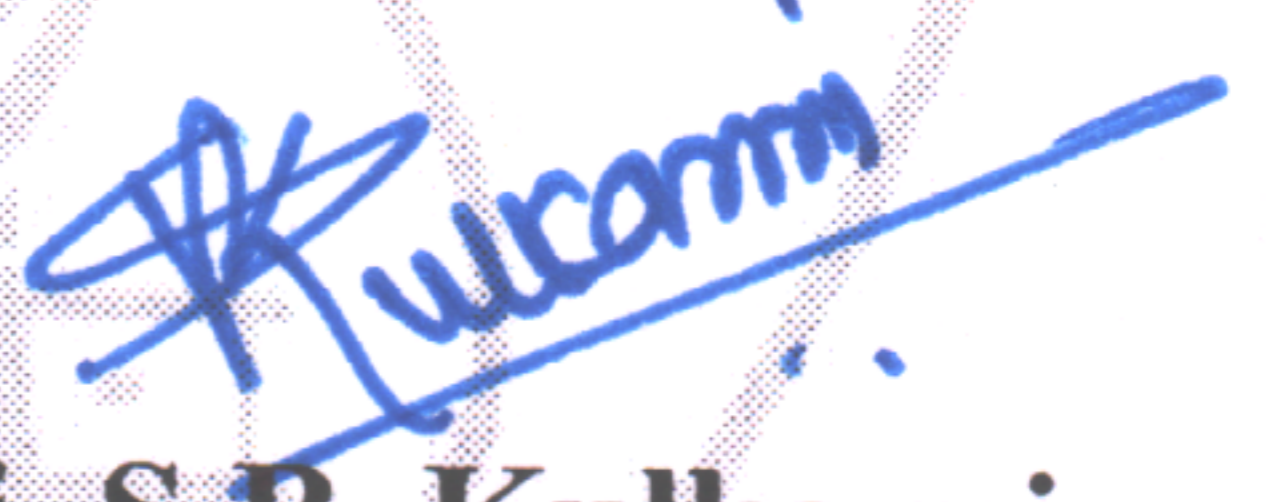
**Legends:- High:03, Medium:02, Low:01, No Mapping: -**  
 \*PSOs are to be formulated at the institute level

**XI.SUGGESTED LEARNING MATERIALS/BOOKS**

Sr.No.	Author	Title	Publisher
1	Swami Vivekananda	Patanjalis Yoga Sutras	Fingerprint Publishing (2019) ISBN-10 9389567351
2	Luisa Ray (Author), Angus Sutherland (Illustrator)	Yoga for Every Body: A beginner's guide to the practice of yoga postures, breathing exercises and meditation.	Vital Life Books (2022) ISBN-13: 9781739737030, ISBN-10: 1739737032
3	Swami Saradananda	Mudras for Modern Life: Boost your health, re-energize your life, enhance your yoga and deepen your meditation	Watkins Publishing ISBN: 9781780289984, Edition: 2018
4	Martha Davis, Elizabeth Robbins, Matthew McKay, Eshelman MSW	The Relaxation and Stress Reduction Workbook	A New Harbinger Self-Help Workbook (2019)
5	SWANSON, ANN	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice	Penguin Random House, ISBN 13 9780241341230

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1.	<a href="https://onlinecourses.swayam2.ac.in/aic19_ed28/preview">https://onlinecourses.swayam2.ac.in/aic19_ed28/preview</a>	Introduction to Yoga and Applications of Yoga - Course (swayam2.ac.in)
2.	<a href="https://onlinecourses.swayam2.ac.in/aic23_review">https://onlinecourses.swayam2.ac.in/aic23_review</a>	Yoga for Creativity
3.	<a href="https://onlinecourses.swayam2.ac.in/aic23_ge05/preview">https://onlinecourses.swayam2.ac.in/aic23_ge05/preview</a>	Yoga for concentration
4.	<a href="https://onlinecourses.swayam2.ac.in/aic23_ge06/preview">https://onlinecourses.swayam2.ac.in/aic23_ge06/preview</a>	Yoga for Memory Development
5.	<a href="https://onlinecourses.nptel.ac.in/noc21_hs29/preview">https://onlinecourses.nptel.ac.in/noc21_hs29/preview</a>	Psychology of Stress, Health and Well-being
6.	<a href="https://onlinecourses.swayam2.ac.in/nce19_sc04/preview">https://onlinecourses.swayam2.ac.in/nce19_sc04/preview</a>	Food Nutrition for Healthy Living

Name & Signature:	
 <b>Shri. Sunil P. Date</b> (Course Experts)	
Name & Signature:	Name & Signature:
 <b>Smt. N.S. Kadam</b> (Programme Head)	 <b>Shri. S.B. Kulkarni</b> (CDC In-charge)

## GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CE / EE / ME / MT
PROGRAMME CODE	01/02/04/ 05
COURSE TITLE	ENGINEERING GRAPHICS
COURSE CODE	ME11201
PREREQUISITE COURSE CODE & TITLE	NA

## I. LEARNING &amp; ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme						Credits	Paper Duration	Assessment Scheme									
			Actual Contact Hrs./Week			SLH	NLH	Theory			Based on LL & TSL				Based on SL		Total Marks			
			CL	TL	LL						FA-TH	SA-TH	Practical		SLA					
													Max	Min	Max	Min		Max	Min	
ME11201	ENGINEERING GRAPHICS	DSC	2	-	4	-	6	3	-	-	-	-	-	50	20	50@	20	-	-	100

Total IKS Hrs for Term: 2 Hrs

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, # - External Assessment, \*# - Online Examination, @\$ - Internal Online Examination

**Note:**

**FA-TH** represents an average of two class tests of 30 marks each conducted during the semester.

- If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
- If a candidate does not secure minimum passing marks in **SLA** (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit **SLA** work.
- Notional learning hours** for the semester are  $(CL + LL + TL + SL)$  hrs. \* 15 Weeks
- 1 credit** is equivalent to **30 Notional hours**.
- \* Self-learning hours shall not be reflected in the Timetable.
- \* Self-learning includes micro-projects/assignments/other activities.

## II. RATIONALE:

Engineering graphics is the language of engineers. The concepts of graphical language are used in expressing the ideas and conveying the instructions, which are used in carrying out the jobs on the sites, shop floor etc. This course is useful in developing drafting and sketching skills in the student. It covers the knowledge & use of drawing instruments & also familiarizes the learner with the Bureau of Indian standards related to engineering drawing. The curriculum aims to develop the ability to draw and read various engineering curves, projections and dimensioning styles. The subject mainly focuses on the use of drawing instruments, developing imagination and translating ideas into sketches. This course also helps to develop the idea of visualizing the actual object or part based on drawings and blueprints. This preliminary course aims to build a foundation for further courses related to engineering drawing and other allied courses in the coming semesters.

## III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1: Draw geometrical figures and engineering curves

CO2: Apply principles of orthographic projections for drawing given pictorial views

CO3: Draw isometric views of given component from orthographic projections

CO4: Use various drawing codes, conventions and symbols as per IS SP-46 in engineering drawing.

CO5: Draw free-hand sketches of given engineering elements.

#### IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I BASIC ELEMENTS OF DRAWING (CL Hrs-04, Marks-04)</b>				
1.	TLO 1.1 Prepare drawing using drawing instruments. TLO 1.2 Use IS SP-46 for dimensioning TLO 1.3 Use different types of lines. TLO 1.4 Draw regular geometrical figures. TLO 1.5 Draw figures having tangency constructions.	1.1 Drawing Instruments and supporting material: method to use them with applications. 1.2 Standard sizes of drawing sheets (ISO-A series) 1.3 I.S. codes for planning and layout. 1.4 Letters and numbers (single stroke vertical) 1.5 Convention of lines and their applications. 1.6 Scale - reduced, enlarged & full size 1.7 Dimensioning techniques as per SP-46 (Latest edition) – types and applications of chain, parallel and coordinate dimensioning 1.8 Geometrical constructions	Model Demonstration	CO1
<b>UNIT-II ENGINEERING CURVES &amp; LOCI OF POINTS (CL Hrs-06, Marks-12)</b>				
2	TLO 2.1 Explain different engineering curves with areas of application. TLO 2.2 Draw different conic sections. TLO 2.3 Draw involute and cycloidal curves. TLO 2.4 Draw helix and spiral curves from the given data TLO 2.5 Plot Loci of points from given data.	2.1 Concept and understanding of focus, directrix, vertex and eccentricity. Conic sections. 2.2 Methods to draw an ellipse by Arcs of Circle method & Concentric circles method. 2.3 Methods to draw a parabola by Directrix-Focus method & Rectangle method 2.4 Methods to draw a hyperbola by Directrix-Focus method. 2.5 Methods to draw involutes: circle & pentagon 2.6 Methods to draw Cycloidal curve: cycloid, epicycloid and hypocycloid 2.7 Methods to draw Helix & Archimedean spiral. 2.8 Loci of points on Single slider crank mechanism with given specifications.	Demonstrations	CO1

<b>UNIT-III ORTHOGRAPHIC PROJECTIONS (CL Hrs-08, Marks-14)</b>				
3	TLO 3.1 Explain methods of Orthographic Projections. TLO 3.2 Draw orthographic views of simple 2D entities containing lines, circles and arcs only. TLO 3.3 Draw the orthographic views from given pictorial views. TLO 3.4 Use of IS code IS SP-46 for dimensioning technique.	3.1 Introduction of projections-orthographic, perspective, isometric and oblique: concept and applications. (No question to be asked in examination) 3.2 Introduction to orthographic projection, First angle and Third angle method, and their symbols. Conversion of pictorial view into Orthographic Views – object containing plain surfaces, slanting surfaces, slots, ribs, cylindrical surfaces. (use First Angle Projection)	Model Demonstration Video Demonstrations	CO2, CO4
<b>UNIT- IV ISOMETRIC PROJECTIONS (CL Hrs-08, Marks-14)</b>				
4	TLO 4.1 Prepare isometric scale. TLO 4.2 Draw isometric views of simple 2D entities containing lines, circles and arcs only. TLO4.3 Interpret the given orthographic views. TLO 4.4 Draw Isometric views from given orthographic views)	4.1 Introduction to Isometric projection. 4.2 Isometric scale and Natural Scale. 4.3 Isometric view and isometric projection. 4.4 Illustrative problems related to simple objects having plain, slanting, cylindrical surfaces and slots on slanting surfaces. 4.5 Conversion of orthographic views into isometric View/projection. (For branches other than mechanical Engineering, the teacher should select branch-specific elements.	Model Demonstration	CO3, CO4
<b>UNIT –V FREE HAND SKETCHES OF ENGINEERING ELEMENTS (CL Hrs-04, Marks-06)</b>				
5	TLO 5.1 Sketch proportionate freehand sketches of given machine elements. TLO 5.2 Select proper fasteners and locking arrangement.	5.1 Free hand sketches of machine elements: Thread profiles, nuts, bolts, studs, set screws, washers, and Locking arrangements. (For branches other than mechanical Engineering, the teacher should select branch-specific elements for freehand sketching)	Model Demonstration	CO4, CO5

**V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.**

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Use drawing instruments	Draw horizontal, vertical, 30-degree, 45-degree, 60- & 75-degree lines using Tee and Set squares/ drafter. (Sketch Book).	2	CO1



Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
2	LLO 2.1 Use IS code related to dimensioning standard LLO 2.2 Draw the given types of lines	Draw different types of lines, and dimensioning styles (Sketch Book)	2	CO1
3	LLO 3.1 Draw the figure as per the given sketch	Draw one figure showing dimensioning techniques, two problems on redrawing the figures and one problem on loci of points - slider crank mechanism. (Sketch Book)	2	CO1
4	LLO 4.1 Draw figures using IS Standard for drawing	Draw one figure showing dimensioning techniques, two problems on redrawing the figures and one problem on loci of points - slider crank mechanism. (01 Sheet)	4	CO1
5	LLO 5.1 Identify different Engineering curves LLO 5.2 Draw different types of curves	Draw any four Engineering Curves (Sketchbook)	2	CO1
6	LLO 6.1 Identify different Engineering curves LLO 6.2 Draw different types of curves	Draw any four Engineering Curves – (01 Sheet)	4	CO1
7	LLO 7.1 Apply the method of projection for drawing simple orthographic views	Draw two problems on orthographic projections using the first angle method of projection having plain surfaces, slanting surfaces slots etc.- (Sketchbook)	2	CO2 CO4
8	LLO 8.1 Apply the method of projection for drawing simple orthographic views	Draw two problems on orthographic projections using the first angle method of projection having plain surfaces, slanting surfaces slots etc.- (01 Sheet)	4	CO2 CO4
9	LLO 9.1 Apply the method of projection for drawing complex orthographic views	Draw two problems on orthographic projections using the first angle method of projection having cylindrical surfaces, ribs etc. (Sketchbook)	2	CO2 CO4
10	LLO 10.1 Apply the method of projection for drawing complex orthographic views	Draw two problems on orthographic projections using the first angle method of projection having cylindrical surfaces, ribs etc.- (01 Sheet)	4	CO2 CO4
11	LLO 11.1 Draw simple isometric projections	Draw two problems on the Isometric view of simple objects having plain and slanting surfaces by using natural scale. (Sketchbook)	4	CO3
12	LLO 12.1 Apply different scales for drawing isometric projections.	Draw two problems on the Isometric view of simple objects having plain and slanting surfaces by using natural scale. ( 01 sheet)	2	CO3

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
13	LLO 13.1 Draw simple isometric projections	Draw two problems on the Isometric Projection of objects having cylindrical surfaces and slots on slanting surfaces by using an isometric scale. (Sketchbook)	2	CO3 CO4
14	LLO 14.1 Apply different scales for drawing isometric projections	Draw two problems on the Isometric Projection of objects having cylindrical surfaces and slots on slanting surfaces by using an isometric scale. ( 01 sheet)	4	CO3 CO4
15	LLO 15.1 Draw Orthographic views of a given object.	Problem-Based Learning: Given the orthographic views of at least three objects with few missing lines, the student will try to imagine the corresponding objects, complete the views and draw these views (Sketchbook).	2	CO2 CO4
16	LLO 16.1 Draw standard discipline-oriented components using free hand.	Draw freehand Sketches of 12 different standard components (Sketchbook)	2	CO5
17	LLO 17.1 Draw standard discipline-oriented components using free hand.	Draw freehand Sketches of 12 different standard components (1 Sheet)	2	CO5
18	LLO 18.1 Collect information on an ancient Indian culture related to engineering graphics	Correlate ancient Indian sculptures, Indian temples, Monuments, etc. with Engineering Graphics	2	CO1 CO2 CO3 CO4 CO5

#### VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

**Micro project:**

NA

**Assignment: -**

NA

#### VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Drawing Table with Drawing Board of Full Imperial/ A1 size.	All
2	Models of objects for orthographic projections	7,8,9,10
3	Models/ Charts of objects mentioned in unit no. 5	16,17
4	Set of various industrial drawings being used by industries.	All
5	A set of drawing sheets mentioned in section 6.0 could be developed by experienced teachers and made available on the MSBTE portal to be used as references/standards.	All

6	Drawing equipment and instruments for classroom teaching-large size: a. T-square or drafter (Drafting Machine). b. Set squares (450 and 300-600) c. Protector. d. Drawing instrument box (containing set of compasses and dividers). Drawing sheets, Drawing pencils, Eraser, Drawing pins/clips	All
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**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE**

(Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basic Elements of Drawing	CO1	4	0	0	04	04
2	II	Engineering curves and loci of Points.	CO1	6	0	0	12	12
3	III	Orthographic projections	CO2,CO4	8	0	0	14	14
4	IV	Isometric Projections	CO3,CO4	8	0	0	14	14
5	V	Free Hand Sketches of Engineering Elements	CO4,CO5	4	0	0	06	06
<b>Grand Total</b>				<b>30</b>	<b>0</b>	<b>0</b>	<b>50</b>	<b>50</b>

**IX. ASSESSMENT METHODOLOGIES/TOOLS**

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Term Work	1. End Term Practical Exam

**X. SUGGESTED COs- POs MATRIX FORM**

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	-	2	-	2	2			
CO2	3	-	-	2	-	2	2			
CO3	3	-	-	2	-	2	2			
CO4	3	-	-	2	-	2	2			
CO5	3	-	-	2	-	2	2			

**Legends:- High:03, Medium:02, Low:01, NoMapping: -**  
 \*PSOs are to be formulated at the institute level


## XI.SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	Bureau of Indian Standards.	Engineering Drawing Practice for Schools and Colleges IS: SP-46	Third Reprint, October 1998 ISBN No. 81- 7061-091-2
2	Bhatt, N.D.	Engineering Drawing	Charotar Publishing House, 2010 ISBN No. 978-93-80358-17-8
3	Bhatt, N.D.; Panchal, V. M	Machine Drawing	Charotar Publishing House, 2010 ISBN No. 978-93-80358-11-6
4	Jolhe, D.A.	Engineering Drawing	Tata McGraw Hill Edu. New Delhi, 2010, ISBN No. 978-0-07-064837-1
5	Dhawan, R. K.	Engineering Drawing	S. Chand and Company New Delhi, ISBN No. 81-219-1431-0
6	Pradhan, S.K Jain, K.K	Engineering Graphics	Khanna Book Publishing CO(P) LTD, New Delhi, ISBN No. 978-93-91505-50-9

## XII. LEARNING WEBSITES &amp; PORTALS

Sr.No	Link/Portal	Description
1.	<a href="https://www.youtube.com/watch?v=dmt6_n7Sgcg">https://www.youtube.com/watch?v=dmt6_n7Sgcg</a>	Free Hand Sketches
2.	<a href="https://www.youtube.com/watch?v=dmt6_n7Sgcg">https://www.youtube.com/watch?v=dmt6_n7Sgcg</a>	Orthographic Projection
3.	<a href="https://www.youtube.com/watch?v=3WXPanCq9LI">https://www.youtube.com/watch?v=3WXPanCq9LI</a>	Basics of Projection
4.	<a href="https://www.youtube.com/watch?v=fyjk7PlxAuo">https://www.youtube.com/watch?v=fyjk7PlxAuo</a>	Introduction to Engineering Graphics
5.	<a href="https://www.youtube.com/watch?v=8j711OWhMIE">https://www.youtube.com/watch?v=8j711OWhMIE</a>	Isometric Projection

Name &amp; Signature:

  
**Mr. Swapnil S Hatwalane**  
 Lecturer in Mechanical Engineering


(Course Experts)

  
**Mr. N B Hirlekar**  
 Lecturer in Mechanical Engineering

Name &amp; Signature:

  
**Smt. N.S.Kadam**  
 (Programme Head)

Name &amp; Signature:

  
**Shri.S.B.Kulkarni**  
 (CDC In-charge)

## GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CE/ ME/ MT
PROGRAMME CODE	01/04/05
COURSE TITLE	ENGINEERING CHEMISTRY
COURSE CODE	SC11201
PREREQUISITE COURSE CODE & TITLE	NA

## I. LEARNING &amp; ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme						Credits	Paper Duration	Assessment Scheme										Total Marks
			Actual Contact Hrs./Week			SL	H	NLH			Theory			Based on LL & TSL				Based on SL			
			CL	TL	LL						FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Min	Max	Min	Max	Min	Max	Min	
SC11201	ENGINEERING CHEMISTRY	DSC	03	-	02	01	06	03	02	30	70*#	100	40	25	10	25@	10	25	10	175	

Total IKS Hrs for Term: 2 Hrs

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, # - External Assessment, \*# - Online Examination, @\$ - Internal Online Examination

**Note:**

**FA-TH** represents an average of two class tests of 30 marks each conducted during the semester.

- If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
- If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit SLA work.
- Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. \* 15 Weeks**
- 1 credit** is equivalent to **30 Notional hours**.
- \* Self-learning hours shall not be reflected in the Timetable.
- \* Self-learning includes micro-projects/assignments/other activities.

## II. RATIONALE:

Applications of Material Science and Chemical Principles have resulted in the development of new materials used in modern medicines and automobiles, synthetic fibers, polymers, alloys, new energy sources and many other important products and processes. Steels, alloys, plastic and elastomers are included considering their present extensive use in automobiles, chemicals and heavy engineering industries.

Corrosion and methods of prevention will make students realize the importance of care and maintenance of machines and equipment. The study of impurities and hardness in water and methods for water softening will help the students make proper use of water.

## III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

- CO1: Distinguish materials based on atomic structure.
- CO2: Select metals and non-metals for given applications
- CO3: Use corrosion preventive measures in the industry.
- CO4: Use relevant water treatment processes to solve industrial problems.
- CO5: Select relevant fuel and lubricant in relevant applications.
- CO6: Use the appropriate engineering material in various applications.

## IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I ATOMIC STRUCTURE (CL Hrs-05, Marks-10)</b>				
1.	<p>TLO 1.1 Explain the characteristics of fundamental particles</p> <p>TLO 1.2 Distinguish between orbit and orbital.</p> <p>TLO 1.3 Draw orbital electronic configurations (s, p, d, f) of elements.</p> <p>TLO 1.4 Explain the formation of molecules</p> <p>TLO 1.5 Explain the Covalent compounds.</p> <p>*</p>	<p>1.1 Indian Chemistry:-Philosophy of an atom by Acharya Kanad.</p> <p>1.2 Orbits: Bohr's energy levels, sub-energy levels, s, p, d, f orbital, shapes and description of s and p orbital.</p> <p>1.3 Aufbau's principle, Hund's rule, orbital electronic configurations (s, p, d, f) of elements having atomic numbers 1 to 30</p> <p>1.4. Definitions of valence electrons, valency, types of valencies, Definition of electrovalency positive and negative electrovalency.</p> <p>1.5. Formation of Electrovalent compounds-NaCl, AlCl<sub>3</sub> Definition of covalency, single, double and triple covalent bonds, formation of Covalent compounds H<sub>2</sub>O, CO<sub>2</sub>, N<sub>2</sub>.</p>	<p>Chalk and board Improved lecture, Tutorial Assignment, and Demonstration</p>	<b>CO1</b>
<b>UNIT-II METALS AND ALLOYS (CL Hrs-08, Marks-12)</b>				
2	<p>TLO 2.1 Draw the flow chart showing different processes in metallurgy.</p> <p>TLO 2.2 Classify carbon steel giving properties and application of each type.</p> <p>TLO 2.3 Define heat treatment and state the purposes of the hardening method.</p> <p>TLO 2.4 Describe the purposes of making alloys.</p> <p>TLO 2.5 State the composition, properties and uses of a given alloy.</p>	<p>2.1 Occurrence of metals, definitions of mineral, ore, flux, matrix, slag and metallurgy, mechanical properties of metal.</p> <p>2.2 Flow chart showing different processes in metallurgy, classification, properties and application of carbon steel,</p> <p>2.3 Heat treatment (definition, purposes and methods)</p> <p>2.4 Definition of alloy, purposes of making alloys with examples, classification of alloys (ferrous and non-ferrous),</p> <p>2.5 Composition, properties and uses of Heat resisting steel, Magnetic steel, Shock resistance steel, Stainless steel, High-speed steel, Spring steel, Tool steel, Duralumin, Woods metal, Brass and Monel metal</p>	<p>Chalk and board, Improved lecture, Tutorial Assignment, Demonstration</p>	<b>CO2</b>

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-III CORROSION (CL Hrs-08, Marks-12)</b>				
3	<p>TLO 3.1 Explain different types of oxide films.</p> <p>TLO 3.2 Explain the mechanism of electrochemical corrosion.</p> <p>TLO 3.3 Explain the factors affecting the rate of atmospheric corrosion and electrochemical corrosion.</p> <p>TLO 3.4 Describe the galvanization process of protection of metal from corrosion.</p> <p>TLO 3.5 Distinguish between galvanization and tinning.</p>	<p>3.1 Definition, causes of corrosion types of corrosion- definition (atmospheric and electrochemical) Types of oxide films</p> <p>3.2 Mechanism of atmospheric and electrochemical corrosion (evolution of hydrogen, absorption of oxygen).</p> <p>3.3 Factors affecting the rate of atmospheric corrosion and electrochemical corrosion.</p> <p>3.4 Protection Methods- Galvanization and Tinning Processes,</p> <p>3.5 Sherardizing Metal spraying, Metal cladding.</p>	<p>Chalk and board, Improved lecture, Tutorial Assignment, Demonstration</p>	<b>CO3</b>
<b>UNIT- IV WATER (CL Hrs-08, Marks-12)</b>				
4	<p>TLO 4.1. Explain the bad effects of hard water in the paper and textile industries.</p> <p>TLO 4.2. Describe the method of removal of hardness by the zeolite process.</p> <p>TLO 4.3. Explain the reverse osmosis process of water.</p> <p>TLO 4.4. Explain sewage treatment of water.</p> <p>TLO 4.5 Calculate the pH and pOH for a given solution</p>	<p>4.1 Definition of hard water and soft water causes of hardness, types of hardness.</p> <p>4.2 Bad effect of hard water in industries (paper, textile, dye, sugar)</p> <p>4.3 Removal of hardness by lime soda method, zeolite, Ion exchange method.</p> <p>4.4 Reverse osmosis, sewage treatment</p> <p>4.5 pH scale, applications of pH in engineering. Numerical based on pH.</p>	<p>Chalk and board, Improved lecture, Tutorial Assignment, Demonstration</p>	<b>CO4</b>
<b>UNIT –V LUBRICANTS &amp; FUELS (CL Hrs-08, Marks-12)</b>				
5	<p>TLO 5.1 Classify lubricant and list the examples of each type.</p> <p>TLO 5.2 Select the proper lubricant for given machines, (I.C.E., gears, cutting tools, high pressure.)</p> <p>TLO 5.3 Describe the characteristics of good fuel.</p> <p>TLO 5.4 Compare solid, liquid and gaseous fuel</p> <p>TLO 5.5 Draw the diagram of refining of crude petroleum</p>	<p>5.1 Lubricants: Classification of lubricant, properties of lubricating oils (physical and chemical)</p> <p>5.2 Selection of lubricant for light machines, I.C.E., gears, cutting tools, high-pressure and low-speed machines, transformers, and spindles in the textile industry for refrigeration systems.</p> <p>5.3 Definition, classification of fuels, characteristics of good fuel.</p> <p>5.4 Comparison between solid, liquid and gaseous fuel, types of coal.</p> <p>5.5 Refining of crude petroleum. Fractions obtained by distillation of</p>	<p>Chalk and board, Improved lecture, Tutorial Assignment, Demonstration</p>	<b>CO5</b>

		crude oil, gasoline, kerosene, and diesel as a fuel (properties and uses).		
<b>UNIT –VI MATERIALS (CL Hrs-08, Marks-12)</b>				
6	<p>TLO6.1 Describe the different constituents of paint.</p> <p>TLO 6.2 Distinguish between varnish and paint.</p> <p>TLO 6.3 Describe the preparation and properties of a given insulator.</p> <p>TLO 6.4 Describe the polymerization process of the given polymer,</p> <p>TLO 6.5 Explain the properties and uses of the given polymer, elastomer.</p> <p>TLO 6.6 Explain the function of different constituents of cement.</p>	<p>6.1 Paints: Definition, the purpose of applying paints, characteristics of paint, constituents of paint, function and examples of each constituent.</p> <p>6.2 Varnish: Definition, types, and difference between varnish and paint.</p> <p>6.3 Insulators: Definition, characteristics, preparation, properties and application of Glass wool and Thermocole.</p> <p>6.4 Plastic: Definition, Classification based on Molecular structure, Monomers (homo polymer and copolymer), &amp; Thermal behaviour (Thermoplastics and Thermosetting).</p> <p>6.5 Types Polymerization Reaction, Addition &amp; condensation, properties and application of Polyethylene, Polyvinyl chloride, Teflon, Polystyrene, Phenol formaldehyde.</p> <p>6.6 Cement: Definition, classification of cement, chemical composition of Portland cement, functions of constituents in cement.</p>	Chalk and board, Improved lecture, Tutorial Assignment, Demonstration	CO6

**V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.**

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1 Write the electronic configuration of atoms from Z=1 to Z=30	Write the electronic configuration of atoms from Z=1 to Z=30	2	CO1
2	LLO 2 Write the formation of compounds NaCl, AlCl <sub>3</sub> , H <sub>2</sub> O, CO <sub>2</sub> , N <sub>2</sub>	Write the formation of compounds NaCl, AlCl <sub>3</sub> , H <sub>2</sub> O, CO <sub>2</sub> , N <sub>2</sub>	2	CO1
3	LLO 3 Determine basic radical-given ionic solutions by performing the selective test	Determination of basic radical from given ionic solution	2	CO1
4	LLO 4 Determine acidic radical given ionic solutions by performing the selective test	Determination of acidic radical from given ionic solution.	2	CO1



Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
5	LLO 5 Determine the percentage of iron in a given steel sample by redox titration.	Determination of the percentage of iron in a given steel sample by redox titration.	2	CO2
6	LLO 6 Prepare phenol formaldehyde resin.	Preparation of phenol formaldehyde resin.	2	CO6
7	LLO 7 Determine the rate of corrosion of Aluminium in an acidic medium	Determination of the rate of corrosion of Aluminium in an acidic medium.	2	CO3
8	LLO 8 Determine the hardness of the given water sample by the EDTA method.	Determination of hardness of given water sample by EDTA method.	2	CO4
9	LLO 9 Determine the coefficient of viscosity using Ostwald's viscometer	Determination of the coefficient of viscosity using Ostwald's viscometer.	2	CO5
10	LLO 10 Determine moisture content from a given coal sample.	Determination of moisture content from a given coal sample.	2	CO5
11	LLO 11 Determine thinner content in oil paint.	Determination of thinner content in oil paint.	2	CO6
12	LLO 12 Preparation of corrosive medium for Aluminium at different temperature	Preparation of corrosive medium for Aluminium at different temperatures	2	CO3

#### VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

- Types of bonds: Prepare a chart and models displaying different types of bonds with examples.
- Metals and Alloys: Prepare a chart showing the Composition, properties application of Ferrous Alloys.
- Insulating materials: Prepare a chart including different synthetic Plastic and Rubber and list their uses.
- Lubricants: Prepare a chart including the Selection of lubricants for different machines.
- Water: Collect and analyse different water samples from different sources.
- Corrosion: Prepare a Chart displaying images of observed corrosion processes in the surrounding
- Materials: Collect information by library survey regarding engineering materials used in various industries.
- Engineering material: Collect information by library survey regarding engineering materials used in various industries.
- Fuels: Prepare a chart of Fractions obtained by distillation of crude oil.

**Assignment:**

- Explain covalent bonds and ionic bonds with examples
- Distinguish between paints and varnishes.
- Write the electronic configuration of atoms
- Write the formation of compounds NaCl, AlCl<sub>3</sub>, H<sub>2</sub>O, CO<sub>2</sub>, N<sub>2</sub>
- Compare Thermoplastics and Thermosetting
- State properties and applications thermocol and glass wool
- Explain types of alloys with examples.
- Demonstrate the Mechanism of the Hydrogen Evolution process.
- Write properties and applications of solid, semisolid and liquid lubricant.
- Write properties and applications of solid, liquid and gaseous fuels.

**VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Digital Hot Air Oven GR Lab temperature ranges from 100 to 250 <sup>0</sup> c	10,11
2.	Electronic balance with the scale range of 0.001 gm to 500 gm	All

**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)**

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Atomic structure	CO 1	05	02	08	00	10
2	II	Metals and alloys	CO 2	08	02	04	06	12
3	III	Corrosion	CO 3	08	02	04	06	12
4	IV	Water	CO 4	08	02	04	06	12
5	V	Lubricants & Fuels	CO 5	08	04	02	06	12
6	VI	Materials	CO 6	08	02	04	06	12
<b>Grand Total</b>				<b>45</b>	<b>14</b>	<b>26</b>	<b>30</b>	<b>70</b>

**IX. ASSESSMENT METHODOLOGIES/TOOLS**

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Rubrics for COs 3. Assignment 4. Midterm Exam 5. Self-Learning 6. Term Work 7. Seminar/Presentation	1. End Term Exam 2. Micro-project

## X. SUGGESTED COs- POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	-	-	2	-	1			
CO2	3	2	-	-	2	1	1			
CO3	3	-	-	2	-	-	1			
CO4	3	2	-	2	2	1	1			
CO5	3	2	-	2	1	1	1			
CO6	3	2	-	3	1	1	-			

**Legends:- High:03, Medium:02, Low:01, NoMapping: -**

\*PSOs are to be formulated at the institute level

## XI.SUGGESTED LEARNING MATERIALS/BOOKS

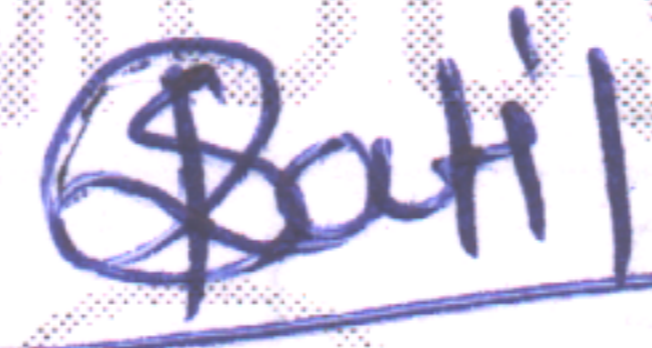
Sl. No.	Author	Title	Publisher
1	Dara S.S. Umare S.S.	Engineering Chemistry	S. Chand and Co publication, New Delhi, 201, ISBN: 8121997658
2	Jain and Jain	Engineering Chemistry	Dhanpat Rai and Sons, New Delhi, 2015, ISBN: 9352160002
3	Vairam. S	Engineering Chemistry	Wiley Indian Pvt. Ltd, New Delhi, 2013 ISBN: 9788126543342
4	Agnihotri, Rajesh	Chemistry for Engineers	Wiley Indian Ptd.Ltd, New Delhi, 2014, ISBN: 9788126550784
5	Agrawal Shikha	Engineering Chemistry	Cambridge University Press, New Delhi, 2015 ISBN: 97811074764
6	George E.Totten, R J Shah SR Westbrook	Fuels and Lubricants Handbook	Published by ASTM with a product code of B-ASTM-002 ISBN of 978-0-8031-4551-1, and 1086 pages.

## XIII. LEARNING WEBSITES &amp; PORTALS

Sr.No	Link/Portal	Description
1.	<a href="http://www.chemistryteaching.com">www.chemistryteaching.com</a>	Physical, inorganic and organic chemistry.
2.	<a href="http://www.chemcollective.org">www.chemcollective.org</a>	Virtual Labs, simulation
3.	<a href="http://www.chem1.com">www.chem1.com</a>	Chemistry instruction and education
4.	<a href="http://www.onlinelibrary.wiley.com">www.onlinelibrary.wiley.com</a>	Materials and corrosion
5.	<a href="http://www.rsc.org">www.rsc.org</a>	Catalysis

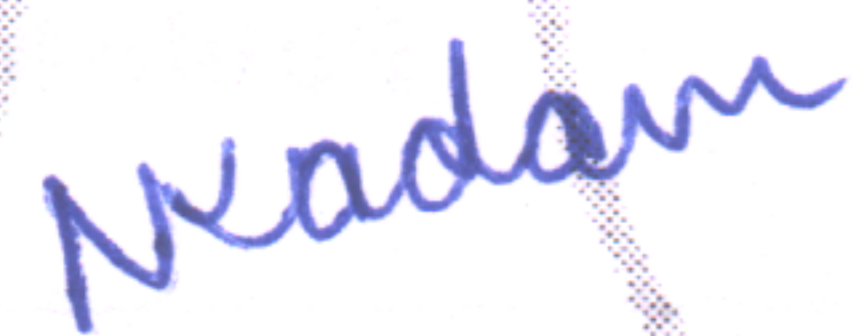
Sr.N o	Link/Portal	Description
6	<a href="http://www.chemcollective.org">www.chemcollective.org</a>	Collection of virtual labs, scenario-based learning activities
7	<a href="http://www.wqa.org">www.wqa.org</a>	Water Quality.
8	<a href="https://www.ancient-origins.net/history-famous-people/indian-sage-acharya-kanad-001399">https://www.ancient-origins.net/history-famous-people/indian-sage-acharya-kanad-001399</a>	IKS Philosophy of atom by Acharya Kanad.

Name &amp; Signature:



**Smt. Rupali S. Patil**  
Lecturer in Chemistry  
(Course Experts)

Name &amp; Signature:



**Mrs. N.S. Kadam**  
(Programme Head)

Name &amp; Signature:



**Shri. S.B. Kulkarni**  
(CDC In-charge)

**GOVERNMENT POLYTECHNIC, PUNE**  
**'120 – NEP' SCHEME**

<b>PROGRAMME</b>	<b>DIPLOMA IN CE/EE/ET/ME/MT</b>
<b>PROGRAMME CODE</b>	<b>01/02/03/04/05</b>
<b>COURSE TITLE</b>	<b>BASIC MATHEMATICS</b>
<b>COURSE CODE</b>	<b>SC11205</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>NA</b>

**I. LEARNING & ASSESSMENT SCHEME**

Course Code	Course Title	Course Type	Learning Scheme						Credits	Paper Duration	Assessment Scheme								Total Marks	
			Actual Contact Hrs./Week			SL	LH	NLH			Theory			Based on LL & TSL		Based on SL				
			CL	TL	LL						FA-TH	SA-TH	Total	Practical		SLA				
						Max	Min	Max						Min	Max	Min				
SC11205	BASIC MATHEMATICS	AEC	4	2	-	-	6	3	3	30	70	100	40	-	-	-	-	-	-	100

**Total IKS Hrs for Term:** 6 Hrs

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, #- External Assessment, \*# - Online Examination, @\$ - Internal Online Examination

**Note:**

**FA-TH** represents an average of two class tests of 30 marks each conducted during the semester.

- If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
- If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit SLA work.
- Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. \* 15 Weeks**
- 1 credit** is equivalent to **30 Notional hours**.
- \* Self-learning hours shall not be reflected in the Timetable.
- \*Self-learning includes micro-projects/assignments/other activities.

**II. RATIONALE:**

Basic Mathematics plays a crucial role in diploma Programmes as it fosters the development of critical thinking skills, enhances quantitative literacy, prepares students for higher education, promotes problem-solving abilities, cultivates logical and abstract thinking, and fosters mathematical literacy. By engaging with Mathematics, students acquire logical reasoning, problem-solving techniques, and analytical thinking, which are valuable for lifelong learning and professional growth.

Calculus is a branch of Mathematics that calculates how matter, particles, and heavenly bodies move. Derivatives are useful for finding maxima and minima of the function; velocity and acceleration are also useful for many engineering optimization problems. Statistics can be defined as a type of mathematical analysis which involves the method of collecting and analyzing data and then summing up the data into a numerical form for a given set of factual data or real-world observations. It equips individuals with the ability to interpret numerical information, make informed decisions, and navigate real-world situations. Moreover, Mathematics provides a foundation for further studies in various disciplines and prepares students to tackle complex challenges.

By exploring abstract concepts and logical structures, students develop their ability to reason; make connections, and approach problems with clarity and precision. Furthermore, studying Mathematics helps students appreciate the historical and cultural significance of Mathematics and its applications in diverse fields, thereby fostering mathematical literacy and a deeper understanding of the world. Hence the course provides the insight to analyze engineering problems scientifically using logarithms, matrices, trigonometry, straight line, differential calculus, and statistics.

By incorporating these topics, students comprehend to approach engineering problems from a mathematical perspective, enabling them to devise efficient and effective solutions, and this leads to preparing Diploma graduates well-rounded, adaptable, and capable of making significant contributions to the branch-specific problems.

### III. COURSE-LEVEL LEARNING OUTCOMES(CO'S)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1 - Apply the concepts of algebra to solve engineering (discipline) related problems.

CO2 - Utilize trigonometry to solve programme-specific engineering problems.

CO3 - Solve programme-specific engineering problems under given conditions of straight lines.

CO4 - Apply differential calculus to solve programme-specific problems.

CO5 - Use techniques and methods of statistics to crack programme-specific problems.

### IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I ALGEBRA (CL Hrs-12, Marks-14)</b>				
1.	TLO 1.1 Solve the given simple problem based on laws of logarithm. TLO 1.2 Solve the given system of linear equations using the matrix inversion method. TLO 1.3 Obtain the proper and improper partial fraction for the given simple rational function. TLO 1.4 Solve simultaneous equations by using concepts given in Ancient Indian Mathematics.	1.1 Logarithm: Concept and laws of logarithm. 1.2 Matrices: Matrices, algebra of matrices, transpose, value of determinant of matrix of order 3x3, adjoint and inverse of matrices. 1.3 Matrices: Solution of simultaneous equations by matrix inversion method. 1.4 Partial Fractions: Types of partial fractions based on the nature of factors and related Problems. 1.5 Algebra in Indian Knowledge System: Solution of simultaneous equations.	Improved Lecture Tutorial Assignment Demonstration Simulation	CO1

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-II TRIGONOMETRY (CL Hrs-16, Marks-14)</b>				
2	<p>TLO 2.1: Apply the concept of Compound angle, allied angle, and multiple angles to solve the given simple engineering problem(s).</p> <p>TLO 2.2: Apply the concept of Sub-multiple angle to solve the given simple engineering-related problem(s).</p> <p>TLO 2.3: Apply the concept of factorization and de-factorization formulae to solve the given simple engineering problem(s).</p> <p>TLO 2.4: Investigate given simple problems by utilizing inverse trigonometric ratios.</p> <p>TLO 2.5: Use concepts given in Ancient Indian Mathematics for trigonometry to solve given problems.</p>	<p>2.1 Trigonometric ratios of allied angles, compound angles, multiple angles (2A, 3A), and submultiples angles (without proof).</p> <p>2.2 Factorization and De factorization formulae (without proof).</p> <p>2.3 Inverse Trigonometric Ratios and related problems.</p> <p>2.4 Principal values and the relation between trigonometric and inverse trigonometric ratios.</p> <p>2.5 Trigonometry in Indian Knowledge System: The Evolution of Sine Function in India.</p> <p>2.6 Indian Trigonometry: Basic Indian Trigonometry - Introduction and Terminology (From Ancient Beginnings to Nilakantha).</p> <p>2.7 Trigonometry in Indian Knowledge System: Pythagorean triples in Sulabasutras.</p>	<p>Improved Lecture Tutorial Assignment Demonstration Simulation</p>	<b>CO2</b>
<b>UNIT-III STRAIGHT LINE (CL Hrs-06, Marks-08)</b>				
3	<p>TLO 3.1 Calculate the angle between given two straight lines.</p> <p>TLO 3.2 Formulate equation of straight lines related to given engineering problems.</p> <p>TLO 3.3 Identify the perpendicular distance from the given point to the line.</p> <p>TLO 3.4 Calculate the perpendicular distance between the given two parallel lines.</p> <p>TLO 3.5 Use geometry given in Sulabasutras to solve the given problems.</p>	<p>3.1 Straight line and slope of a straight line:</p> <ol style="list-style-type: none"> <li>a. The angle between two lines</li> <li>b. Condition of parallel and perpendicular lines</li> </ol> <p>3.2 Various forms of straight lines:</p> <ol style="list-style-type: none"> <li>a. General form</li> <li>b. Slope-point form</li> <li>c. Slope-intercept form</li> <li>d. Two-point form</li> <li>e. Double intercept form</li> </ol> <p>3.3 Perpendicular distance from a point on the line</p> <p>3.4 Perpendicular distance between two parallel lines</p> <p>3.5 Geometry in Sulabasutras in Indian Knowledge System:</p> <ol style="list-style-type: none"> <li>a. Construction of square</li> <li>b. Circling the square</li> </ol>	<p>Improved Lecture Tutorial Assignment Demonstration Simulation</p>	<b>CO3</b>

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT- IV DIFFERENTIAL CALCULUS (CL Hrs-16, Marks-20)</b>				
<b>4</b>	<p>TLO 4.1: Solve the given simple problems based on functions.</p> <p>TLO 4.2: Solve the given simple problems based on rules of differentiation.</p> <p>TLO 4.3: Obtain the derivatives of composite, implicit, parametric, inverse, logarithmic, and exponential functions.</p> <p>TLO 4.4: Apply the concept of differentiation to find the given equation of tangent and normal.</p> <p>TLO 4.5: Apply the concept of differentiation to calculate maxima, minima, and radius of curvature for a given function.</p> <p>TLO 4.6: Familiar with the concept of calculus given in Indian Mathematics.</p>	<p>4.1 Functions and Limits: Concept of function and simple examples.</p> <p>4.2 Functions and Limits: Concept of limits without examples.</p> <p>4.3 Derivatives: Rules of derivatives such as sum, product, and quotient of functions.</p> <p>4.4 Derivatives: Derivative of composite functions (chain rule), implicit and parametric functions.</p> <p>4.5 Derivatives: Derivatives of inverse, logarithmic, and exponential functions.</p> <p>4.6 Applications of derivative: Second-order derivative without examples, equation of tangent and normal, maxima and minima, radius of curvature.</p> <p>4.7 Calculus in Indian Knowledge System: The Discovery of Calculus by Indian Astronomers.</p>	<p>Improved Lecture Tutorial Assignment Demonstration Simulation</p>	<b>CO4</b>
<b>UNIT –V STATISTICS (CL Hrs-10, Marks-14)</b>				
<b>5</b>	<p>TLO 5.1: Obtain the range and coefficient of range of the given grouped and ungrouped data.</p> <p>TLO 5.2: Calculate the mean and standard deviation of ungrouped and grouped data related to the given simple engineering problem(s).</p> <p>TLO 5.3: Determine the variance and coefficient of variance of given grouped and ungrouped data.</p> <p>TLO 5.4: Justify the consistency of given simple sets of data.</p>	<p>5.1 Range, coefficient of range of discrete and grouped data.</p> <p>5.2 Mean deviation and standard deviation from the mean of grouped and ungrouped data.</p> <p>5.3 Variance and coefficient of variance.</p> <p>5.4 Comparison of two sets of observation.</p>	<p>Improved Lecture Tutorial Assignment Demonstration Simulation</p>	<b>CO5</b>



## V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1: Solve simple problems of Logarithms based on given applications.	Logarithm and applications.	2	CO1
2	LLO 2.1: Solve elementary problems on Algebra of matrices for branch-specific engineering-related applications.	Algebra of matrices	2	CO1
3	LLO 3.1: Apply the concept of matrix to solve engineering problems.	Simultaneous Equations using the inversion method.	2	CO1
4	LLO 4.1: Apply the concept of matrix to solve engineering problems.	Matrix Inversion method to determine currents.	2	CO1
5	LLO 5.1: Apply the concept of matrix to solve engineering problems.	Inverse of a non-singular matrix.	2	CO1
6	LLO 6.1: Apply the concept of partial fractions to solve engineering problems.	Partial fractions.	2	CO1
7	LLO 7.1: Solve problems on Compound, Allied, multiple and sub-multiple angles for related shapes.	Compound, Allied, multiple, and sub-multiple angles.	2	CO2
8	LLO 8.1: Utilize the concept of trigonometry to solve engineering problems.	Factorization and de-factorization formulae.	2	CO2
9	LLO 9.1: Utilize the concept of trigonometry to solve engineering problems.	Inverse trigonometric ratios.	2	CO2
10	LLO 10.1: Solve branch-specific engineering problems under given conditions of straight lines.	Equation of straight lines using different forms.	2	CO3
11	LLO 11.1: Solve branch-specific engineering problems under given conditions of straight lines.	Perpendicular distance, distance between two parallel lines, and angle between two lines.	2	CO3
12	LLO 12.1: Solve branch-specific engineering problems under given conditions of straight lines.	Use of a straight line to calculate the speed, distance, and time of a moving object.	2	CO3
13	LLO 13.1: Apply the concept of derivative to solve engineering problems.	Derivatives of implicit functions and parametric functions.	2	CO4
14	LLO 14.1 - Apply the concept of derivatives to solve engineering problems.	Derivative of logarithmic and exponential functions.	2	CO4
15	LLO 15.1 - Apply the concept of the equation of tangent and normal to solve engineering problems.	Equation of tangent and normal.	2	CO4

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
16	LLO 16.1 - Apply the concept of maxima, minima, and radius of curvature to solve engineering problems.	Maxima, minima of function and radius of curvature.	2	CO4
17	LLO 17.1 - Apply the concept of the equation of tangent and normal to solve engineering problems.	Concept of tangent and normal to solve the given problems of Engineering Drawing.	2	CO4
18	LLO 18.1 - Apply the concept of maxima and minima to solve engineering problems.	Maxima and Minima to obtain optimum value.	2	CO4
19	LLO 19.1 - Apply the concept of the radius of curvature to solve engineering problems.	Radius of curvature.	2	CO4
20	LLO 20.1 - Utilize the concept of derivatives to solve engineering problems.	Use of derivative to find the slope of a bending curve.	2	CO4
21	LLO 21.1 - Use the concept of range and mean deviation to crack branch-specific problems.	Range, coefficient of range and mean deviation.	2	CO5
22	LLO 22.1 - Use the concept of standard deviation and coefficient of variance to crack branch-specific problems.	Standard deviation, coefficient of variation and comparison of two sets.	2	CO5
23	LLO 23.1 - Use the concept of standard deviation to crack branch-specific problems.	Standard Deviation for Concrete with the given data.	2	CO5
Note: 1.Take any15 tutorials out of 23 and ensure that all the units are covered. 2.Take the tutorial in a batch size of 20 to 30 students. 3.Give students at least 10 problems to solve in each tutorial.				

#### VI. SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

##### Micro-project

NA

##### Assignment

NA

#### VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	EquipmentNamewithBroadSpecifications	Relevant LLO Number
1	Open-source software like SageMaths, MATHS3D, GeoGebra, Graph, DPLOT and Graphing Calculator (GraphEq2.13), ORANGE can be used for Algebra, Calculus, Trigonometry and Statistics respectively.	All

### VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Algebra	CO1	12	2	6	6	14
2	II	Trigonometry	CO2	16	2	6	6	14
3	III	StraightLine	CO3	6	2	2	4	8
4	IV	DifferentialCalculus	CO4	16	2	8	10	20
5	V	Statistics	CO5	10	2	6	6	14
<b>Grand Total</b>				<b>60</b>	<b>10</b>	<b>28</b>	<b>32</b>	<b>70</b>

### IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests	1. End Term Exam

### X. SUGGESTED COS- POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes*(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	-	1	-	1	1			
CO2	3	1	-	-	1	1	1			
CO3	3	-	-	-	-	-	-			
CO4	3	1	1	1	-	1	-			
CO5	3	2	1	1	1	1	1			

**Legends:-High:03, Medium:02, Low:01, No Mapping:-**  
\*PSOs are to be formulated at the institute level.



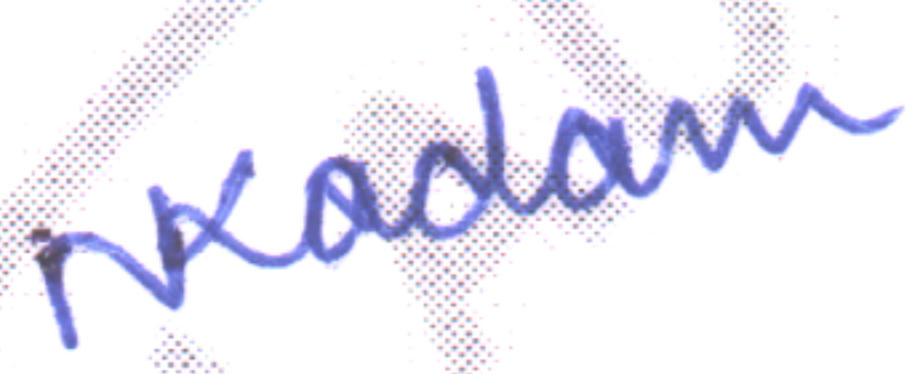

### XI. SUGGESTED LEARNING MATERIALS/BOOKS

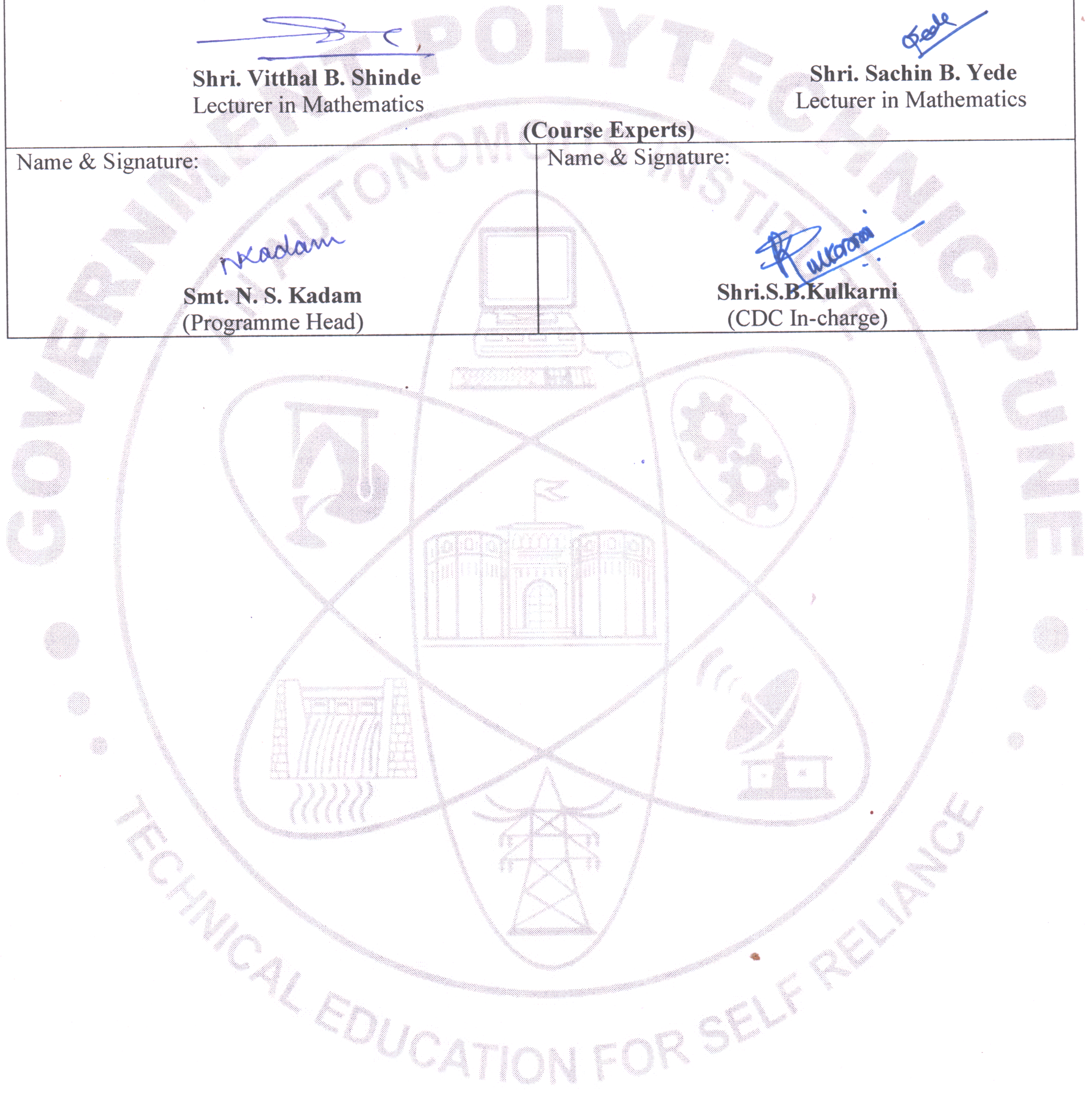
Sr. No	Author	Title	Publisher
1	Grewal B.S.	Higher Engineering Mathematics	Khanna publication New Delhi, 2013 ISBN: 8174091955
2	Dutta D.	A textbook of Engineering Mathematics	New Age publication New Delhi, 2006 ISBN: 978-81-224-1689-3
3	Kreyszig, Ervin	Advance Engineering Mathematics	Wiley publication New Delhi 2016 ISBN: 978-81-265-5423-2
4	Das H. K.	Advance Engineering Mathematics	S Chand publication New Delhi 2008 ISBN: 9788121903455
5	Marvin L. Bittinger David J. Ellenbogen Scott A. Sargent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1

Sr. No	Author	Title	Publisher
6	C. S. Seshadri	Studies in the History of Indian Mathematics	Hindustan Book Agency, New Delhi 110016. ISBN978-93-80250-06-9
7	George Gheverghese Joseph	Indian Mathematics Engaging with the World from Ancient to Modern Times	World Scientific Publishing Europe Ltd. 57 ISBN 978-17-86340-61-0
8	Deepak Singh	Mathematics-I	Khanna Book Publishing Co.(P) Ltd. ISBN: 978-93-91505-42-4
9	Garima Singh	Mathematics-II	Khanna Book Publishing Co.(P) Ltd. ISBN: 978-93-91505-52-3
10	Gareth James, Daniela Witten, Trevor Hastie Robert and Tibshirani	An Introduction to Statistical Learning with Applications in R	Springer New York Heidelberg Dordrecht London ISBN 978-1-4614-7137-0 ISBN978-1-4614-7138-7 (eBook)
11	Gunakar Muley	Sansar Ke Mahan Ganitagya	First Edition, Rajkamal Prakashan, ISBN-10. 8126703571, ISBN-13.978-8126703579
12	T. S. Bhanumurthy	A Modern Introduction to Ancient Indian Mathematics	New Age International Private Limited, 1 January 2008 ISBN-10.812242600X, ISBN-13.978-8122426007
13	M. P. Trivedi and P. Y. Trivedi	Consider Dimension and Replace Pi	Notion Press; 1st edition (2018), ISBN-978-1644291795

### XIII. LEARNING WEBSITES & PORTALS

Sr. No	Link/Portal	Description
1.	<a href="http://nptel.ac.in/courses/106102064/1">http://nptel.ac.in/courses/106102064/1</a>	Online Learning Initiatives by IITs and IISc
2.	<a href="http://www.scilab.org/-SCILab">www.scilab.org/-SCILab</a>	Signal processing, statistical analysis and image enhancement.
3.	<a href="http://www.mathworks.com/product/matlab/-MATLAB">www.mathworks.com/product/matlab/-MATLAB</a>	Applications of concepts of Mathematics to coding.
4.	Spreadsheet Applications	Use of Microsoft Excel, Apple Numbers and Google Sheets.
5.	<a href="https://ocw.mit.edu/">https://ocw.mit.edu/</a>	MIT Courseware
6.	<a href="https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig">https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig</a>	Concept of Mathematics through video lectures and notes
7.	<a href="http://ocw.abu.edu.ng/courses/mathematics/">http://ocw.abu.edu.ng/courses/mathematics/</a>	List of Mathematical Courses.
8.	<a href="https://libguides.furman.edu/oer/subject/mathematics">https://libguides.furman.edu/oer/subject/mathematics</a>	Open Education Resources (OER) in Mathematics.
9.	<a href="https://phet.colorado.edu/en/simulations/filter?subjects=math&amp;type=html,prototype">https://phet.colorado.edu/en/simulations/filter?subjects=math&amp;type=html,prototype</a>	Phet Simulation for Mathematics.
10.	<a href="https://libguides.cmich.edu/OER/mathematics">https://libguides.cmich.edu/OER/mathematics</a>	Mathematics with OER.

Name & Signature:	
 <b>Shri. Vitthal B. Shinde</b> Lecturer in Mathematics	 <b>Shri. Sachin B. Yede</b> Lecturer in Mathematics
<b>(Course Experts)</b>	
Name & Signature:	Name & Signature:
 <b>Smt. N. S. Kadam</b> (Programme Head)	 <b>Shri.S.B.Kulkarni</b> (CDC In-charge)



**GOVERNMENT POLYTECHNIC, PUNE**  
**'120 – NEP' SCHEME**

<b>PROGRAMME</b>	<b>DIPLOMA IN ME/MT</b>
<b>PROGRAMME CODE</b>	<b>04/05</b>
<b>COURSE TITLE</b>	<b>ENGINEERING WORKSHOP PRACTICE(ME/MT)</b>
<b>COURSE CODE</b>	<b>WS11204</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>NA</b>

**I. LEARNING & ASSESSMENT SCHEME**

Course Code	Course Title	Course Type	Learning Scheme						Credits	Paper Duration	Assessment Scheme									
			Actual Contact Hrs./Week			SLH	NLH	Theory			Based on LL & TSL				Based on SL		Total Marks			
			CL	TL	LL						Practical		SLA							
											FA-TH	SA-TH	Total	FA-PR	SA-PR	SLA				
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min											
WS11204	ENGINEERING WORKSHOP PRACTICE(ME/MT)	SEC	-	-	4	-	4	2	-	-	-	-	50	20	50@	20	-	-	100	

**Total IKS Hrs for Term: 0 Hrs**

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, #- External Assessment, \*# - Online Examination, @\$ - Internal Online Examination

**Note:**

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in FA-PR (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are (CL + LL + TL + SL) hrs. \* 15 Weeks
4. **1 credit** is equivalent to **30 Notional hours**.
5. \* Self-learning hours shall not be reflected in the Timetable.
- 6.\* Self-learning includes micro-projects/assignments/other activities.

**II. RATIONALE:**

Workshop Practice is a basic engineering course. The knowledge of basic shops like woodworking, fitting, welding, plumbing and sheet metal shops is essential for a technician to perform his/her duties in industries. Students can perform various operations using hand tool equipment and machinery in various shops. Working in a workshop develops the attitude of group working and safety awareness. This course provides an industrial environment in the educational institute.

**III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)**

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

- CO1: Use firefighting tools and equipment.  
 CO2: Prepare the job using different tools in the fitting shop.  
 CO3: Perform various operations using plumbing and carpentry tools  
 CO4: Prepare various welding joints.  
 CO5: Produce simple jobs using different sheet metal operations

## IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I SAFETY PRACTICES &amp; PRECAUTIONS (CL Hrs-Nil, Marks-Nil)</b>				
1.	<p><b>TLO 1.1:</b> Explain the safety practices &amp; precautions while operating firefighting equipment.</p> <p><b>TLO 1.2:</b> Explain the procedure for using the given type of fire extinguisher.</p> <p><b>TLO 1.3:</b> Justify the given type of firefighting equipment for the given situation.</p> <p><b>TLO 1.4:</b> Prepare a list of equipment used for safety in workshop operations.</p> <p><b>TLO 1.5:</b> Maintain good housekeeping in the working area</p> <p><b>TLO 1.6:</b> Prepare a layout of the workshop.</p>	<p><b>1.1.</b> Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols, and Safety Precautions.</p> <p><b>1.2.</b> First Aid box and its constituent materials.</p> <p><b>1.3.</b> Fire, Causes of Fire, Basic ways of extinguishing the fire. Classification of fire, Firefighting equipment, and fire extinguishers (Class A, B, C, D). ( As per NBC 2016).</p> <p><b>1.4.</b> Workshop Layout: Issue and return system of tools, equipment and consumables.</p>	<p>Demonstrate Show first aid box Hands-on practice Video Demonstrations</p>	CO1
<b>UNIT-II FITTING (CL Hrs-Nil, Marks-Nil)</b>				
2	<p>TLO 2.1 Identify fitting tools</p> <p>TLO 2.2 Explain the operation of fitting shop machines</p> <p>TLO 2.3 Use fitting tools</p> <p>TLO 2.4 Operate Machineries.</p> <p>TLO 2.5 Perform fitting operations</p> <p>TLO 2.6 Maintain tools, equipment and types of machinery.</p>	<p>2.1 Fitting hand tools bench vice, hammers, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set and their Specifications</p> <p>2.2 Operation of fitting shops machinery - Drilling machine, Power saw, grinder their specifications and maintenance.</p> <p>2.3 Basic process chipping, filing, scraping, grinding, marking, sawing, drilling, tapping, Dieing reaming etc.</p>	<p>Model Demonstration</p>	CO2

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-III PLUMBING (CL Hrs-Nil, Marks-Nil)</b>				
3	<p>TLO 3.1 Identify plumbing tools.</p> <p>TLO 3.2 Explain the operation of fitting shop machines.</p> <p>TLO 3.3 Use plumbing tools</p> <p>TLO 3.4 Operate machineries.</p> <p>TLO 3.5 Perform plumbing operations</p> <p>TLO 3.6 Maintain tools, equipment and types of machinery.</p>	<p>3.1 Plumbing hand tools pipe vice, pipe bending equipment, pipe wrenches, dies and their Specifications.</p> <p>3.2 Pipe fittings- bends, elbows, tees, cross, coupler, socket, reducer, cap, plug, nipple and their Specifications.</p> <p>3.3 Operation of types of Machinery in plumbing shops- pipe bending machines their specifications and maintenance. Basic process cutting, threading.</p>	Model Demonstration	CO3
<b>UNIT- IV METAL JOINING (CL Hrs-Nil, Marks-Nil)</b>				
4	<p>TLO 4.1 Identify metal joining tools.</p> <p>TLO 4.2 Explain the gas and arc welding procedure</p> <p>TLO 4.3 Use metal joining tools.</p> <p>TLO 4.4 Perform welding, soldering, and brazing operations</p> <p>TLO 4.5 Maintain tools, equipment and types of machinery.</p>	<p>4.1 Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush and their Specifications</p> <p>4.2 Operation of types of machinery in welding shops- arc welding transformer their specifications and maintenance. Welding Electrode, filler rod, fluxes, and solders.</p>	Video Demonstrations Demonstration	CO3
<b>UNIT –V CARPENTRY (CL Hrs-Nil, Marks-Nil)</b>				
5	<p>TLO 5.1 Select woodworking tools per job requirement.</p> <p>TLO 5.2 Explain the operation of woodworking machines</p> <p>TLO 5.3 Use furniture-making tools</p> <p>TLO 5.4 Operate machineries.</p> <p>TLO 5.5 Perform woodworking operations</p> <p>TLO5.6 Maintain tools, equipment and types of machinery.</p>	<p>5.1 Types of artificial woods such as plywood, blockboard, hardboard, laminated boards, Veneer, and fiber Boards and their applications.</p> <p>5.2 Woodworking hand tools carpentry vice, marking and measuring tools, saws, claw hammer, mallet, chisels, plans, squares, and their specifications</p> <p>5.3 Operation of woodworking types of machinery - Wood turning lathe, circular saw, their specifications and maintenance.</p> <p>5.4 Basic process- marking, sawing, planning, chiselling, turning, grooving, boring.</p>	Demonstration	CO4



UNIT –VI SHEET METAL (CL Hrs-Nil, Marks-Nil)				
6	TLO 6.1 Identify sheet metal tools.	6.1 Sheet metal hand tools snip, shears sheet gauge, straight edge, L square, scribe, divider, trammel, punches, pliers, stakes, groovers, limit set and their Specifications	Demonstration	CO6
	TLO 6.2 Explain the operation of sheet metal types of machinery.	6.2 Operation of types of machinery in sheet metal shops- sheet cutting and bending machine and its specifications and maintenance.		
	TLO 6.3 Use sheet metal tools	6.3 Basic process- marking, bending, folding, edging, seaming, staking, riveting.		
	TLO6.4 Operate sheet metal types of machinery.			
	TLO 6.5 Perform bending operations Maintain tools, equipment and types of machinery.			

#### V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Use a fire extinguisher	Identify fire extinguishers according to their specification	2	CO1
2	LLO 2.1 Operate fire extinguisher	Perform mock drill sessions in groups of a minimum of 10 students for extinguishing fire.	2	CO1
3	LLO 3.1 Identify different tools used in the workshop.	Identify different tools used in the workshop.	2	CO1 CO2 CO3 CO4 CO5
4	LLO 4.1 Select proper fitting tools LLO 4.2 Prepare fitting job using different tools.	Prepare the job using the following operations:part1 a. Marking operation as per drawing b. punching operation as per drawing c. Filing operation as per drawing d. sawing operation as per drawing e. drilling operation as per drawing f. tapping operation as per drawing	6	CO2
5	LLO 5.1 Select proper plumbing tools LLO 5.2 Use plumbing operations for preparing plumbing joints	Prepare T joint pipe fitting job as per the given drawing (individually)	4	CO3
6	LLO 6.1 Select proper plumbing tools LLO 6.2 Use plumbing operations for preparing plumbing joints	Prepare elbow joint pipe fitting job as per the given drawing(individually)	4	CO3
7	LLO 7.1 Develop a list of different components as per the specification	Prepare bill of material for given pipeline layout (individually)	2	CO3

8	LLO 8.1 Obey safety rules employed in the welding shop.	Practice different safety rules in the welding shop as per the given instructions.	2	CO4
9	LLO 9.1 Prepare various welded joints using different welding processes.	Prepare lap joint using arc welding as per the given drawing (individually)	4	CO4
10	LLO 10.1 Prepare various welded joints using different welding processes.	Prepare butt joint using arc welding as per the given drawing (individually)	4	CO4-
11	LLO 11.1 Assemble utility jobs using different manufacturing processes.	Prepare utility jobs (like stools, benches, tables or similar jobs) involving arc welding and artificial wood as per the given drawing (in a group of 4 to 5 students) Fabrication operation involves measuring, marking, cutting, edge preparation, welding	8	CO3 CO4
12	LLO 12.1 Select proper sheet metal tools LLO 12.2 Prepare sheet metal components using different operations.	Prepare sheet metal utility job using following operations a. Cutting And Bending b. Edging c. End curling d. Lancing e. Soldering f. Riveting	6	CO5
13	LLO 13.1 Collect information about ancient tools for understanding Indian Knowledge.	Draw sketches of various ancient tools	2	CO1 CO2 CO3 CO4 CO5

#### VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

NOT APPLICABLE

#### VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Fire buckets of standard size.	1,2
2	Fire extinguisher A, B and C types	1,2
3	Wood Turning Lathe Machine, Height of Centre: 200mm, Distance between Centers: 1200mm, Spindle Bore: 20mm with Taper, Range of Speeds: 425 to 2800 with suitable Motor Drive. with all accessories	11
4	Circular Saw Machine, Diameter of saw blade 200 mm, Maximum Depth of Cut 50 mm, Table Size -350 x 450 mm, Table Tilting – 450	11
5	Woodworking tools- marking and measuring tools, saws, claw hammers, mallets, chisels, plans, squares	11

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
6	Carpentry Vice 200 mm	11
7	Work Benches- size:1800 x 900 x 750 mm	4
8	Bench Drilling machine (up to 13 mm drill cap) with ½ H.P. Motor, 1000 mm height.	4
9	Power Saw machine 350 mm mechanical with 1 HP Motor & all Accessories.	4
10	Bench Grinder 200 mm Grinding Disc diameter 200 mm. with 25 mm. bore 32 mm. with ½ HP/1HP Motor.	4
11	Vernier height Gauge 450 mm	4,5,6,8
12	Surface Plate 600 x 900 mm Grade I	4,5
13	Angle Plate 450 x 450 mm	4,5
14	Welding machine 20 KVA 400A welding current 300A at 50, 100, 200, 250, 300 with std. Accessories and Welding Cable 400 amp. ISI with holder	8,9,10,11
15	Oxygen and acetylene gas welding and cutting kit with cylinders and regulators.	8,9,10,11
16	Pipe Bending Machine	5,6
17	Pipe Vice – 100 mm	5,6
18	Pipe Cutter- 50 mm	5,6
19	Bench Vice 100 mm	5,6
20	Portable Hammer Drill Machine 0-13 mm A.C. 230 V, 2.5Amp, Pistol type, having different types of bits	4
21	Sheet Bending Machine	12
22	Sheet Cutting Machine	12
23	Brazing Equipment	12
24	Fitting tools - hammers, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set.	3,4
25	Plumbing tools- pipe vice, pipe bending equipment, pipe wrenches, dies.	3,5,6
26	Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush.	8,9,10,11
27	Sheet metal hand tools- snip, shears sheet gauge, straight edge, L square, scribe, divider, trammel, punches, pliers, stakes, groovers, limit set	12

### VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

NOT APPLICABLE

### IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Assignment and Terms work	Lab performance

### X. SUGGESTED COs- POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	-	2	3	3	1			
CO2	3	-	-	3	2	3	-			
CO3	3	-	-	3	2	3	1			
CO4	3	-	-	3	2	3	1			
CO5	3	-	-	3	2	3	1			

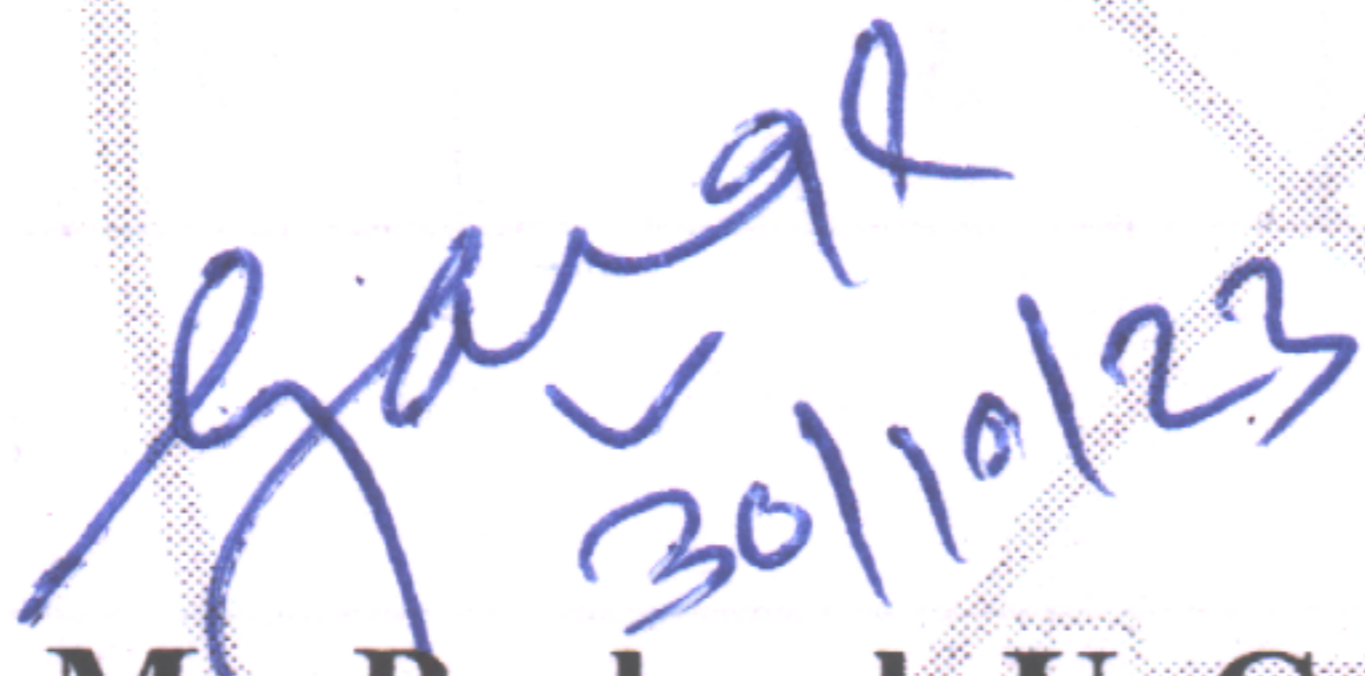
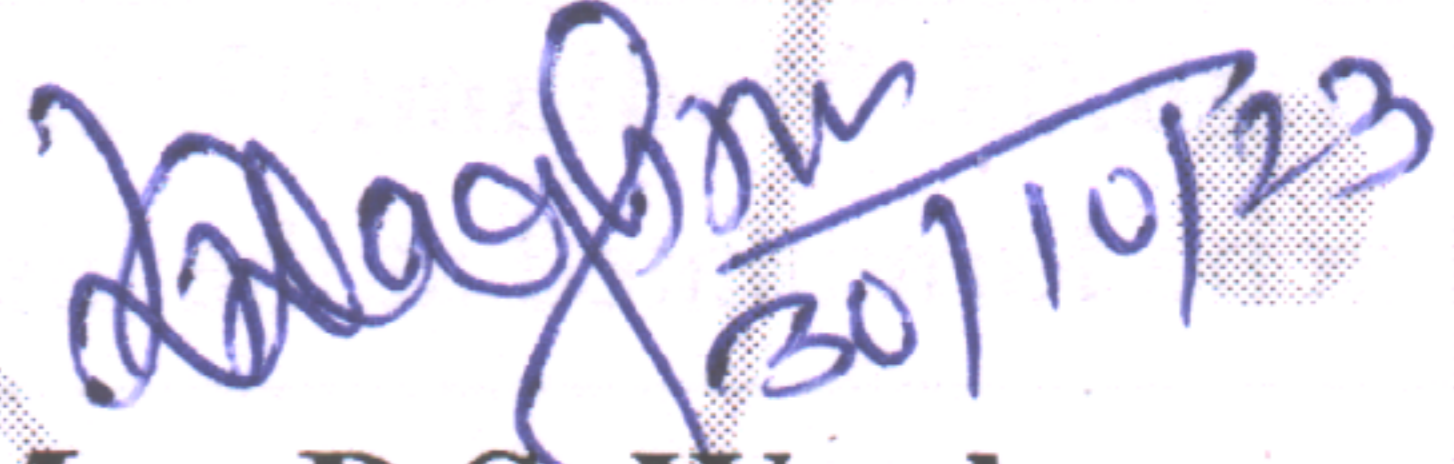
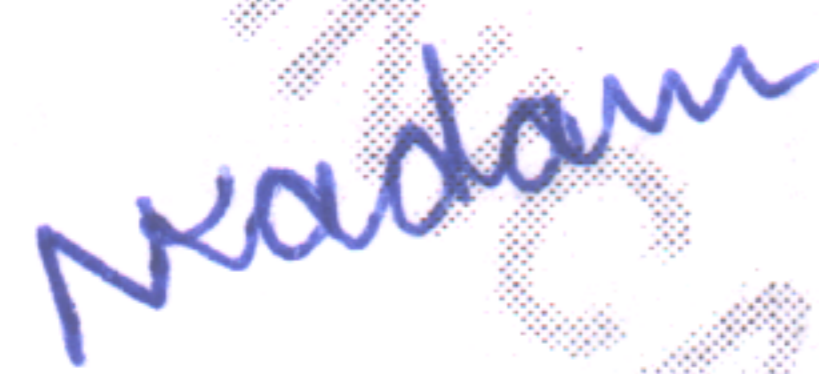

**Legends:- High:03, Medium:02, Low:01, No Mapping: -**  
\*PSOs are to be formulated at the institute level

### XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No	Author	Title	Publisher
1	Bawa, H.S.	Workshop Practice	McGraw Hill Education, Noida; ISBN-10: 0070671192 ISBN-13: 978-0070671195
2	Gupta, J.K.; Khurmi, R.S.	A Textbook of Manufacturing Process (Workshop Tech.)	S.Chand and Co. New Delhi ISBN:81-219-3092-8
3	Hegde, R.K.	Workshop Practice Manual For Engineering Diploma & ITI Students	Sapna Book House, 2012, ISBN:13: 9798128005830
4	Singh, Rajender	Introduction to Basic Manufacturing Process & Workshop Technology	New Age International, New Delhi; 2014, ISBN: 978-81-224-3070-7
5	Hajra; Choudhary	Elements of Workshop Technology	Media Promoters and Publishers Mumbai, 2009, ISBN: 10-8185099146
6	Sarathe, A.K	Engineering Workshop Practice	Khanna Book Publishing CO(P) LTD, New Delhi, ISBN No. 978-93-91505- 51-6

## XIII. LEARNING WEBSITES &amp; PORTALS

Sr.No	Link/Portal	Description
1.	<a href="http://www.asnu.com.au">http://www.asnu.com.au</a>	Basic engineering tools.
2.	<a href="http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf">http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf</a>	Woodworking
3.	<a href="http://www.weldingtechnology.org">http://www.weldingtechnology.org</a>	Welding techniques
4.	<a href="http://www.newagepublishers.com/samplechapter/001469.pdf">http://www.newagepublishers.com/samplechapter/001469.pdf</a>	Basic engineering tools.
5.	<a href="http://www.youtube.com/watch?v=TeBX6cKKHWY">http://www.youtube.com/watch?v=TeBX6cKKHWY</a>	Welding techniques
6.	<a href="http://www.youtube.com/watch?v=QHF0sNHnttw&amp;feature=related">http://www.youtube.com/watch?v=QHF0sNHnttw&amp;feature=related</a>	Welding techniques
7.	<a href="http://www.youtube.com/watch?v=Kv1zo9CAxt4&amp;feature=relmfu">http://www.youtube.com/watch?v=Kv1zo9CAxt4&amp;feature=relmfu</a>	Woodworking
8.	<a href="http://www.piehtoolco.com">http://www.piehtoolco.com</a>	Basic engineering tools.
9.	<a href="http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/">http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/</a>	Basic engineering tools.
10.	<a href="https://www.youtube.com/watch?v=9_enkaAbtCM">https://www.youtube.com/watch?v=9_enkaAbtCM</a>	Basic engineering tools.

Name & Signature:	
 <b>Mr. Pushpak U. Garge</b> Lecturer in Mechanical Engineering & I/C Workshop Superintendent	 <b>Mrs. D.S. Waghmare</b> Lecturer in Mechanical Engineering
(Course Experts)	
Name & Signature:	Name & Signature:
 <b>Mrs. N.S. Kadam</b> (Programme Head)	 <b>Shri. S.B. Kulkarni</b> (CDC In-charge)

## GOVERNMENT POLYTECHNIC, PUNE

‘120 – NEP’ SCHEME

<b>PROGRAMME</b>	<b>DIPLOMA IN ME / MT</b>
<b>PROGRAMME CODE</b>	<b>04/05</b>
<b>COURSE TITLE</b>	<b>BASIC ELECTRICAL TECHNOLOGY</b>
<b>COURSE CODE</b>	<b>EE21203</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>NA</b>

### I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme						Credits	Assessment Scheme										Total Marks
			Actual Contact Hrs./Week			SLH	NLH	Paper Duration Hrs.		Theory			Based on LL & TSL				Based on SL			
			CL	TL	LL					Total	Practical		SLA							
						FA-TH	SA-TH				Max	Min	FA-PR	SA-PR	Max	Min	Max	Min		
EE21203	BASIC ELECTRICAL TECHNOLOGY	AEC	2	-	2	-	4		3	-	-	-	-	-	25	10	25@	10	-	-

**Total IKS Hrs for Term: 0 Hrs**

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, **IKS** – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, # - External Assessment,\*# - Online Examination,@\$ - Internal Online Examination

**Note:**

**FA-TH** represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. \* 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. \* Self-learning hours shall not be reflected in the Timetable.
- 6.\* Self-learning includes micro-projects/assignments/other activities.

### II. RATIONALE:

Diploma holders are expected to handle various mechanical, electrical and electronics tools. This course will develop skills in handling tools, equipment safely related electrical engineering aspects useful for manufacturing, production and mechanical engineering based processes in industries.

### III. COURSE-LEVEL LEARNING OUTCOMES (CO's)

Students will be able to achieve and demonstrate the following CO's on completion of course-based learning

CO1: Use Principles of electrical and magnetic circuits to solve mechanical engineering broadly defined problems.

CO2: Use of Transformer and Electric motors for given applications.

CO3: Use electrical safety devices in electrical circuits.

## IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I ELECTRIC AND MAGNETIC CIRCUIT (CL Hrs.- 10)</b>				
1	<p>TLO 1.1 Explain the given technical terms related to Electric and Magnetic circuits.</p> <p>TLO 1.2 Identify an analogy between Electric and Magnetic Circuits.</p> <p>TLO 1.3 Apply Fleming's right-hand rule and Lenz's law for the determination of the direction of induced emf in the given situation.</p> <p>TLO 1.4 Explain attributes of the given AC quantities.</p> <p>TLO 1.5 Find currents and voltages in the given star &amp; delta AC circuits.</p> <p>TLO 1.6 Explain the working of batteries.</p> <p>TLO 1.7 Wiring specifications &amp; Standards.</p>	<p>1.1 Electric circuits E.M.F, Potential difference, power, Magnetic circuits M.M.F, magnetic force, permeability.</p> <p>1.2 Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law, dynamically induced emf.</p> <p>1.3 Statically induced emf. (a) Self-induced emf (b) Mutually induced emf; Equations of self and mutual inductance.</p> <p>1.4 A.C. Signal terms: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, and power factor.</p> <p>1.5 Voltage and Current relationship in Star and Delta connections.</p> <p>1.6 Batteries- Types and Working</p> <p>1.7 wiring specifications and IS electrical standards for safety and appliances.</p>	<p>Chalk-Board Presentations Videos on Flemings Right-hand rule and Lenz Law</p>	CO1
<b>UNIT-II TRANSFORMER AND THE SINGLE-PHASE INDUCTION MOTOR (CL Hrs.- 10)</b>				
2	<p>TLO 2.1 Explain with sketches the construction and working principle of the given type of single-phase transformer.</p> <p>TLO 2.2 Explain with sketches the working principle of the given autotransformer.</p> <p>TLO 2.3 Describe with sketches the construction of the given single-phase motor.</p> <p>TLO 2.4 Explain with the sketches the working principle of the given single-phase induction motors.</p>	<p>2.1 General construction and principle of different types of transformers, EMF equation and transformation ratio of transformers.</p> <p>2.2 Auto transformers. Working Principles and Applications</p> <p>2.3 Construction and Working principle of single phase AC. motor. Types of single phase motors, applications of single phase motors.</p> <p>2.4 Applications of single phase Induction motors.</p>	<p>Chalk-Board Demonstration Hands-on</p>	CO2
<b>UNIT-III ELECTRICAL SAFETY AND PROTECTIVE DEVICES (CL HRS-10)</b>				
3	<p>TLO 3.1 Describe the characteristics and features of different protective devices</p> <p>TLO 3.2 Select the relevant protective device for the given application.</p> <p>TLO 3.3 Select the suitable switchgear for the given situation</p>	<p>3.1 Fuse: Operation, types and applications</p> <p>3.2 MCB and ELCB/RCB: Operation and general specifications</p> <p>3.3 Earthing: Types, Importance of Earthing, Factors Affecting Earthing Resistance.</p> <p>3.4 Measures for reducing earth</p>	<p>Chalk-Board Demonstration Hands-on</p>	CO3

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	with justification. TLO 3.4 Select the I.E rule related to be applied for a given type of earthing.	resistance, I.E rules relevant to earthing.		

**V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES. (Any 12)**

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1 Voltage and Current measurement	Measure voltage and current in single-phase circuits with resistive load using appropriate meters	2	CO1
2	LLO 2 Power measurement of single-phase circuit	Measure power required by single phase circuit with resistive load.	2	CO1
3	LLO 3 Energy measurement	Measure Energy consumed by given equipment using energy meter.	2	CO1
4	LLO 4 Line and Phase voltage measurement of the star-delta connection circuit	Make a star and delta connection to measure line and phase voltage	2	CO1
5	LLO 5 Battery Testing	Test given battery using a digital multimeter.	2	CO1
6	LLO 6 Input and output quantities of Single phase transformer	6.1 Connect Single phase transformer for measuring input and output quantities 6.2 Determine its turns ratio	2	CO2
7	LLO 7 Continuity test of transformer- primary and secondary windings	Test primary and secondary winding to measure the continuity of the transformer.	2	CO2
8	LLO 8 Autotransformer	Measure the output voltage of the autotransformer.	2	CO2
9	LLO 9 Electrical wire specifications	Select the suitable gauge of wire for the given electrical application.	2	CO1
10	LLO 10 Electrical Switchboard assembly	Build the switchboard for the given requirement by connecting suitable coloured wire to respective terminals.	2	CO1
11	LLO 13 Connection of fuses in the electrical circuit.	Connect the fuse in the electrical circuit and check its operation at normal and abnormal conditions	2	CO3
12	LLO 14 Connection of MCB in the electrical circuit.	Connect MCB in the electrical circuit and check its operation at normal and abnormal conditions.	2	CO3
13	LLO 15 Connection of ELCB in electrical circuit.	Connect ELCB in the electrical circuit and check its operation at normal and abnormal conditions.	2	CO3

**VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)**

**Micro project: NOT APPLICABLE**

**Assignment: - NOT APPLICABLE**



**VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED**

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Single Phase Autotransformer: Single phase, Input 0-230,10 A, Output:0- 270 Volts	1,2,8
2	Measurement Digital Multimeter: Minimum 3 ½ digit 4 ½ digit display, multimeter measures Vac, Vdc (1000V max), Adc, Aac (10-amp max), Resistance (0-100 Mohm),	1,2,3,4,5, 6,7,8
3	Lamp Bank - 230 V 0-20 A	1,2,3,4, 6,7,8
4	Single phase Transformer-Single Phase Input 230/115V, 1KVA	6,7,8
5	Single Phase Induction Motor - 230 V 50 Hz AC supply	
6	Wattmeter of suitable rating, Stopwatch, Energymeter, Wire gauge	2,3,9
7	Fuse, MCB, ELCB	11,12

**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE**

(Specification Table)

NOT APPLICABLE

**IX. ASSESSMENT METHODOLOGIES/TOOLS**

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
For FA_PR, Formative (Continuous ) assessment shall be based on process and product-related performance indicators. Course teachers may assign 60%, weightage for process and 40% weightage for product-related LL work.	For SA PR at the end of the semester PR examination will be conducted by the course teacher and based on PR exam performance marks out of 25 will be allocated

**X. SUGGESTED COs- POs MATRIX FORM**

For ME

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)	
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CO1	3	1	-	-	-	-	1	-	-
CO2	3	1	-	-	-	-	2	-	-
CO3	2	-	-	-	-	-	3	-	-
<b>Legends:- High: 03, Medium: 02, Low: 01, No Mapping: -</b> *PSOs are to be formulated at the institute level									

For MT

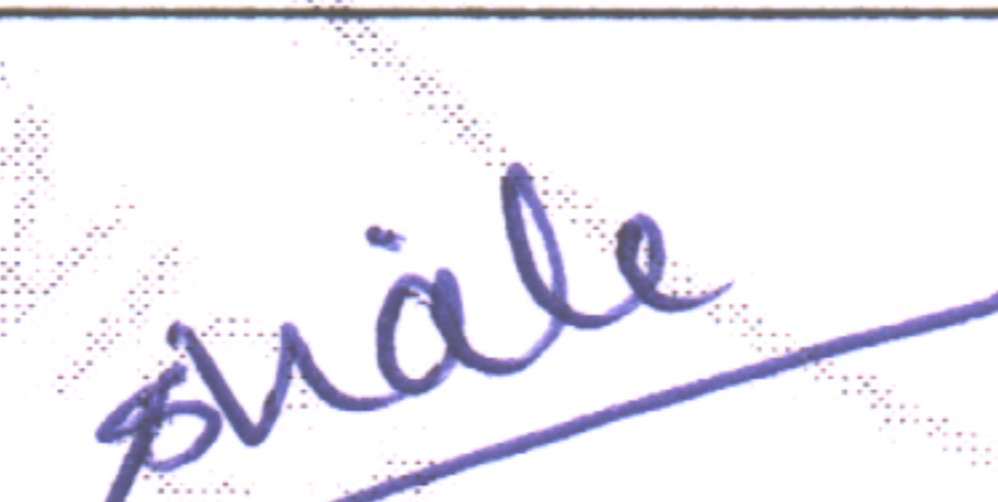
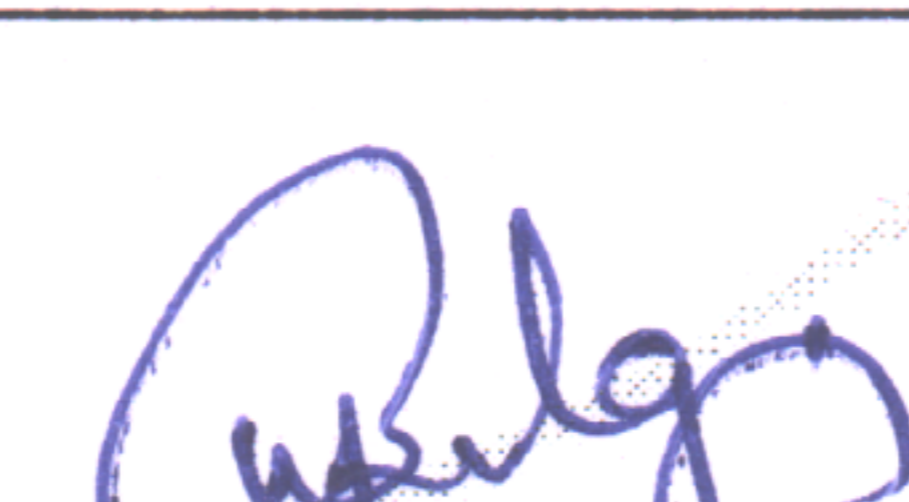


Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)			
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO4
CO1	3	1	-	-	-	-	1	-	-	1	-
CO2	3	1	-	-	-	-	2	-	1	1	-
CO3	2	-	-	-	-	-	3	2	2	2	-
<b>Legends:- High: 03, Medium: 02, Low: 01, No Mapping: -</b> *PSOs are to be formulated at the institute level											

## XI.SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher with ISBN Number
1	Mittle and Mittal	Basic Electrical Engineering	McGraw Education, New Delhi, edition 2017, ISBN-13 978-0070593572
2	Jegathesan, V	Basic Electrical and Electronics Engineering	Wiley India, New Delhi, edition-2015 ISBN 978- 8126529513
3	Sedha, R.S.	A Textbook of Applied Electronics	S.Chand New Delhi, edition-2008 ISBN-13: 978- 8121927833

## XII. LEARNING WEBSITES &amp; PORTALS

Sr. No	Link/Portal	Description
1	<a href="https://www.electrical4u.com/fleming-left-hand-rule-and-fleming-right-hand-rule/">https://www.electrical4u.com/fleming-left-hand-rule-and-fleming-right-hand-rule/</a>	Flemings's hand and left-hand rule
2	<a href="https://www.electrical4u.com/lenz-law-of-electromagnetic-induction/">https://www.electrical4u.com/lenz-law-of-electromagnetic-induction/</a>	Lenz's Law
3	<a href="https://www.animations.physics.unsw.edu.au/jw/">https://www.animations.physics.unsw.edu.au/jw/</a>	Electronic components, A.C. circuits, transformer, Electric motors.
4	<a href="https://en.wikipedia.org/wiki/Transformer">https://en.wikipedia.org/wiki/Transformer</a>	Transformer
5	<a href="http://www.alpharubicon.com/altenergy/understandingAC.htm">http://www.alpharubicon.com/altenergy/understandingAC.htm</a>	A.C. Current

Name & Signature:	
 <b>Smt. S.P. Phadnaik</b> Lecturer in Electrical (Course Experts)	 <b>Smt. M. H. Bilgi</b> Lecturer in Electrical
Name & Signature:	Name & Signature:
 <b>Mrs. Namita S. Kadam</b> (Programme Head)	 <b>Mr. Sudin B Kulkarni</b> (CDC In-charge)

**GOVERNMENT POLYTECHNIC, PUNE**  
**'120 – NEP' SCHEME**

<b>PROGRAMME</b>	<b>DIPLOMA IN CE/EE/ET/ME/MT/CM/IT/DDGM</b>
<b>PROGRAMME CODE</b>	<b>01/02/03/04/05/06/07/08</b>
<b>COURSE TITLE</b>	<b>PROFESSIONAL COMMUNICATION</b>
<b>COURSE CODE</b>	<b>HU11202</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>NA</b>

**I. LEARNING & ASSESSMENT SCHEME**

Course Code	Course Title	Course Type	Learning Scheme						Credits	Paper Duration	Assessment Scheme									
			Actual Contact Hrs./Week			SL	H	NLH			Theory			Based on LL & TSL				Based on SL		Total Marks
			CL	TL	LL						FA-TH	SA-TH	Total	Practical		SLA				
			Max	Max	Max	Min	Max	Min						Max	Min	Max	Min			
HU11202	<b>PROFESSIONAL COMMUNICATION SKILLS</b>	SEC	-	-	2	-	2	1		-	-	-	-	25	10	25@	10	-	-	

**Total IKS Hrs for Sem. : 0 Hrs**

**Abbreviations:** CL- Classroom Learning, TL- Tu tutorial Learning, LL-Laboratory Learning, SL H-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA - Self Learning Assessment.

**Legends:** @ Internal Assessment, # External Assessment, \*# OnLine Examination,@/\$ Internal Online Examination.

**Note :**

1. FA-TH represents the average of two class tests of 30 marks each conducted during the semester.
2. If the candidate does not secure minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If the candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.\* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. \* Self-learning hours shall not be reflected in the timetable.
7. \* Self-learning includes micro-projects/assignments / other activities.

**II. RATIONALE:**

Communication is key to the smooth and efficient functioning of any industry or business. Professional communication is the need of every organization to maintain ethics, quality and standards. The efficacy of business communication skills is essential for engineering professionals to instruct, guide and motivate peers/ subordinates to achieve desired goals at the workplace. Thus, this course has been designed to enhance professional communication skills for effective presentation both in written and oral forms at the workplace.

**III. COURSE-LEVEL LEARNING OUTCOMES (CO'S):**

Students will be able to achieve and demonstrate the following COs on completion of course-based learning

CO1: Communicate effectively (oral and written) in various formal and informal situations minimizing the barriers.

CO2: Develop listening skills through active listening and note-taking.

CO3: Write the circulars, notices and minutes of the meeting.

CO4: Draft enquiry letter, complaint letter, and Job application with resume / CV, Compose effective Emails.

CO5: Write Industrial reports.

**IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:**

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I PROFESSIONAL COMMUNICATION: AN OVERVIEW</b>				
1	<p>TLO 1.1 Describe the importance of professional communication in given situations.</p> <p>TLO 1.2 Identify the types of communication barriers in given situations and suggest remedies.</p> <p>TLO 1.3 Use different types of verbal and non-verbal communication for the given situation.</p>	<p>1.1 Definition of professional communication- Importance, relevance, Elements and process of communication,7 C's of Professional Communication (Clarity, Conciseness, correctness, coherent, concrete, courteous &amp; Complete).</p> <p>1.2 Communication barriers, Types of barriers (Linguistic, Psychological, Technological).</p> <p>1.3 Types of Communication- Verbal (Oral-Written), Formal, Informal (Grapevine) and Vertical Comm.</p>	<p>Language lab, Role plays, Chalkboard, Reference books, Case studies.</p>	<b>CO1</b>
<b>UNIT - II LISTENING &amp; NOTE-TAKING</b>				
2	<p>TLO 2.1 Identify the difference between listening and hearing.</p> <p>TLO 2.2 Differentiate the types of listening in various situations.</p> <p>TLO 2.3 Take notes during lectures and seminars. Make use of types of note-taking and note-making for different subjects/topics.</p>	<p>2.1 Difference between listening &amp; Hearing.</p> <p>2.2 Types of listening a)Active listening b)Passive listening c)Selective listening.</p> <p>2.3 Techniques of Note-taking, Types of note taking (Outline notes, Mind Mapping, Flowcharts).</p>	<p>Language Lab, Classroom learning, NPTEL, Role Play.</p>	<b>CO2</b>
<b>UNIT - III OFFICE DRAFTING</b>				
3	<p>TLO 3.1 Prepare notices/agenda for the given type of meeting/information.</p> <p>TLO 3.2 Prepare minutes of meeting/s.</p> <p>TLO 3.3 Draft a circular for a particular information/event.</p>	<p>3.1 Format of Notice, Drafting Agenda.</p> <p>3.2 Preparing Minutes of the meeting.</p> <p>3.3 Format of Circular.</p>	<p>Whiteboard, Language Lab, Reference books, Classroom learning.</p>	<b>CO3</b>
<b>UNIT - IV WRITING SKILLS FOR PROFESSIONAL COMMUNICATION</b>				
4	<p>TLO 4.1 Compose cover letter and CV / Resume for jobs.</p> <p>TLO 4.2 Apply E-mail Etiquettes for professional purposes.</p> <p>TLO 4.3 Compose Emails for different official purposes.</p>	<p>4.1 Job Application with Resume / CV.</p> <p>4.2 E-Mail Etiquettes.</p> <p>4.3 Writing official E-Mails to communicate intended purposes.</p>	<p>Language lab, Classroom learning NPTEL, Reference books.</p>	<b>CO4</b>

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT - V REPORT WRITING</b>				
5	TLO 5.1 Compose technical reports. TLO5.2 Draft accident and Investigation.	5.1 Introduction to report writing 5.2 Accident Report and Investigation Report.	Chalk and talk, Language Lab, Collaborative learning, Classroom learning.	<b>CO5</b>

#### V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL /TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	*LLO 1.1 Draw the communication cycle using real-life examples and explain the process of communication.	Communication Process and Cycle	2	CO1
2	LLO 2.1 Undertake the Roleplay / Group discussion to illustrate types/barriers to communication.	Role plays and Group Discussion	2	CO1
3	*LLO 3.1 Listen to audio in the language lab and make notes of it.	Active Listening	2	CO2
4	*LLO 4.1 Give a presentation / Seminar using the 7 C's of Communication.	Presentations / Seminars	2	CO1
5	*LLO 5.1 Explain the types of note-taking with examples and make notes on any one topic related to your curriculum.	Note taking & Note Making	2	CO2
6	*LLO 6.1 Prepare agenda for meeting and draft minutes of the meeting.	Agenda and Minutes of the Meeting	2	CO3
7	*LLO 7.1 Draft circulars for the given situation.	Office Drafting	2	CO3
8	*LLO 8.1 Respond to job advertisements referring to newspapers, and LinkedIn. Write a cover letter with a resume /CV.	Job Application with Resume / CV	2	CO4
9	*LLO 9.1: Write Four (formal) E-mails using ethics and etiquette.	E-Mail writing.	2	CO4
10	*LLO 10.1: Write a detailed report on the Accident/ Investigation.	Technical Report writing	2	CO5
11	*LLO 11.1: Prepare a case study related to linguistic barriers: language pronunciation, punctuation, and technical jargon and suggest remedies for the same.	Barriers to Communication	2	CO1

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
12	LLO 12.1: draft complaint/enquiry letter for various situations.	Complaint and Enquiry letter	2	CO4
13	LLO 13.1: List psychological barriers to communication. LLO 13.2 Prepare case studies on any two psychological barriers and suggest remedies to overcome the barriers.	Psychological barriers to Communication.	2	CO1
14	*LLO 14.1 - Draw a flow chart and mind mapping for any topic related to the curriculum.	Listening Skills.	2	CO2
15	*LLO 15.1 - Face mock interview arranged by your teacher.	Job Application, Resume / CV & Interview.	2	CO4

**Note:**

- "\*" marked practicals are compulsory for coverage of all course outcomes.
- The remaining practicals are recommended to provide enhanced skills/abilities.
- Any 12 assignments out of 15 are compulsory

**Note:**

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her at the beginning of the semester. She/he ought to submit it by the end of the semester to develop the industry-oriented COs. Each micro-project should encompass two or more COs. The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain a dated work diary consisting of individual contributions to the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 15 (fifteen) student engagement hours during the course. In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become a problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty.

## VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

### Micro project

- Conduct an interview of any person and follow the procedure ( interview questions, photo with the interviewee etc.)
- Listening and Speaking are lifelong learnings. Explain with appropriate examples and real-life case studies.
- Collect (four to five) emails with technical jargon, and barriers, make required corrections and keep a record of both the emails (original and Corrected one)
- Prepare a case study on Technological barriers to communication
- Complete any one certification course of (Two Weeks duration) from (MOOC/ NPTEL/ Coursera/ any other source)related to Communication Skills / Personality Development.
- Prepare a report on aspects of body language.

**VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED:**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Language Lab with software with internet facility.	All
2	LCD Projector	All
3	Smart Board with networking.	All
4	Printer.	All

**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE**

(Specification Table):

N.A.

**IX. ASSESSMENT ETHODOLOGIES/TOOLS:**

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Term Work (FA-PR) 2. Micro-project.	1. Practical Exam of 25 marks using language lab. (SA-PR)

**X. SUGGESTED COs- POs MATRIX FORM:**

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	-	-	-	-	-	-	1	-	-	-
CO2	-	-	-	-	-	-	1	-	-	-
CO3	-	-	-	-	-	-	1	-	-	-
CO4	-	-	-	-	-	-	1	-	-	-
CO5	-	-	-	-	-	-	1	-	-	-

**Legends:- High:03, Medium:02, Low:01, No Mapping: -**




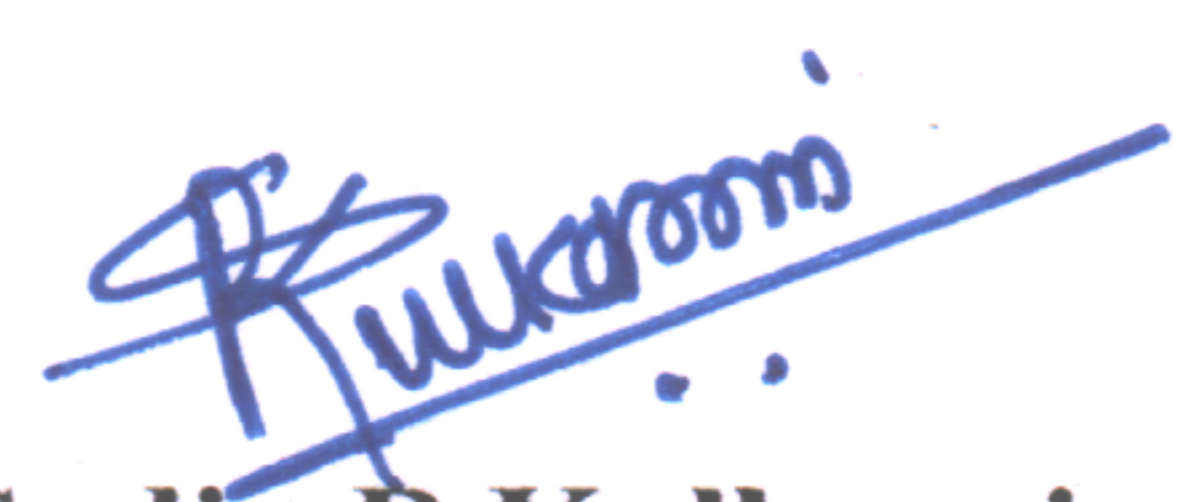
\*PSOs are to be formulated at the institute level.

## XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher with ISBN Number
1	M Ashraf Rizvi	Effective Communication Skills	Tata McGraw-Hill Publication-ISBN 0070599521, 9780070599529
2	Sanjay Kumar and Pushp Lata	Communication Skills	Oxford University Press ISBN 9780199457069
3	MSBTE Textbook	Communication Skills	MSBTE
4	Robert King	Effective communication Skills	Audio Book -ISBN 978181667009742
5	N P Sudharshana, C Savitha	English for Technical Communication	Cambridge-ISBN 978-13-16640-08-1
6	C. Murlikrishna, Sunita Mishra	Communication Skills for Engineers	Pearson - ISBN 978-81-317-3384-4
7	Meenakshi Raman, Sangeeta Sharma	Technical Communication, Principles and Practice	Oxford University Press -ISBN 978-1316640-08-1
8	K. K. Sinha	Business Communication	Galgotiya Publishing company, New Delhi ISBN 9789356227064
9	Rajendra Pal, J.S. Korlahalli	Essentials of Business Communication	Sultan Chand & Sons, New Delhi ISBN 9788180547294

## XII. LEARNING WEBSITES &amp; PORTALS

Sr. No	Link / Portal	Description
1	<a href="https://www.britishcouncil.in">https://www.britishcouncil.in</a>	Conversations
2	<a href="https://www.coursera.org">https://www.coursera.org</a>	Certification courses
3	<a href="https://www.udemy.com">https://www.udemy.com</a>	Communication skills training courses
4	<a href="http://www.makeuseof.com">http://www.makeuseof.com</a>	Dale Carnegie's free resources

<b>Name &amp; Signature:</b>  <b>Mr. V.V. Kulkarni</b> Lecturer in English  <b>Dr. S.P. Palve</b> Lecturer in English <p style="text-align: center;"><b>(Course Experts)</b></p>	
<b>Name &amp; Signature:</b>  <b>Mrs. Namita S. Kadam</b> (Programme Head)	<b>Name &amp; Signature:</b>  <b>Mr. Sudin B Kulkarni</b> (CDC In-charge)



## GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CE/EE/ET/ME/MT/CM/IT/DDGM
PROGRAMME CODE	01/02/04/05/05/06/07/08
COURSE TITLE	YOUTH LEADERSHIP FOR CLIMATE ACTION
COURSE CODE	HU21202
PREREQUISITE COURSE CODE AND TITLE	NO

## I. LEARNING &amp; ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Paper Duration Hrs.	Assessment Scheme										Total Marks
			Actual Contact Hrs./Week			SLH	NLH			Theory			Based on LL & TSL				Based on SL			
			CL	TL	LL					FA-TH	SA-TH	Total	Practical		SLA					
			Max	Max	Max	Min	Max						Min	Max	Min	Max	Min			
HU21202	YOUTH LEADERSHIP FOR CLIMATE ACTION	VEC	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50

Total IKS Hrs for Term: 0 Hrs

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, # - External Assessment,\*# - Online Examination,@\$ - Internal Online Examination

**Note:**

1. FA-TH represents an average of two class tests of 30 marks each conducted during the semester.
2. If a candidate is not securing minimum passing marks in FA-PR (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
3. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit SLA work.
4. **Notional learning hours** for the semester are (CL + LL + TL + SL) hrs. \* 15 Weeks
5. **1 credit** is equivalent to **30 Notional hours**.
6. \* Self-learning hours shall not be reflected in the Timetable.
- 6.\*Self-learning includes micro-projects/assignments/other activities.

## II. RATIONALE:

Climate change is a global phenomenon that transcends borders. Climate change poses significant threats to biodiversity, ecosystems, and natural resources. Its impacts, such as rising temperatures, extreme weather events, and sea-level rise, affect communities worldwide. Addressing climate change is a collective responsibility to safeguard the planet and its ecosystems for current and future generations. Climate change exacerbates social and economic inequalities, affecting vulnerable communities disproportionately. With increasing climate risks, and exposure to hazards, citizens need to improve clean and green skills.

Mitigating climate change and taking climate action is essential for preserving the Earth's biodiversity, maintaining ecosystem services, and ensuring the sustainability of vital resources upon which human societies depend. By taking climate action, societies can enhance resilience, reduce vulnerability, and promote social and economic stability. Sustainable practices help protect, preserve, and sustain the environment, as well as stimulate economic growth in sectors such as renewable energy and energy efficiency.

Climate action involves transitioning to more sustainable and resource-efficient practices. This includes adopting clean energy sources, improving energy efficiency, and promoting circular economies. Imparting skills to the human resources in the clean and green sectors is also a climate action. Such measures not only mitigate climate change but also contribute to the efficient use of resources and the reduction of environmental degradation.

The national, state, and multilateral efforts, such as the Mission Life, State Climate Action Planning, Paris Agreement, etc. provide a framework for countries to work together in reducing greenhouse gas emissions, adapting to climate impacts, and fostering technology transfer for sustainable development.

**III. COURSE-LEVEL LEARNING OUTCOMES ( CO's)**

Students will be able to achieve & demonstrate the following COs on completion of course-based learning

**CO1:** Demonstrate a comprehensive understanding of the science behind climate change, its causes, and its impacts on the environment, economy and society.

**CO2:** Understand the principles of water resource management (WRM), water conservation and its application in the context of climate change.

**CO3:** Understand the relationship between climate change and waste management, including the issues and impacts of waste management practices on greenhouse gas emissions.

**CO4:** Demonstrate a comprehensive understanding of energy systems, including sources, distribution, and consumption patterns

**CO5:** Advocate for and implement energy conservation practices at individual, community, and organizational levels to reduce overall energy demand.

**CO6:** Develop a comprehensive understanding of the intricate interconnections between biodiversity and climate, and recognize the reciprocal impacts each has on the other.

**IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:**

Sr. No	Theory Learning Outcomes(TLO'S) aligned to COs.	Learning content mapped with TLOs.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I LIVING WITH CLIMATE CHANGE</b>				
<b>SUBUNIT 1: CLIMATE CHANGE PHENOMENON AND SCIENCE</b>				
1.1	<p><b>TLO 1.1.1</b> Able to articulate the fundamental differences between weather and climate</p> <p><b>TLO 1.1.2</b> Understanding of the basic principles of climate change, including the greenhouse effect, human-induced factors, and the consequences of a warming planet.</p> <p><b>TLO 1.1.3</b> Able to define the concept of a carbon footprint, understanding it as the total amount of greenhouse gases.</p>	<p>1.1.1 Understanding Climate: Weather versus Climate</p> <p>1.1.2 Climate and the Greenhouse Effect</p> <p>1.1.3 Natural and Human-induced Climate Change</p> <p>1.1.4 Carbon footprint</p>	<p>Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p>	1
<b>SUB UNIT 2: CLIMATE CHANGE IMPACTS</b>				
1.2	<p><b>TLO 1.2.1</b> Grasp the foundational science behind climate change, including the greenhouse effect, human-induced emissions, and the role of feedback mechanisms in global warming.</p> <p><b>TLO 1.2.2</b> Identify and analyze key indicators of climate change, such as rising global temperatures, changing precipitation patterns, sea level rise, and the frequency of extreme weather events.</p> <p><b>TLO 1.2.3</b> Understand the diverse climate patterns across India's biogeographic regions, including the Himalayas, Indo-Gangetic Plains, Western Ghats, Eastern Ghats, Deccan Plateau, and coastal regions.</p>	<p>1.2.1 Global impacts and uncertainties</p> <p>1.2.2 Effects on India and its various biogeographic regions</p> <p>1.2.3 Impacts on livelihoods and economy: Agriculture and Horticulture</p> <p>1.2.4 Impacts on Vulnerable Communities: Fishing Communities</p>	<p>Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p>	1

<b>SUB UNIT 3: CLIMATE ACTION</b>			
1.3	<p><b>TLO1.3.1</b> Understand the concept of climate change mitigation and adaptation and its role in preparing for and responding to the impacts of climate change.</p> <p><b>TLO1.3.2</b> Understand the concept of sustainable development and its three dimensions: economic, social, and environmental.</p> <p><b>TLO1.3.3</b> Identify and articulate the connections between climate change impacts and existing social, economic, and environmental inequalities.</p> <p><b>TLO1.3.4</b> Understand the importance of community-based climate action and initiatives led by local communities in India.</p> <p><b>TLO 1.3.5</b> Understand the concepts of green skills and green work, emphasizing their role in promoting sustainability and environmentally conscious practices in various industries.</p>	<p>1.3.1 Mitigation and Adaptation</p> <p>1.3.2 Intergovernmental processes</p> <p>1.3.3 Sustainable Development Goals</p> <p>1.3.4 Climate Justice</p> <p>1.3.5 India’s journey towards Climate Action</p> <p>1.3.6 Majhi Vasundhara and Other Initiatives</p> <p>1.3.7 Role of Individuals</p> <p>1.3.8 Green Skills and Green Work</p>	2
<b>UNIT-II WATER MANAGEMENT FOR CLIMATE CHANGE</b>			
<b>SUB UNIT 1: THE NEED OF WATER MANAGEMENT AND CONSERVATION</b>			
2.1	<p><b>TLO 2.1.1</b> Understand the concept of water management and its significance in addressing water-related challenges.</p> <p><b>TLO 2.1.2</b> Describe the water cycle and its role in the distribution and availability of water.</p> <p><b>TLO 2.1.3</b> Identify regions facing water scarcity and understand the factors contributing to water shortages.</p> <p><b>TLO 2.1.4</b> Analyze patterns of human water consumption and its impact on local and global water resources.</p> <p><b>TLO 2.1.5</b> Examine water quality issues, including pollution sources, contaminants, and their effects on ecosystems and human health.</p> <p><b>TLO 2.1.6</b> Recognize the role of community engagement in water conservation efforts and sustainable water management practices.</p> <p><b>TLO 2.1.7</b> Understand the</p>	<p>2.1.1 Water - the basis of life.</p> <p>2.1.2 The water cycle and freshwater availability.</p> <p>2.1.3 Water use in India and the importance of groundwater.</p> <p>2.1.4 Water Resources in Maharashtra.</p> <p>2.1.5 Use of water in our lives.</p> <p>2.1.6 Virtual Water.</p> <p>2.1.7 Traditions of water use and management.</p> <p>2.1.8 Water Quality - an important dimension.</p> <p>2.1.9 Wastewater: a problem and a potential resource.</p>	2

	concept of wastewater and Identify and analyze the sources of pollutants in wastewater, including industrial discharges, agricultural runoff, and urban sewage.			
<b>SUB UNIT 2: ISSUES AND CHALLENGES IN WATER MANAGEMENT</b>				
2.2	<p><b>TLO 2.2.1</b> Understand the concept of water stress and its implications for a region's ability to meet water demand for various purposes.</p> <p><b>TLO 2.2.2</b> Explore the role of agriculture in water stress, including irrigation practices, cropping patterns, and the impact of changing agricultural practices.</p> <p><b>TLO 2.2.3</b> Understand the concept of water pollution and differentiate between various types of pollutants affecting water bodies.</p> <p><b>TLO 2.2.4</b> Understand the environmental, ecological, and public health impacts of different pollutants in water, such as nutrients, heavy metals, pathogens, and synthetic chemicals.</p> <p><b>TLO 2.2.5</b> Identify common waterborne diseases, such as cholera, typhoid, dysentery, and gastroenteritis, and understand their causative agents.</p> <p><b>TLO 2.2.6</b> Define the challenges associated with inadequate sanitation, including issues related to open defecation, lack of access to sanitary facilities, and the impact on public health.</p>	<p>2.2.1 Water Stress in India.</p> <p>2.2.2 Water resources limitation and increasing use.</p> <p>2.2.3 Water stress in agriculture.</p> <p>2.2.4 Water pollution and contamination.</p> <p>2.2.5 Health impacts of poor water quality.</p> <p>2.2.6 Water management and climate change.</p> <p>2.2.7 The global challenge of water and sanitation.</p> <p>2.2.8 Summary - causes of water stress.</p>	<p>Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p>	2
<b>SUB UNIT 3:TOWARDS SUSTAINABLE WATER MANAGEMENT</b>				
2.3	<p><b>TLO 2.3.1</b> Understand and define the concept of sustainable water management, considering its ecological, social, and economic dimensions.</p> <p><b>TLO 2.3.2</b> Understand the significant initiatives launched by the Government of India/State government which focuses on water resources and management.</p>	<p>2.3.1 Towards sustainable water management</p> <p>2.3.2 Swachh Bharat - The Mission for a Clean India</p> <p>2.3.3 Jal Jeevan Mission - Water for All</p> <p>2.3.4 Atal Bhujal Yojana - Replenish Groundwater</p> <p>2.3.5 Mission Amrit Sarovar - Rejuvenate Water bodies</p> <p>2.3.6 Jalyukt Shivar Abhiyan – Waterscapes.</p>	<p>Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p>	2

<b>SUB UNIT 4: INDIVIDUAL AND COMMUNITY ACTIONS FOR WATER AND WASTEWATER MANAGEMENT</b>			
<b>2.4</b>	<p><b>TLO 2.4.1</b> Understand the concept of a water audit and its significance in assessing water use, efficiency, and conservation.</p> <p><b>TLO 2.4.2</b> Analyze water use patterns in common household activities, including bathing, washing dishes, laundry, and gardening.</p> <p><b>TLO 2.4.3</b> Understand the definition of greywater and Recognize common sources of greywater in households, including bathroom sinks, showers, bathtubs, and washing machines.</p> <p><b>TLO 2.4.4</b> promote awareness within communities about the benefits of greywater management and its potential impact on water conservation.</p> <p><b>TLO 2.4.5</b> Understand the concept of rainwater harvesting and its significance in sustainable water management.</p> <p><b>TLO 2.4.6</b> Learn different methods used to calculate rainwater harvesting potential</p>	<p>2.4.1 Conduct water audits</p> <p>2.4.2 Save water at home</p> <p>2.4.3 Promote greywater management at home and in the community</p> <p>2.4.4 Spread the word on sustainable water management</p> <p>2.4.5 Calculate Rainwater Harvesting Potential.</p>	2
<b>UNIT III: WASTE MANAGEMENT AND CLIMATE ACTION</b>			
<b>SUBUNIT 1: WHAT IS WASTE?</b>			
<b>3.1</b>	<p><b>TLO 3.1.1</b> Understand the term "domestic waste" and distinguish it from other types of waste generated in different contexts.</p> <p><b>TLO 3.1.2</b> Classify domestic waste into different categories such as organic waste, recyclables, hazardous waste, and non-recyclables.</p> <p><b>TLO 3.1.3</b> Learn various methods used to quantify household waste, including direct measurement, sampling, and estimation techniques.</p> <p><b>TLO 3.1.4</b> Identify specific waste patterns associated with different generations and lifestyles</p> <p><b>TLO 3.1.5</b> Understand the Sustainable Development Goals (SDGs)</p>	<p>3.1.1 Define and enlist types of waste</p> <p>3.1.2 List the components of domestic waste</p> <p>3.1.3 Differentiate between biodegradable and non-biodegradable waste</p> <p>3.1.4 Assess the quantum of waste generated at home</p> <p>3.1.5 Changes in Waste generation over human generations</p> <p>3.1.6 Review lifestyle choices</p> <p>3.1.7 SDGs and Link of Waste with SDGs</p>	3

	<b>TLO 3.1.6</b> Analyze the critical role of waste management in achieving multiple SDGs			
<b>SUBUNIT 2: ISSUES IN WASTE MANAGEMENT</b>				
3.2	<p><b>TLO 3.2.1</b> Emphasizing waste impact on the environment, human health, and overall sustainability.</p> <p><b>TLO 3.2.2</b> Identify health risks associated with improper waste disposal, such as the spread of diseases and exposure to hazardous materials.</p> <p><b>TLO 3.2.3</b> Analyze how waste, particularly organic waste in landfills, contributes to greenhouse gas emissions and climate change.</p>	<p>3.2.1 Why is waste an issue?</p> <p>3.2.2 Health impacts from mismanagement of waste</p> <p>3.2.3 Work conditions of waste workers</p> <p>3.2.4 Waste of natural resources and increased greenhouse gas emissions</p>	<p>Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p>	3
<b>SUBUNIT 3: APPROACHES TO WASTE MANAGEMENT</b>				
3.3	<p><b>TLO 3.3.1</b> Clearly define the waste management hierarchy</p> <p><b>TLO 3.3.2</b> Waste management hierarchy role in guiding sustainable waste management practices such as source reduction, reuse, recycling, energy recovery, and disposal.</p>	<p>3.3.1 Hierarchy of waste management</p> <p>3.3.2 Waste segregation at source</p> <p>3.3.3 Reduce, Reuse, Recycle and Recover</p> <p>3.3.4 Recycling of waste materials</p> <p>3.3.5 Principle of circular economy</p> <p>3.3.6 Avoiding waste by design</p> <p>3.3.7 Composting</p>	<p>Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p>	3
<b>SUBUNIT 4: LEGISLATIONS RELATED TO WASTE MANAGEMENT</b>				
3.4	<p><b>TLO 3.4.1</b> Familiarize yourself with major national and international legislation related to waste management.</p> <p><b>TLO 3.4.2</b> Define Extended Producer Responsibility (EPR) and explain its concept in the context of environmental management.</p> <p><b>TLO 3.4.3</b> Define biomedical waste and distinguish it from other types of waste. Identify the various sources and types of biomedical waste generated in healthcare facilities.</p>	<p>4.1 Municipal Solid Waste Management Rules 2016</p> <p>4.2 Plastic Waste Management Rules</p> <p>4.3 Extended Producer Responsibility (EPR)</p> <p>4.4 Biomedical Waste Management</p> <p>4.5 Preventive Measures for Manual Scavenging</p>	<p>Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p>	3
<b>SUBUNIT 5: ACTION FOR IMPROVING WASTE MANAGEMENT</b>				
3.5	<p><b>TLO 3.5.1</b> Develop skills in data collection methods for waste assessment, such as waste audits, surveys, and interviews.</p>	<p>5.1 Waste assessment in your community or town</p> <p>5.2 Setting up a compost unit</p>	<p>Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p>	3

<p><b>TLO 3.5.2</b> Analyze collected data to identify patterns, trends, and areas for improvement in waste management practices.</p> <p><b>TLO 3.5.3</b> Define composting and explain the biological processes involved in the decomposition of organic matter.</p> <p><b>TLO 3.5.4</b> Explore different composting methods, such as aerobic and anaerobic composting, and choose the most suitable technique for the compost unit.</p> <p><b>TLO 3.5.5</b> Explore different biogas production technologies, such as continuous stirred tank reactors (CSTR) and anaerobic digesters.</p>	<p>5.3 Biogas: Is it a possibility?</p>		
<p><b>UNIT IV: ENERGY MANAGEMENT AND CLIMATE ACTION</b></p>			
<p><b>SUBUNIT 1: ENERGY IN OUR LIVES</b></p>			
<p><b>4.1 TLO 4.1.1</b> Identify the key principles of efficient energy use and conservation.</p> <p><b>TLO 4.1.2</b> Familiarize yourself with different energy sources, including renewable and non-renewable options.</p> <p><b>TLO 4.1.3</b> Understand the connection between energy production, consumption, and climate change.</p> <p><b>TLO 4.1.4</b> Understand India's commitments to sustainable energy at the national and international levels, including agreements</p>	<p>4.1.1 Energy and quality of life                  4.1.2 Sources of energy                  4.1.3 Energy and C Change                  4.1.4 Judicious use of non-renewable energy resources                  4.1.5 A Just Transition                  4.1.7 India's commitment to sustainable energy                  4.1.8 Policies and Programs for Energy Management                  4.1.9 Clean Energy for Cooking</p>	<p>Video Lectures                  (Online Mode:                  Link  <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p>	<p>4</p>

<b>SUBUNIT 2: YOUTH ACTION TO IMPROVE ENERGY MANAGEMENT</b>			
<b>4.2</b>	<p><b>TLO 4.2.1</b> Recognize the role of youth in driving positive change in energy management.</p> <p><b>TLO 4.2.2</b> Understand how youth-led initiatives can influence energy policies, behaviours, and practices.</p> <p><b>TLO 4.2.3</b> Identify and promote energy-efficient practices in daily life, schools, and communities.</p>	<p>4.1.1 Avoid energy wastage</p> <p>4.2.2 Energy-efficient appliances</p> <p>4.2.3 Renewable Energy-Specific Policies and Schemes</p> <p>4.2.4 Low Carbon Lifestyles book</p>	<p>Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p> <p style="text-align: center;">4</p>
<b>SUBUNIT 3: PROMOTE SUSTAINABLE ENERGY AT HOME, INSTITUTION AND IN THE COMMUNITY</b>			
<b>4.3</b>	<p><b>TLO 4.3.1</b> Identify and calculate energy requirements at the household level and enlist ways of efficient energy usage</p> <p><b>TLO 4.3.2</b> Identify opportunities for improving public energy use in their village or town</p> <p><b>TLO 4.3.3</b> Design surveys that effectively capture data on energy-efficient appliance availability and usage patterns.</p> <p><b>TLO 4.3.4</b> Identify and analyze emerging technologies within the energy sector that require specialized skills.</p> <p><b>TLO 4.3.5</b> Demonstrate the ability to map existing skills within the energy sector workforce.</p> <p><b>TLO 4.3.6</b> Analyze skill gaps and their implications for the industry.</p>	<p>4.3.1 Energy audit at home or institution</p> <p>4.3.2 Energy saving opportunities</p> <p>4.3.3 Energy access survey</p> <p>4.3.4 Surveys of energy-efficient appliance availability and use</p> <p>4.3.5 Survey of renewable energy use</p> <p>4.3.6 Survey energy sector skilling opportunities</p> <p>4.3.7 Share study findings with policymakers</p>	<p>Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p> <p style="text-align: center;">5</p>
<b>UNIT V: BIODIVERSITY CONSERVATION AND CLIMATE ACTION</b>			
<b>SUBUNIT 1: BIODIVERSITY IN OUR LIVES</b>			
<b>5.1</b>	<p><b>TLO 5.1.1</b> Understand the concept of biodiversity and its components</p> <p><b>TLO 5.1.2</b> Clearly define the concept of biocultural diversity, explaining the interconnectedness of biological diversity (biodiversity) and cultural diversity.</p> <p><b>TLO 5.1.3</b> Clearly define the concept of human dependence on biodiversity, outlining the various ways in which humans rely on</p>	<p><b>5.1.1</b> What is biodiversity?</p> <p><b>5.1.2</b> What is Biocultural diversity?</p> <p><b>5.1.3</b> Nature of Human Dependence on Biodiversity</p> <p><b>5.1.4</b> Biodiversity resources in your landscape</p>	<p>Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a>)</p> <p style="text-align: center;">6</p>



	diverse ecosystems for survival and well-being. <b>TLO 5.1.4</b> Develop the ability to identify and categorize the various forms of biodiversity present in the specific landscape, including plants, animals, microorganisms, and their interactions.			
<b>SUBUNIT 2: THREATS TO BIODIVERSITY</b>				
5.2	<b>TLO 5.2.1</b> Categorize and differentiate between natural and anthropogenic threats to biodiversity, including habitat loss, pollution, climate change, invasive species, and overexploitation. <b>TLO 5.2.2</b> Clearly define the concepts of biocultural diversity and climate change, highlighting the interconnectedness between biological diversity, cultural diversity, and changing climatic conditions.	<b>5.2.1 Threats to biodiversity</b> <b>2.2.2 Biocultural diversity and climate change</b>	Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a> )	6
<b>SUBUNIT 3: CONSERVING BIODIVERSITY</b>				
5.3	<b>TLO 5.3.1</b> Clearly define the concept of biodiversity conservation, emphasizing its importance in maintaining ecological balance and supporting human well-being. <b>TLO 5.3.2</b> Explore the historical background that led to the development of forest acts, considering factors such as colonial influences, resource extraction, and changing societal attitudes towards forests. <b>TLO 5.3.3</b> Clearly define the concept of biodiversity conservation actions, emphasizing the multifaceted approaches and strategies employed to protect and sustain biodiversity.	<b>5.3.1</b> Approaches to conservation of biodiversity. <b>5.3.</b> Key legislations for biodiversity conservation <b>5.3.3</b> Actions for biodiversity conservation at various levels, including awareness raising and advocacy in the community	Video Lectures (Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a> )	6

**Note: All above Units are Mandatory units. (In Online mode, only Units nos 1 and 2 are Mandatory and units nos 3,4, and 5 are Elective/optional)**

#### V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

NOT APPLICABLE

**VI. SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)**

**Table 01: Individual Activities**

Sr. No	Unit Name	Activity	Activity Details
1	Living with Climate Change	Calculation of your carbon footprint online	To Calculate your carbon footprint online at <a href="https://www.unfccc.int/">https://www.unfccc.int/</a> <a href="https://www.carbonfootprint.com/">https://www.carbonfootprint.com/</a> Use two carbon footprint calculators available online to Prepare your report for Carbon footprint. Compare the calculators used and suggest which is the better calculator with the reasons.
2	Water Management and Climate Action	Conducting water audits	To conduct a Personal-level water audit. 1. Track your overall water usage: a) Read your water meter, b) Estimate usage without a meter 2. Measure individual fixture flow rates: a) Faucet and showerhead flow b) Toilet flush: 3. Monitor your water habits: a) Keep a water use log b) Observe your routines 4. Analyze your findings: a) Compare your usage to benchmarks, b) Identify potential leaks c) Prioritize areas for improvement 5. Implement water-saving strategies: a) Install water-efficient fixtures b) Shorten showers and bath times c) Run appliances only when full d) Fix leaky faucets promptly e) Utilize alternative water sources
3	Waste Management and Climate Action	Surveying Home waste	To find out How much waste is generated in your home every day conduct a home survey for a week Analyze as per the following: a) What makes up the maximum part of the waste? b) How much of what was thrown out could have been reused or recycled? c) Could the amount of garbage be reduced? List the ways to reduce waste at home. Calculate: a) Waste generated over a week (in grams) divided by 7= waste (gms)/ day, b) Waste (gms)/ day divided by the number of persons in your house= Waste (gms)/ day/capita Using your survey results, you can calculate the approximate waste generated by the entire population of a block of flats, township, village, town, city, etc.
4	Energy Management and Climate Action	Preparation of Survey report on energy-efficient appliances.	To prepare a Survey report on energy-efficient appliances, their availability and use. 1. Availability of Energy-Efficient Appliances: 2. Use of Energy-Efficient Appliances 3. Government Policies and Incentives 4. Technological Advancements 5. Environmental Impact and Consumer Trends
5	Biodiversity Conservation and Climate Action	Preparation of a Survey report on Biodiversity resources in your landscape	To prepare a Survey report on Biodiversity resources in your landscape based on any one point among the list given below. 1. List of trees, plants, and shrubs in the village/ town outskirts, their classification, occurrence, and usage study. 2. Draw a biocultural map of the landscape of the village/ town, the diversity of trees (mother trees) and those who maintain it 3. A village called Tree: Understand a tree as an ecosystem and the biodiversity associated with the tree. 4. Ranmeva special study 5. Dietary diversity across three generations, a 'change over time' study.

Table 2: Group Activity

Sr. No.	Unit Name	Community Project Name	Activity Details
1.	Living with Climate Change	Conduction of Feasibility Study of Renewable Energy	Conduct a feasibility study on implementing renewable energy sources (such as solar, wind, or hydroelectric power) for a specific area or institution. Analyze costs, benefits, environmental impacts, and logistics involved in transitioning to renewable energy.
2.	Water Management and Climate Action	Preparation of water audit for the college campus.	To prepare a water audit for the college campus based on the following points 1. Gather Information: 2. Identify Water Use Areas: 3. Assess Indoor Water Usage: 4. Evaluate Outdoor Water Usage: 5. Measurements and Inspections: 6. Data Analysis: 7. Recommendations for Conservation: 8. Cost-Benefit Analysis: 9. Create an Action Plan: 10. Implementation and Monitoring: 11. Educational Outreach: 12. Documentation and Reporting:
3.	Waste Management and Climate Action	Conduction of survey on Waste assessment in your locality.	1. Conduct a survey of waste management systems in your town/ locality. Observe all the stages of waste management, and note who is involved at each stage viz. Waste collection Transport Processing in different ways Disposal etc. 2. Analysis of waste management in your /locality. 3. Assessment of Waste Segregation in your /locality.
4	Energy Management and Climate Action	Conduction of energy audit at home or Institute	To conduct an energy audit at home or Institute based on the following points. Analyze your findings based on the energy audit and suggest necessary actions to minimize energy consumption. 1. Gather information and Create a checklist about the following. <b>1. Lighting:</b> <ul style="list-style-type: none"> <li>• Turn off lights in unoccupied rooms.</li> <li>• Replace incandescent bulbs with LEDs</li> <li>• Utilize natural light whenever possible</li> </ul> <b>2. Heating and Cooling:</b> <ul style="list-style-type: none"> <li>• Set your thermostat to energy-efficient temperatures (25°C in summer, 20°C in winter)</li> <li>• Seal air leaks around windows and doors.</li> <li>• Clean or replace air filters regularly.</li> </ul> <b>3. Appliances:</b> <ul style="list-style-type: none"> <li>• Unplug electronics and chargers when not in use.</li> <li>• Wash clothes and dishes in cold water whenever possible.</li> <li>• Use energy-efficient appliances when purchasing new ones</li> </ul> <b>4. Insulation:</b> <ul style="list-style-type: none"> <li>• Check your attic and basement for proper insulation.</li> <li>• Seal any gaps or cracks around pipes and vents.</li> </ul> <b>5. Suggest corrective actions.</b>

Sr. No.	Unit Name	Community Project Name	Activity Details
5.	Biodiversity Conservation and Climate Action	Preparation of report on Bio-Cultural Diversity Conservation	Prepare a report on Bio-Cultural Diversity Conservation. The report should include : <b>a) Introduction</b> i) What is biodiversity? ii) What is its importance in our life? iii) Connections of human beings with their nonliving surrounding and with living forms. <b>b) Biodiversity resources in your landscape -:</b> List of trees, plants, and shrubs in the village/ town outskirts, their classification, occurrence, and usage study. <b>c) Understand a tree as an ecosystem and the biodiversity associated with the tree.</b>
<p><b>Note:</b> (1) <b>Individual activities:</b></p> <p>The student should complete <b>any Three activities</b> among the list given in Table No. 01. above. ( <b>Total Marks: 30</b> i.e. 10 Marks for each activity)</p> <p>(2) <b>Group activity:</b></p> <p>Students should complete <b>any One Community Project</b> among the list given in Table No. 02 above. (<b>Total Marks: 20</b>)</p>			

#### VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	NIL ( SLA Course)	NIL

#### VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & AND ASSESSMENT PURPOSE

(Specification Table)

NOT APPLICABLE

**IX.ASSESSMENT METHODOLOGIES/TOOLS**

<b>Formative assessment (Assessment for Learning)</b>	<b>Summative Assessment (Assessment of Learning)</b>
Individual activities and group activities. (50 marks)	Online Examination and issue of online certificate. (Total 4 Certificates)

**Note: Student will be awarded 1 credit only upon submission of certificates**

- i) **One Certificate on combined completion of Units 1 and 2 and**
- ii) **One Certificate each on completion of Units nos. 3,4, and 5.**

**A total of 4 Certificates are needed to be submitted which will be issued online along with the submission of Individual activities and Group activities.**

**X. SUGGESTED COS- POs MATRIX FORM**

NOT APPLICABLE

**XI.SUGGESTED LEARNING MATERIALS/BOOKS**

<b>Sr.No</b>	<b>Description</b>	<b>Mode</b>	<b>Remarks</b>
1	Learning material.	Learning material is available in PDF form	Learning material is available for all units in PDF form at the institute website.

**XII. LEARNING WEBSITES & PORTALS**

<b>Sr.No</b>	<b>Web Link /Portal</b>	<b>Description</b>
1	(Online Mode: Link <a href="https://www.mahayouthnet.in/">https://www.mahayouthnet.in/</a> )	Learning material is available online in the course menu after registration for this online course for all units.

**XIII. ROLE OF STUDENT AND FACULTY:****(a) ROLE OF STUDENT.**

1. i) **Course Registration:** Students should register for this course by adopting the normal procedure for registration as applicable for other courses, as per the schedule declared in the academic calendar through his/her MIS login.
- ii) **Online Registration:** Online registration for this **Self-paced course “YOUTH LEADERSHIP FOR CLIMATE ACTION”** in online mode by using the URL as under.

“ URL for online registration: <https://www.mahayouthnet.in/>

Students may join the course by scanning the QR Code as mentioned below.



**(Important Note: Students must complete both actions “a” and “b” as mentioned above. Merely completing the registration process in the Institute MIS will not get the student registered for this course.)**




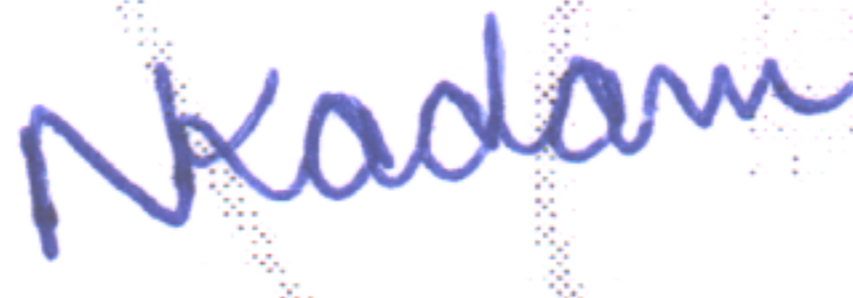

2. Students should complete the **Module No. 01 and 02** of this course in online mode and complete the online assignments as available in the online module. Upon completion of these activities, the student will receive a certificate of completion for Units No. 1 and 2. (Will be generated Online from The portal)
3. Students should take up online **Module Nos. 03, 04 and 05 (which are available as “Elective Modules” in the same online module, No separate registration is needed for these modules)** and complete all unit-wise assignments as available in the online module. Upon completion of these activities, students will receive a separate certificate of completion for each unit i.e. **Units 03,04 and 05) i.e. three certificates.** (Will be generated Online from The portal)
4. Student must submit all 4 certificates (first certificate upon completing units nos. 1 and 2 and individual certificates upon completing units nos 3,4 and 5. A Total 4 certificates are needed to be submitted to the concerned faculty assigned for this course by the Concerned Head of the Department)
5. **Most Important Note regarding the award of 1 credit for this course: student must complete any 3 individual activities among the list of activities mentioned in table no 1 above AND must complete any 1 group activity AND submit all 4 certificates (generated in online mode upon completion of all 5 units in online study mode). Upon satisfying these conditions, the student will be awarded 1 credit for this course (SLA).**
6. **Detention/ Fail:** If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as a 'fail' and will have to repeat and resubmit SLA work.

**(b) ROLE OF FACULTY:**

1. i) **Regarding confirmation of Course Registration:** Faculty should confirm that the course registration has been confirmed by the concerned registration in charge and HOD from their MIS login.  
ii) **Online Registration for the course:** Faculty should confirm that the student has registered for the course in online mode by scanning the QR code OR through the link provided by the portal for registering for the **Self-paced course “YOUTH LEADERSHIP FOR CLIMATE ACTION”** in online mode. Faculty should collect screenshots from the students and maintain a record of such screenshots for the concerned semester/term.
2. **Regarding submissions to be accepted:** The faculty should ensure that the student has completed all 5 modules as mentioned above. The faculty should get the 4 certificates (per student) submitted as submission against completion of the online self-paced course **“YOUTH LEADERSHIP FOR CLIMATE ACTION”** during the term/semester for which, the student have registered. Also, the Faculty should accept the submissions from each student regarding the completion of the group activities as well as individual activities as mentioned above. This activity of submission must be completed before the last date of submission for other courses. ie before the provisional detention schedule as per the academic calendar for that term.

3. **Regarding SLA assessment and allocation of Marks:** Faculty should assess the submission with following guidelines.

- i) Upon submission of online generated all 4 certificates (upon completion of online modules from the portal), the student should be considered eligible for the award of 1 credit along with satisfying the following conditions. ( Faculty must not assess the individual activities and group activities if the student fails to submit all 4 certificates as proof of completion of the online course)
- ii) Upon accepting the submission concerning individual activities and group activities, the assessment of these activities should be done by the faculty as per the assessment norms mentioned above in “VI” titled “**SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)**”
- iii) Faculty should preserve the record of student-wise allotted marks in the rubrics provided for SLA assessment.
- iv) FACULTY should fill UP the marks of the student in the MIS mark sheet, only if the student has completed the online course ( submitted all 4 certificates) and assessment of the group activities along with individual activities has been completed within the term schedule.
- v) In case the student fails to complete “ iv” above, the faculty should fill up the marks obtained by the student for the part-submission and fill up those marks in the MIS mark sheet.

<b>Name &amp; Signature:</b>	
 <b>Shri. Nitin D. Toradmal</b> Lecturer in Electronics Govt. Polytechnic, Pune	 <b>Shri. Balaji Vharkat</b> UNICEF, Maharashtra
 <b>Shri. Girish W. Sonone</b> Lecturer in Electronics Govt. Polytechnic, Mumbai	
<b>Name &amp; Signature:</b>	<b>Name &amp; Signature:</b>
 <b>Smt. N. S. Kadam</b> (Programme Head)	 <b>Shri. S. B. Kulkarni</b> (CDC In-charge)

## GOVERNMENT POLYTECHNIC, PUNE

‘120 – NEP’ SCHEME

PROGRAMME	DIPLOMA IN METALLURGICAL ENGINEERING
PROGRAMME CODE	05
COURSE TITLE	ELEMENTS OF MECHANICAL ENGINEERING
COURSE CODE	ME21203
PREREQUISITE COURSE CODE & TITLE	NA

### I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme						Credits	Paper Duration Hrs.	Assessment Scheme										Total Marks
			Actual Contact Hrs./Week			SLH	NLH	Theory			Based on LL & TSL				Based on SL						
			CL	TL	LL						Practical				SLA						
						FA-TH	SA-TH	Total			FA-PR	SA-PR	Max	Min	Max	Min					
ME21203	ELEMENTS OF MECHANICAL ENGINEERING	SEC	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175	

**Total IKS Hrs for Term: 0 Hrs**

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, # - External Assessment, \*# - Online Examination, @\$ - Internal Online Examination

**Note:**

**FA-TH** represents an average of two class tests of 30 marks each conducted during the semester.

- If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
- If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit SLA work.
- Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. \* 15 Weeks**
- 1 credit** is equivalent to **30 Notional hours**.
- \* Self-learning hours shall not be reflected in the Timetable.
- \* Self-learning includes micro-projects/assignments/other activities.

### II. RATIONALE:

Metallurgy Engineers often come across various engg. components for selection of materials and manufacturing processes. They are required to know basic principles of working of different machines and equipments. They are also required to look after the maintenance of the machines. It is therefore necessary for them to know how to interpret the assembly drawings, component drawings in order to carry out any engineering work.

### III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1: Draw proportionate free hand drawing of IC engine parts etc.

CO2: Develop the ability to read the drawing and identify conventional representations.

CO3: State working principal of IC engines.

CO4: State working principal of compressors, pumps etc.

CO5: Identify different power transmission devices.



## IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I ADVANCED SECTIONAL VIEWS (CL Hrs- 9, Marks- 12 )</b>				
1	TLO 1.1 Draw different types of sections. TLO 1.2 Draw sectional views of IC engine parts. TLO 1.3 Draw sectional views of pulley, gear, flanged couplings and bearings.	1.1 Types of sections: Conventional, revolved, removed, partial, offset. 1.2 Free hand sketches of Crankshaft, Engine body, camshaft, flywheel. 1.3 Free hand sketches of Pump body, pulley, gears, flanged coupling, bearing.	Chalk-Board Model Demonstration Video Demonstrations	CO1
<b>UNIT-II BLUE PRINT READING (CL Hrs- 8, Marks- 12)</b>				
2	TLO 2.1 Draw machine symbols and surface finish symbols. TLO 2.2 Identify specifications on drawing TLO 2.3 Identify limit fit and tolerance, Hole and shaft basis system.	2.1 Machine symbols, surface finish. 2.2 Specification on drawing such as material hardness, heat treatment, micro structure. 2.3 Concept of limit fit and tolerance. Hole basic system, shaft basis system.	Chalk-Board Model Demonstration Video Demonstrations	CO2
<b>UNIT-III I. C. ENGINES (CL Hrs- 10, Marks- 16)</b>				
3	TLO 3.1 Classify IC engines. TLO 3.2 Identify different IC engine parts. TLO 3.3 Describe working of two stroke petrol and four stroke petrol/diesel engines. TLO 3.4 Comparison between 2 stroke and 4 stroke cycle I.C. engine. TLO 3.5 Comparison between petrol and diesel I.C. engine.	3.1 Classification of I.C. engine, construction of I.C. engine. 3.2 I.C. engine terminology 3.3 Construction and working of 2 stroke cycle petrol engine. 3.4 Construction and working of 4 stroke cycle petrol engine. 3.5 Construction and working of 4 stroke cycle diesel engine. 3.6 Applications of I.C. engine.	Chalk-Board Model Demonstration Video Demonstrations	CO3
<b>UNIT-IV PUMPS AND COMPRESSORS (CL Hrs- 10, Marks- 16)</b>				
4	TLO 4.1 Select suitable pumps. TLO 4.2 Describe working of reciprocating pump. TLO 4.3 Describe working of centrifugal pump. TLO 4.4 Select suitable Compressors. TLO 4.5 Describe working of reciprocating Compressor.	4.1 Classification of pumps. 4.2 Construction of reciprocating pump. 4.3 Working of single acting reciprocating pump. 4.4 Construction and working of centrifugal pump. 4.5 Classification of Compressors. 4.6 Working of reciprocating Compressors. 4.7 Uses of Compressors air.	Chalk-Board Model Demonstration Video Demonstrations	CO4
<b>UNIT-V POWER TRANSMISSION DEVICES (CL Hrs- 8, Marks- 14 )</b>				
5	TLO 5.1 Identify different types of drives. TLO 5.2 Identify different types of gears. TLO 5.3 Compare between different drives. TLO 5.4 List advantages & disadvantages of different drives.	5.1 Types of Belt drive (according to shape and arrangement), Open and cross belt, Flat belt and V belt. 5.2 Chain Drives- introduction. 5.3 Classification of Gears- Spur, Helical, Bevel, Worm. 5.4 Comparison between drives. 5.5 advantages & disadvantages of different drives.	Chalk-Board Model Demonstration Video Demonstrations	CO5

**V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.**

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Draw two views from given isometric view	Draw two views from given isometric view of couplings and pulley and bearings.	4	1
2	LLO 2.1 Draw two views from given isometric view	Draw two views from given isometric view of gears and bearings.	4	1
3	LLO 3.1 Draw simple assembly	Draw simple assembly containing six parts.	4	2
4	LLO 4.1 Draw free hand sketches	Draw free hand sketches of IC engine parts	2	1
5	LLO 5.1 Identify IC engine parts	Observe IC engine parts and write function of each.	2	1,3
6	LLO 6.1 Demonstrate working of Petrol engine	Demonstrate working of Petrol engine.	2	3
7	LLO 7.1 Demonstrate working of Diesel engine.	Demonstrate working of Diesel engine.	2	3
8	LLO 8.1 Demonstrate working of centrifugal pump	Demonstrate working of centrifugal pump.	2	3
9	LLO 9.1 Demonstrate working of reciprocating pump	Demonstrate working of reciprocating pump.	2	3
10	LLO 10.1 Demonstrate working of reciprocating compressor.	Demonstrate working of reciprocating compressor.	2	3
11	LLO 11.1 Demonstrate working of belt drive	Demonstrate working of belt drive.	2	5
12	LLO 12.1 Demonstrate working of gear drive	Demonstrate working of gear drive.	2	5

**VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)****Micro project:**

Only one micro project is planned to be undertaken by student that needs to be assigned to him/her. It should preferably be undertaken individually to build up skill and confidence in every student to become problem solver so that he/she contributes to the projects of industry. In special situations where groups have to be formed for micro projects, the number of students in one group should not exceed three. A suggestive list of micro projects is given here. a. Prepare model of any suitable topic from syllabus. b. Prepare charts of suitable topics from syllabus. c. Any other suitable micro project as decided by teacher and industry expert. d. Literature survey and report writing on recent developments in any area from syllabus.

A suggestive list of micro projects is given here.

- a. Prepare model of any suitable topic from syllabus.
- b. Prepare charts of suitable topics from syllabus.
- c. Any other suitable micro project as decided by teacher and industry expert.
- d. Literature survey and report writing on recent developments in any area from syllabus.

**Assignments:**

- a. Prepare journal based on practical performed in laboratory. Journal consists of drawing, observations, required equipment's, date of performance with teacher signature.
- b. Group discussion
- c. Assignments
- d. Seminar

**VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED**

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Drawing board/minidrafter and drawing instruments, Std.specifications	1,2,3,4
2	Petrol engine with any standard specifications	5,6
3	Diesel engine with any standard specifications.	5,7
4	Centrifugal pump with any standard specifications.	8
5	Reciprocating pump with any standard specifications	9
6	Belt drive, chain drive with any standard specifications.	11
7	Different models of gears	12

**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE  
(Specification Table)**

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Advanced Sectional Views	CO1	9	4	4	4	12
2	II	Blue Print Reading	CO2	8	4	4	4	12
3	III	IC Engines Working	CO3	10	4	8	4	16
4	IV	Pumps and Compressors	CO4	10	4	8	4	16
5	V	Power Transmission Devices	CO5	8	4	6	4	14
<b>Grand Total</b>				<b>45</b>	<b>20</b>	<b>34</b>	<b>20</b>	<b>70</b>

**IX. ASSESSMENT METHODOLOGIES/TOOLS**

<b>Formative assessment (Assessment for Learning)</b>	<b>Summative Assessment (Assessment of Learning)</b>
1. Tests 2. Seminar/Presentation 3. Term Work	1. Practical 2. Theory

## X. SUGGESTED COs- POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes * (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	2	-	2	-	-	1	2	-	-	-	-
CO2	2	1	2	-	-	1	2	-	-	-	-
CO3	2	-	-	-	1	1	2	-	-	-	-
CO4	2	-	1	-	1	1	2	-	-	-	-
CO5	2	-	1	-	1	1	2	-	-	-	-

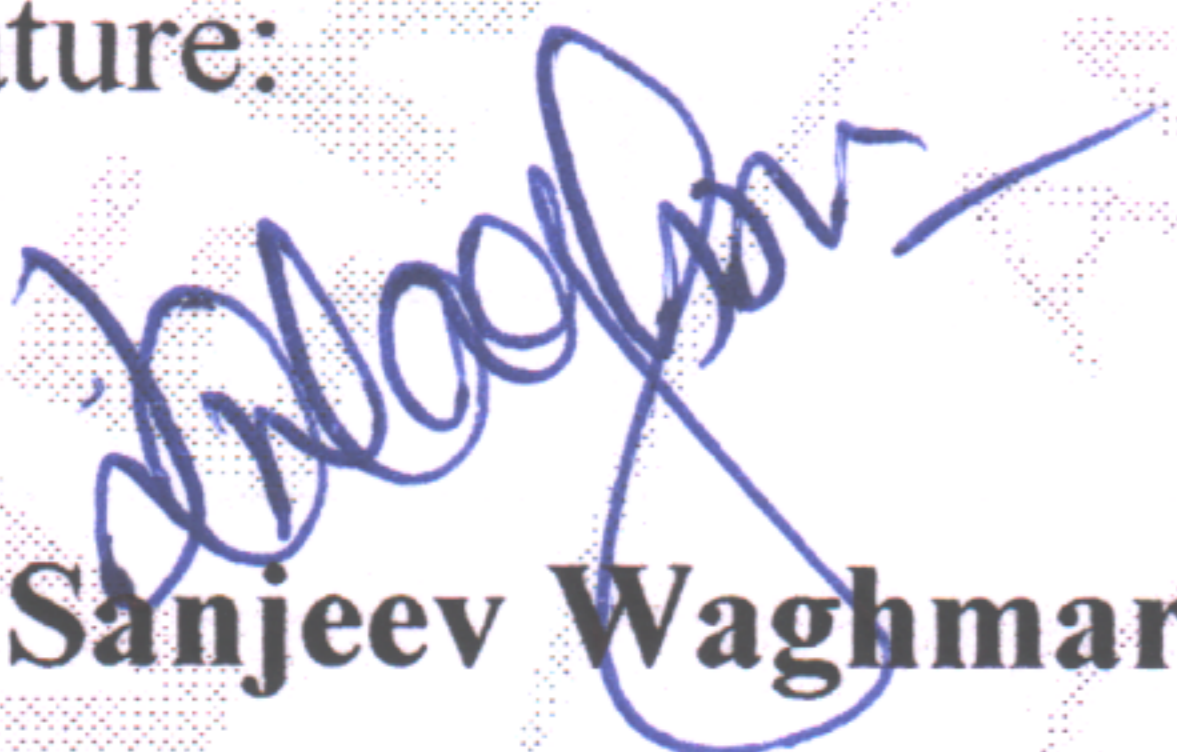



**Legends:- High: 03, Medium: 02, Low: 01, No Mapping: -**  
\*PSOs are to be formulated at the institute level

## XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher with ISBN Number
1	N.D.Bhatt	Machine Drawing	Chartor Publishing House ISBN: 9789385039232
2	N.Sidheswar, P.Kannaiah, Sastry V.V.S	Machine Drawing	McGraw Hill Education ISBN: 9780074603376
3	V.Ganesan	IC Engines	Tata Mc Graw Hill ISBN: 9781259006197
4	R. S. Khurmi	Hydraulic Machinery	S.Chand Co Ltd.,New Delhi ISBN: 9788121901628
5	Jagadish Lal	Hydraulic Machinery	Metropolitan Publishers ISBN: 9788120004405
6	S.P.Sukhatme	Heat Transfer	Tata McGraw Hill ISBN: 9788173715440

## XII. LEARNING WEBSITES &amp; PORTALS

Sr. No	Link/Portal	Description
1	<a href="https://www.youtube.com/watch?v=TEOcTMj8o7w">https://www.youtube.com/watch?v=TEOcTMj8o7w</a>	Introduction to Sections
2	<a href="https://www.youtube.com/watch?v=VO-xekz8vps&amp;pp=ygUgbGltaxQgZml0IGFsbG93YW5jZSA%3D">https://www.youtube.com/watch?v=VO-xekz8vps&amp;pp=ygUgbGltaxQgZml0IGFsbG93YW5jZSA%3D</a>	Limit, Fit, Allowance & Tolerance – Difference explained with example
3	<a href="https://www.youtube.com/watch?v=NP_yYqPx0VE">https://www.youtube.com/watch?v=NP_yYqPx0VE</a>	how to read engineering drawing - GD&T - Geometric dimensions and tolerances
4	<a href="https://www.youtube.com/watch?v=0SPn5AxVx3k">https://www.youtube.com/watch?v=0SPn5AxVx3k</a>	4 Stroke Engine Animation
5	<a href="https://www.youtube.com/watch?v=Gfz_I0GV9zk&amp;pp=ygUucHVtcCBhbmltYXRpb24gdmlkZW8%3D">https://www.youtube.com/watch?v=Gfz_I0GV9zk&amp;pp=ygUucHVtcCBhbmltYXRpb24gdmlkZW8%3D</a>	Reciprocating Pumps   Working of Single acting and Double acting reciprocating pumps
6	<a href="https://www.youtube.com/watch?v=lmjIQqo8mX4">https://www.youtube.com/watch?v=lmjIQqo8mX4</a>	Centrifugal Pumps

Name & Signature:	
 <b>Mrs. Dipika Sanjeev Waghmare</b> Lecturer in Mechanical Engineering	 <b>Ms. Vaishali Govindrao Talkit</b> Lecturer in Mechanical Engineering
(Course Experts)	
Name & Signature:	Name & Signature:
 <b>Mrs. Namita S. Kadam</b> (Programme Head)	 <b>Mr. Sudin B Kulkarni</b> (CDC In-charge)

## GOVERNMENT POLYTECHNIC, PUNE

‘120 – NEP’ SCHEME

PROGRAMME	DIPLOMA IN METALLURGICAL ENGINEERING
PROGRAMME CODE	05
COURSE TITLE	PRINCIPLES OF PHYSICAL METALLURGY
COURSE CODE	MT21201
PREREQUISITE COURSE CODE & TITLE	NA

### I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme						Credits	Paper Duration Hrs.	Assessment Scheme									
			Actual Contact Hrs./Week			SLH	NLH	Theory			Based on LL & TSL				Based on SL		Total Marks			
			CL	TL	LL			Total			Practical		SLA							
						FA-TH	SA-TH				FA-PR	SA-PR	Max	Min	Max	Min				
MT21201	PRINCIPLES OF PHYSICAL METALLURGY	SEC	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

**Total IKS Hrs for Term: 0 Hrs**

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, **IKS** – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, # - External Assessment, \*# - Online Examination, @\$ - Internal Online Examination

**Note:**

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

- If a candidate is not securing minimum passing marks in FA-PR (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
- If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit SLA work.
- Notional learning hours** for the semester are (CL + LL + TL + SL) hrs. \* 15 Weeks
- 1 credit** is equivalent to **30 Notional hours**.
- \* Self-learning hours shall not be reflected in the Timetable.
- \* Self-learning includes micro-projects/assignments/other activities.

### II. RATIONALE:

This course deals with solidification of metals and alloys. Various types of equilibrium diagrams and their relationship between microstructure and properties of metals and alloys are studied in course. It forms a vital link in the processes of making, shaping and heat treating of metals. It thus interfaces with the other areas of metallurgy such as process metallurgy, mechanical metallurgy and engineering metallurgy. Therefore, an engineering diploma student must be conversant with equilibrium diagrams, and metallography from the point of view of producing structures of metals that give the best properties. The study of these concepts and principles of physical metallurgy will develop skills in students to identify and interpret microstructures, and properties of steel, where the emphasis is laid on the application of these metals and alloys.

### III. COURSE LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve & demonstrate the following CO's on completion of course-based learning

CO1: Plot various cooling curves for pure metals and alloys.

CO2: Plot various binary equilibrium diagrams and calculate amount of phases using Lever Rule.

CO3: Interpret Iron -Iron carbide diagram Phase equilibrium diagram.

CO4: Prepare metallographic specimen and operate Metallurgical microscope for microstructure analysis.

CO5: Perform macroscopic test on steel.

## IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I SOLIDIFICATION OF METALS (CL Hrs- 06, Marks- 12)</b>				
1	<p>TLO 1.1 Describe solidification.</p> <p>TLO 1.2 Describe the nucleation and growth process during solidification.</p> <p>TLO 1.3 Compare solidification of pure metal with alloy.</p> <p>TLO 1.4 Define grain and grain boundary.</p> <p>TLO 1.5 Draw cooling curves for pure metal and alloy.</p> <p>Define Solid Solution.</p> <p>Describe different solid solutions.</p> <p>Differentiate between substitution and interstitial solid solutions.</p> <p>TLO 1.6 State and apply Hume-Rothery's principles for formation of solid solutions.</p> <p>TLO 1.7 Describe different compounds.</p>	<p>1.1 Concept of solidification- Transformation of liquid pure metal and alloys into solid.</p> <p>1.2 Nucleation and growth, dendrite formation.</p> <p>1.3 Grain and grain boundaries.</p> <p>1.4 Cooling curves for pure metals and binary alloys.</p> <p>1.5 Solid solutions - Substitutional solid solution, Interstitial solid solution &amp; Intermediate solid solution.</p> <p>1.6 Hume- Rothery's rules for formation of solid solution.</p> <p>1.7 Intermediate compounds, electron compounds, their examples.</p>	Lecture Assignment	CO1
<b>UNIT-II EQUILIBRIUM DIAGRAMS (CL Hrs- 09, Marks- 14)</b>				
2	<p>TLO 2.1 Define phase.</p> <p>TLO 2.2 Derive Gibbs phase rule for metallurgical systems.</p> <p>TLO 2.3 Construct binary equilibrium diagram.</p> <p>TLO 2.4 Derive Lever Rule.</p> <p>TLO 2.5 Determine proportions of phases by applying lever rule.</p>	<p>2.1 Definition of phase.</p> <p>2.2 Gibbs's phase rule and its application.</p> <p>2.3 Construction of equilibrium diagrams.</p> <p>2.4 Isomorphous System, Eutectic system, Partial Eutectic systems, Layer type systems.</p> <p>2.5 Lever Rule: Its derivation and application to equilibrium diagrams,</p>	Lecture Assignment Chart	CO2
<b>UNIT-III IRON-IRON CARBIDE EQUILIBRIUM DIAGRAM (CL Hrs- 12, Marks- 16)</b>				
3	<p>TLO 3.1 Define allotropy.</p> <p>TLO 3.2 Draw Fe-Fe<sub>3</sub>C diagram.</p> <p>TLO 3.4 Write transformation reactions in Iron-Iron carbide diagram.</p> <p>TLO 3.5. Classify steel based on Iron -Iron carbide diagram</p> <p>TLO 3.6 Draw microstructures of different steels.</p> <p>TLO 3.6 Describe microstructure and properties of plain carbon steels on cooling with reference to iron - iron carbide diagram.</p>	<p>3.1 Allotropic transformation of iron.</p> <p>3.2 Draw Fe-Fe<sub>3</sub>C diagram.</p> <p>3.3 Reactions in Fe-Fe<sub>3</sub>C diagram.</p> <p>3.4 Critical temperatures in Fe-Fe<sub>3</sub>C diagram.</p> <p>3.5 Classifications of plain carbon steel with reference to Fe-Fe<sub>3</sub>C diagram. (Hypo and hyper eutectoid steels)</p>	Lecture Assignment Chart	CO3

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-IV MICROSCOPIC EXAMINATION (CL Hrs- 12, Marks-16)</b>				
4	<p>TLO 4.1 Describe steps for microscopic examination.</p> <p>TLO 4.2 Describe steps for metallographic preparation of specimens.</p> <p>TLO 4.3 Define Etching.</p> <p>TLO 4.4 Describe etching techniques.</p> <p>TLO 4.5 Name etching reagents.</p> <p>TLO 4.6 Select proper etchant.</p> <p>TLO 4.7 Draw microstructures of steels.</p> <p>TLO 4.8 Use metallurgical microscope.</p> <p>TLO 4.9 Draw ray diagram of metallurgical microscope.</p> <p>TLO 4.10 State advantages of oil immersion objective.</p> <p>TLO 4.11 Define Electron Microscopy.</p> <p>TLO 4.12 State types of electron microscopes.</p> <p>TLO 4.13 State use of Image Analyzer software.</p>	<p>4.1 Define Microscopic Examination,</p> <p>4.2 Specimen Preparation: Sampling, mechanical and electrolytic polishing. Metallographic polishing abrasives polishing cloth, and cleaning methods.</p> <p>4.3 Define Etching, etching techniques and etching reagents,</p> <p>4.4 Analysis and interpretation of phases in plain carbon steel.</p> <p>4.5 Metallurgical microscope- Optical /Inverted microscope: Principle, construction and working of Optical microscope optical system, objectives, eyepiece.</p> <p>4.6 Draw ray diagram of metallurgical microscope.</p> <p>4.7 Define Electron Microscopy.</p> <p>4.8 Types of Electron Microscopes- Introduction to Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM).</p> <p>4.9 Introduction to Image Analyzer software.</p>	<p>Lecture Assignment Demonstration</p>	<b>CO4</b>
<b>UNIT- V MACROSCOPIC EXAMINATION (CL Hrs- 6, Marks- 12)</b>				
	<p>TLO 5.1 State purpose and principle of macroscopic examination.</p> <p>TLO 5.2 Describe steps for macroscopic examination.</p> <p>TLO 5.3 Explain various methods of recording macrostructures.</p> <p>TLO 5.4 Describe the Sulphur printing, phosphorus printing, and oxide printing tests.</p> <p>TLO 5.5 Enlist various types of Etching reagents for macro etching.</p> <p>TLO 5.6 To study Grain flows of forged components, hydrogen flakes.</p>	<p>5.1. Macroscopic Examination: Purpose and Principle.</p> <p>5.2 Procedure for macroscopic examinations.</p> <p>5.3 Methods of recording macrostructures by photographic and contact printing.</p> <p>5.4 Sulphur printing, phosphorus printing, and oxide printing.</p> <p>5.5 Etching reagents for macro etching,</p> <p>5.6 Grain flows of forged components, examination of fractures and other applications of macro etching.</p>	<p>Lecture Assignment Demonstration</p>	<b>CO5</b>



## V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Draw cooling curves for pure metals and alloys.	Draw cooling curves for pure metals and alloys.	4	CO1
2	LLO 2.1 Draw various binary equilibrium diagrams.	Draw various binary equilibrium diagrams.	4	CO2
3	LLO 3.1 Draw Iron -Iron carbide diagram Phase equilibrium diagram and interpret transformation reactions and critical temperature.	A) Draw Fe-Fe <sub>3</sub> C equilibrium diagram.	4	CO3
		B) To study transformation reactions in Iron-Carbon diagram. Critical temperatures in Iron- iron carbide diagram.	8	CO3
4	LLO 4.1 Develop skill for metallographic specimen preparation and operate Metallurgical microscope for microstructure analysis.	Prepare micro-specimen for metallographic observation.	8	CO4
5	LLO 5.1 Prepare etching reagent and do etching of specimen	Prepare etching reagent and do etching of specimen.	8	CO4
6	LLO 6.1 Operate and identify metallurgical microscope.	Identify and label various parts of metallurgical microscope.	8	CO4
7	LLO 7.1 Draw microstructures of plain carbon steels by microscopic observation.	Observe prepared specimen under microscope and interpret the micro structural phases. Draw microstructures of plain carbon steels by microscopic observation.	8	CO4
8	LLO 8.1 To study Phosphorus, Sulphur and oxide distribution by Phosphorous, Sulphur and oxide printing	To study Phosphorus, Sulphur and oxide distribution by Phosphorous, Sulphur and oxide printing.	8	CO5

Note: Take the practical 1 in a batch size of 20 to 30 students.

## VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)

**Micro projects-**

- Search and write different grades of materials used as abrasives in polishing of specimens.
- Search and write the information on backup materials used in specimen mounting.
- Make a report on industrial applications of quantitative metallographic techniques.
- To make a poster of an Iron -Iron carbide diagram.
- To make poster of ray diagram of optical microscope.

**Assignment**

- Study and draw cooling curves for any two pure metals. (ferrous and 1 nonferrous)
- Write any five examples of various solid solutions.
- Draw any two types of phase diagrams of metallic alloy systems (Example Cu-Ni).
- Define and derive the Lever rule with an example.
- Calculate the amount of phases present at particular temperature and composition (Select any one type of alloy).
- Study and draw Iron –Iron carbide diagram.
- Prepare posters /tables to illustrate the use of etching reagents for different metals and alloys.
- Construct equilibrium diagrams for different types of solid solutions. Eg. Cu-Ni system.
- Construct equilibrium diagram for metals partially soluble in solid state from given data.
- Study Principle, construction and working of Optical microscope
- Study Principle, construction, working and applications of Electron microscopes and compare it with optical microscopy.

**VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED**

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Standard Fe-Fe <sub>3</sub> C equilibrium diagram, Equilibrium diagram	3
2	Metallurgical Microscope with Image Analyzer software	6
3	Standard specimens (for steels)	6,7
4	Mounting press	6
5	Emery papers of different grades	6
6	Etching reagents	5,8
7	Grinder	6
8	Chart Polishing /Lapping machine	6
9	Cutting machine	6

**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE**

(Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Solidification of metals	CO1	06	04	06	02	12
2	II	Equilibrium diagrams	CO2	09	04	08	04	14
3	III	Iron –iron carbide equilibrium diagram	CO3	12	04	04	04	16
4	IV	Microscopic examination	CO4	12	04	08	04	16
5	V	Macroscopic examination	CO5	06	04	06	02	12
<b>Grand Total</b>				<b>45</b>	<b>20</b>	<b>32</b>	<b>16</b>	<b>70</b>

**IX. ASSESSMENT METHODOLOGIES/TOOLS**

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Rubrics for COs 3. Assignment 4. Self-Learning 5. Term Work 6. Seminar/Presentation	1. End Term Exam 2. Micro-project

## X. SUGGESTED COs- POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes *(PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	3	2	2	1	1	1	3	3	2	2	2
CO2	3	3	3	2	1	2	2	3	2	2	2
CO3	3	3	2	2	2	2	3	3	2	3	3
CO4	3	2	2	3	1	1	2	3	3	3	3
CO5	3	2	2	3	1	1	2	3	3	3	3

**Legends:- High: 03, Medium: 02, Low: 01, No Mapping: -**  
\*PSOs are to be formulated at the institute level

## XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher
1	Sidney H. Avner	Introduction to Physical Metallurgy	Second Edition, Tata McGraw-Hill 1997 ISBN 0-07-463006-7
2	Robert W. CAHN, Peter HAASEN	Physical Metallurgy	Volume Fourth Edition, 1996, North Holland ISBN 0 444 89875
3	Dr. V.D. Kodgire, S.V. Kodgire	Material Science and Metallurgy	Everest Publishing House, 43rd Edition ISBN 81-86314-00-8
4	V. Raghavan	Physical Metallurgy	PHI Learning Private limited

## XII. LEARNING WEBSITES &amp; PORTALS

Sr. No	Link/Portal	Description
1	<a href="https://youtu.be/2a1Ft6j1n1Q">https://youtu.be/2a1Ft6j1n1Q</a>	Solidification of metals
2	<a href="https://youtu.be/b2PRoZ0dxac">https://youtu.be/b2PRoZ0dxac</a>	Mechanism of solidification
3	<a href="https://youtu.be/VtBrmWcNu8k">https://youtu.be/VtBrmWcNu8k</a>	Equilibrium Phase diagram
4	<a href="https://www.youtube.com/watch?v=eWs6Sv4S7yU">https://www.youtube.com/watch?v=eWs6Sv4S7yU</a>	Lever rule derivation
5	<a href="https://www.youtube.com/watch?v=5vaYfd0fekI">https://www.youtube.com/watch?v=5vaYfd0fekI</a>	Iron carbide diagram
6	<a href="https://www.youtube.com/watch?v=fc8zrgYJCJw">https://www.youtube.com/watch?v=fc8zrgYJCJw</a>	Metallographic specimen preparation steps
7	<a href="https://www.youtube.com/watch?v=UuHofNW40Yw">https://www.youtube.com/watch?v=UuHofNW40Yw</a>	Etching technique and etchant preparation

Name &amp; Signature:

*Sarika*  
Mrs. Sarika Satish Aglave  
Lecturer in Metallurgical Engineering  
(Course Expert)

Name &amp; Signature:

*Nkadam*  
Mrs. Namita S. Kadam  
(Programme Head)

Name &amp; Signature:

*R. Kulkarni*  
Mr. Sudin B Kulkarni  
(CDC In-charge)

## GOVERNMENT POLYTECHNIC, PUNE

‘120 – NEP’ SCHEME

<b>PROGRAMME</b>	<b>DIPLOMA IN METALLURGICAL ENGINEERING</b>
<b>PROGRAMME CODE</b>	<b>05</b>
<b>COURSE TITLE</b>	<b>BASIC METALLURGY</b>
<b>COURSE CODE</b>	<b>MT31201</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>NA</b>

### I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme						Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH	Credits	Paper Duration Hrs.	Theory				Based on LL & TSL				Based on SL		Total Marks
			CL	TL	LL					Practical				SLA						
						FA-TH	SA-TH	Total		FA-PR		SA-PR		Max	Min					
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min							
MT31201	BASIC METALLURGY	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

**Total IKS Hrs for Term: 1 Hr**

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, **IKS** – Indian Knowledge System, **SLA**- Self Learning Assessment

**Legends:** @- Internal Assessment, # - External Assessment, \*# - Online Examination, @\$ - Internal Online Examination

**Note:**

**FA-TH** represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
2. If a candidate does not secure minimum passing marks in **SLA** (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit **SLA** work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. \* 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. \* Self-learning hours shall not be reflected in the Timetable.
6. \* Self-learning includes micro-projects/assignments/other activities.

### II. RATIONALE:

Basic metallurgy mainly deals with basic topics required for understanding metallurgical subjects. The subject is a collection of widely different basic topics such as fuels, refractory, vacuum technology, and conceptual understanding of the structure of solid materials and their properties.

### III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve and demonstrate the following CO's on completion of course-based learning

CO1: Familiar with material structure and properties.

CO2: Compare cold-working and hot-working

CO3: Select and apply various fuels for applications.

CO4: Select appropriate refractory as per applications.

CO5: State working principles of various temperature measuring device.

CO6: State role of vacuum in metallurgical applications.

## IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I INTRODUCTION (CL Hrs-01 Marks-02)</b>				
1	TLO 1.1 State the different aspects of basic metallurgy. TLO 1.2 State the area applications of Basic metallurgy. TLO 1.3 Use concepts given in Ancient Indian Metallurgy for metal working or processing to solve given problems.	1.1 Importance of metallurgy, various branches of metallurgy and scope under Indian conditions. 1.2 Ancient Indian Metallurgy for metal working or processing.e.g Blacksmithy	Improved Lecture Assignment Demonstration	CO1
<b>UNIT-II NATURE OF SOLIDS (CL Hrs-06, Marks-10)</b>				
2	TLO 2.1 Conversant with structure and unit cell, types of crystal system and designation of planes and direction with applications. TLO 2.2 Apply the concept of a defect in crystal with causes and effects.to solve the given simple engineering-related problem(s). TLO 2.3 Use of the concept of allotropic & and polymorphism in metal to investigate simple engineering works. TLO 2.4 Explain polymeric materials' properties; uses and Structure. TLO 2.5 Explain the characteristics and structure of nonmetallic materials.	2.1States of matter, types of structures (amorphous and crystalline), atomic structure of metals. 2.2 Types of crystal structure, Unit cell and Parameter, No. of atoms per unit cell of FCC, BCC, HCP and SC. 2.3 Determination of atomic packing factor and density of metal 2.4 Allotropic forms of metals & and alloys with importance. 2.5 Miller indices for planes and directions 2.6 Imperfections in the crystals - point; line and surface, with examples. 2.7 Polymorphism. 2.8 Structures of silicates, carbon, and glasses 2.9 Polymeric structure. Ceramics and their comparison with metals (Strength-to-weight ratio).	Improved Lecture Assignment Demonstration	CO1
<b>UNIT-III PLASTIC DEFORMATION (CL Hrs-06, Marks-08)</b>				
3	TLO 3.1 Compare cold and hot working of process, parameter, properties and application. TLO 3.2 Explain the annealing mechanism with applications.	3.1 Grain structure, cold working, Hot working, process, advantages, disadvantages, applications and comparison. 3.2 Mechanism of annealing, recovery recrystallisation and grain growth.	Improved Lecture Assignment Demonstration	CO2

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT- IV SOLIDS FUELS (CL Hrs-10, Marks-14 )</b>				
4	<p>TLO 4.1 Explain the term fuel and its classification.</p> <p>TLO 4.2 Classify solid fuels.</p> <p>TLO 4.3 Explain the properties and advantages of each solid fuel.</p> <p>TLO 4.4 Compare wood, peat; lignite bituminous coal and anthracite in terms of appearance, properties and uses.</p> <p>TLO 4.5 Classify bituminous coal.</p> <p>TLO 4.6 Explain the carbonization process and list various products of carbonization.</p> <p>TLO 4.7 Enlist properties and application of Metallurgical Coke or Hard Coke.</p> <p>TLO 4.8 Describe various requirements/selection criteria of fuel for a cupola Furnace or any coal-fired furnace.</p>	<p>4.1 Classifications of fuels, solid fuels classification; properties; advantages, limitations and application,</p> <p>4.2 Occurrence/origin of coal with reference to Indian conditions,</p> <p>4.3 Classifications &amp; characteristics of fuels- wood, peat, lignite, bituminous anthracite proximate analysis &amp; ultimate analysis, calorific value, units of heat energy, ignition temperature.</p> <p>4.4 Carbonization of coal-process, products and their uses.</p> <p>4.5 Properties and uses of Metallurgical coke, bi-products of coke. Use of pulverized and briquetted coal or coke.</p> <p>4.6 Selection criteria of good fuel for a particular application.</p>	Improved Lecture Assignment Demonstration	CO3
<b>UNIT –V LIQUID &amp; GASEOUS FUELS (CL Hrs-10, Marks-14)</b>				
5	<p>TLO 5.1 Explain the properties, advantages, limitations and general uses of liquid fuels.</p> <p>TLO 5.2 Classify petroleum.</p> <p>TLO 5.3 Define refinery and list various products of petroleum refining.</p> <p>TLO 5.4 Describe properties, calorific value, composition and uses of any one liquid fuel.</p> <p>TLO 5.5 Describe the manufacturing of water gas or producer gas.</p> <p>TLO 5.6 Properties and uses of LPG/BF gas.</p> <p>TLO 5.7 Describe any one liquid or gaseous fuel consisting of burners.</p>	<p>5.1 Important properties and uses of various liquid fuels.</p> <p>5.2 Resources of petroleum, classification of crude oil- properties, refining of petroleum, products and uses</p> <p>5.3 Properties, calorific value advantages, disadvantages and uses of Petrol, diesel, kerosene and furnace oil &amp; other products.</p> <p>5.4 Classification of gaseous fuels, Manufacture of water gas and producer gas fuels.</p> <p>5.5 Gaseous fuels composition. Properties and uses of Natural gas. Blast furnace gas, coke oven gas and liquefied petroleum gases. Water gas, producer gas.</p> <p>5.6 Introduction to green fuel eg. H<sub>2</sub> fuel.</p> <p>5.7 Types of flames, Burners required for combustion of liquid and gaseous fuels and their working principles.</p> <p>5.7 Regenerators &amp; recuperators.</p>	Improved Lecture Assignment Demonstration	CO3

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT –VI REFRACTORY MATERIALS (CL Hrs-06, Marks-10)</b>				
6	<p>TLO 6.1 Define and classify refractory</p> <p>TLO 6.2 Explain important properties of refractories</p> <p>TLO 6.3 Explain the PCE test of refractory.</p> <p>TLO 6.4 Explain the properties and uses of any one acidic refractory</p> <p>TLO 6.5 Explain the properties and uses of any one basic refractory</p> <p>TLO 6.6 Explain any special /neutral refractory advantages and applications.</p>	<p>6.1 Classification of refractory. General properties such as refractoriness, porosity, chemical inertness, and strength at elevated temperatures.</p> <p>6.2 Testing of refractory such as PCE test.</p> <p>6.3 Properties and application of acidic refractories such as fireclay, silica, and alumina.</p> <p>6.4 Properties and application of basic refractories such as magnesite, and chromite.</p> <p>6.5 Properties and application of neutral refractories such as carbon and special refractories like insulation materials, zirconia, and cer-wool.</p> <p>6.6 Selection of refractory for specific furnaces.</p>	Improved Lecture Assignment Demonstration	<b>CO4</b>
<b>UNIT –VII FURNACE &amp; TEMPERATURE MEASURING DEVICES (CL Hrs-05, Marks-08)</b>				
7	<p>TLO 7.1 Enlist various industrial furnaces in the metallurgical area application</p> <p>TLO 7.2 State refractory and the fuel used in the cupola furnace.</p> <p>TLO 7.3 Classification of Furnaces explain the working and uses of the shaft furnace.</p> <p>TLO 7.4 Enlist various temperature measuring devices and state their working principle.</p> <p>TLO 7.5 Explain the infrared analyzer for temperature measurement.</p>	<p>7.1 Basic types of furnaces, Use in industries</p> <p>7.2 Types of furnaces – Shaft, reverberatory, coke-fired furnace.</p> <p>7.3 Refractories used in furnaces, different fuels used in furnaces.</p> <p>7.4 Classification of temperature measuring device.</p> <p>7.5 Construction, working, advantages, disadvantages and applications of Thermocouples and Pyrometers in Metallurgical Industries.</p> <p>7.6 Introduction to Infrared analyzer for temperature measurement.</p>	Improved Lecture Assignment Demonstration	<b>CO5</b>
<b>UNIT –VIII VACCUM &amp; APPLICATION IN METALLURGY (CL Hrs-01, Marks-04)</b>				
8	<p>TLO 8.1 Explain the term vacuum with measuring unit.</p> <p>TLO 8.2 Enlist various vacuum-producing pumps.</p> <p>TLO 8.3 Explain the working of vacuum pumps.</p> <p>TLO 8.4 Enlist and explain areas of vacuum in metallurgical applications.</p>	<p>8.1 Define vacuum. Unit of vacuum.</p> <p>8.2 Method of vacuum production, equipment, and its working principles.</p> <p>8.3 Application of Vacuum Metallurgy.</p>	Improved Lecture Assignment Demonstration	<b>CO6</b>

**V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.**

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 (a) Calculate atomic packing density & and theoretical density of metal by knowing crystal structure. (b) Draw planes & and directions in the unit cell of the crystal (c) identify & and compare various crystal defects.	A: Study of Crystal structures F.C.C., B.C.C., H.C.P., structures to be studied with the help of models, sketching structures, B: Miller indices planes and direction with the help of models and sketches. C: Study of Point, line and surface Crystal defect with models and sketch.	16	CO1
2	LLO 2.1 Proximate analysis of coal and coke.	Determination of moisture content, volatile matter, ash content & and carbon % in coal and coke.	12	CO3
3	LLO 3.1 Calculate the Calorific value of solid (coal/ coke) fuel.	Determination of calorific value of coal and coke by using a bomb calorimeter.	8	CO3
4	LLO 4.1 Study of flash point apparatus.	Determination of flash point of liquid fuel such as furnace oil.	4	CO3
5	LLO 5.1 Familiar with the working of oil burners.	Study of different types of oil burners of furnaces.	4	CO3
6	LLO 6.1 Familiar with the working of gas burners.	Study of burners used for gas fuels.	4	CO3
7	LLO 7.1 Measure mechanical properties of refractories.	Determination of cold crushing strength and porosity of different refractories.	8	CO4
8	LLO 8.1 Visual inspection of refractories	Identification of various types of refractories and physical defects such as chips, cracks etc.	4	CO4

**VI. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)****Micro projects-**

- Model of Crystal unit cell: Prepare model or sketch 3D or isometric diagram of cubic –SC, FCC, BCC & HCP.
- Miller indices to plot planes & and direction in unit cell: Collect data and plot given planes and direction in given sketch.
- Model or sketch of crystal defects: Prepare models or sketches using a tennis ball or 3-D diagram. Collect information about the cause of defects.
- **Data Analysis of solid, liquid and gaseous fuels:** Collect data on quality control analysis, energy efficiency assessment, environmental monitoring, and process optimization. Analyze the data, calculate composition, Physical Properties & and thermal properties (CV), and create a presentation, including short videos, to present your findings.
- **Burners of liquid fuel and gaseous fuels of melting or HT furnaces:** Prepare design or drawing using information and collect data r information regarding the working and performance of burners in fuels.
- **Properties & application of different furnace refractories:** Create an information sheet using the proper properties of the refractories with respect to given furnace n.
- **Construction of fuel-fired furnace or Model:** Design a model or furnace using construction details and working principles.
- **Induction furnace:** create animations or collect videos showing working principles & and effective melting.
- **Temperature measuring devices:** Develop a list, working, construction, and specification details of various thermocouples, sugar cones or any high-temperature measuring instruments or pyrometry.
- **Applications of vacuum in Metallurgy:** Collect and present applications of vacuum in various fields such as in vacuum melting, vacuum heat treatment & and vacuum casting a 5-minute video presentation.



**Assignments –**

- Collect examples based on real-world applications of basic metallurgical principles and make a PDF file.
- Calculate the theoretical density using unit cell & atomic area of particular metals
- Collect examples of crystal defects and prepare a PDF file.
- Collect information about various natural and synthetic solid fuels in terms of chemical composition, physical properties, CV and uses eg peat, lignite, bituminous coal & anthracite and Make a PDF file.
- Collect information about various natural & synthetic liquid fuels in terms of chemical composition, physical properties, CV, and uses and Make a PDF file.
- Collect information about various natural and synthetic gas fuels in terms of chemical composition, physical properties, CV, and uses and Make a PDF file.
- Collect information and make information sheets for various refractories.
- Collect information about the construction & working of furnaces and make information sheets for various furnaces.
- Collect at least 05 examples of the use of temperature-measuring devices or pyrometers in the metallurgical field.

**VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED**

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Models of crystal structure and defects	1
2	Bomb calorimeter, micro oven, muffle furnace, Models of industrial gas or oil burners	2,3,4,5,6
3	Weigh balance, UTM	7

**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)**

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction	CO1	1	1	1	-	02
2	II	Nature of Solids	CO1	6	2	4	4	10
3	III	Plastic Deformation	CO2	6	2	2	4	08
4	IV	Solid Fuels	CO3	10	4	4	6	14
5	V	Liquid & Gaseous Fuels & Furnaces	CO3	10	4	4	6	14
6	VI	Refractory Materials	CO4	6	3	3	4	10
7	VII	Furnace & Temperature Measuring devices	CO5	5	2	2	4	08
8	VIII	Vacuum & Application In Metallurgy	CO6	1	1	1	2	04
<b>Grand Total</b>				<b>45</b>	<b>19</b>	<b>21</b>	<b>30</b>	<b>70</b>

**IX. ASSESSMENT METHODOLOGIES/TOOLS**

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Assignment 3. Self-Learning 4. Term Work	1. End Term Exams

## X. SUGGESTED COs- POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	3	2	2	2	2	1	2	3	1	2	1
CO2	3	1	1	2	1	-	2	3	1	2	1
CO3	3	2	2	2	1	-	2	3	2	2	1
CO4	2	2	1	3	2	2	2	3	2	2	1
CO5	1	2	2	2	2	2	2	3	2	2	1
CO6	1	1	2	-	2	1	-	2	-	-	1

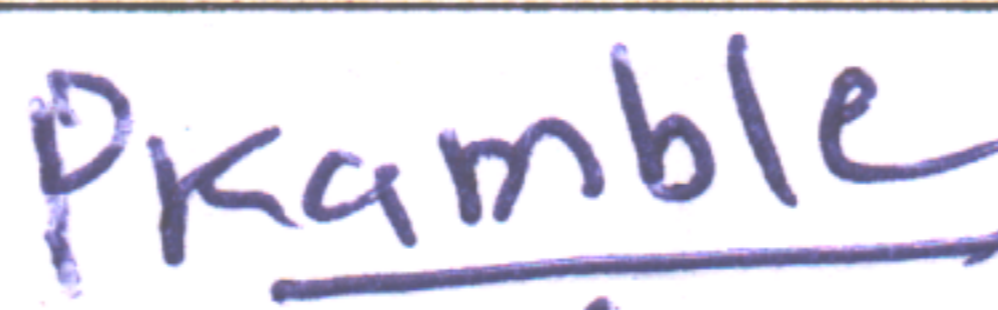


**Legends:- High: 03, Medium: 02, Low: 01, No Mapping: -**  
 \*PSOs are to be formulated at the institute level

## XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr. No	Author	Title	Publisher
1	Francis	Fuel Technology Vol I & II	Pergaman Press, London
2	D. Swarup	Elements of Metallurgy	Rastogi Publication, Meerut ISBN-10: 8171338135 ISBN-13: 9788171338139
3	Gilchrist J.D.	Fuels & Refractories	Perganson Press, London ISBN-10:0080204295 ISBN13:9780080204291
4	O.P. Gupta	Elements of Fuels, Refractories	Oxford Press ISBN-10:8174090886 ISBN13:9788174090881
5	Dr.V.D. Kodgire, S.V. Kodgire	Material Science and Metallurgy	Everest Publishing House, 43rd Edition ISBN: 81-86314-00-8

## XII. LEARNING WEBSITES &amp; PORTALS

Sr. No	Link/Portal	Description
1.	<a href="https://www.youtube.com/watch?v=ZhneRTIQcJo&amp;list=PLTRfC2ohxTauriO03RgT_ps_bicjD19Pbb">https://www.youtube.com/watch?v=ZhneRTIQcJo&amp;list=PLTRfC2ohxTauriO03RgT_ps_bicjD19Pbb</a>	Unit cell and structure
2.	<a href="https://www.youtube.com/watch?v=X1ZSqLXROpg&amp;list=PLpSo8psGcEo1CQu8kp7vuMSh1_TzXiBoL">https://www.youtube.com/watch?v=X1ZSqLXROpg&amp;list=PLpSo8psGcEo1CQu8kp7vuMSh1_TzXiBoL</a>	Fuels- types and uses

Name & Signature:  <b>Mr. Pravin B. Kamble</b> Lecturer in Metallurgical Engineering (Course Expert)	
Name & Signature:  <b>Mrs. Namita S. Kadam</b> (Programme Head)	Name & Signature:  <b>Mr. Sudin B Kulkarni</b> (CDC In-charge)

**GOVERNMENT POLYTECHNIC, PUNE**

'120 – NEP' SCHEME

<b>PROGRAMME</b>	<b>DIPLOMA IN CE/ME/MT</b>
<b>PROGRAMME CODE</b>	<b>01/04/05</b>
<b>COURSE TITLE</b>	<b>APPLIED PHYSICS</b>
<b>COURSE CODE</b>	<b>SC11204</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>NA</b>

**I. LEARNING & ASSESSMENT SCHEME**

Course Code	Course Title	Course Type	Learning Scheme					Credits	Paper Duration Hrs.	Assessment Scheme										Total Marks
			Actual Contact Hrs./Week			SLH	NLH			Theory	Based on LL & TSL				Based on SL					
			CL	TL	LL						Practical		SLA							
						FA-TH	SA-TH			Total		FA-PR	SA-PR	Max	Min					
SC11204	APPLIED PHYSICS	DSC	3	0	2	1	6	3	2	30	70*#	100	40	25	10	25@	10	25	10	175

**Total IKS Hrs for Term: 02 Hrs**

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @- Internal Assessment, # - External Assessment, \*# - Online Examination, @\$ - Internal Online Examination

**Note:**

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in FA-PR (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are (CL + LL + TL + SL) hrs. \* **15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours**.
5. \* Self-learning hours shall not be reflected in the Timetable.
6. \*Self-learning includes micro-projects/assignments/other activities.

**II. RATIONALE:**

This course is designed with some fundamental information to help diploma engineers apply the basic concepts and principles of physics to solve broad-based engineering problems. The study of basic principles and the concepts of motion, elasticity, viscosity, surface tension, sound, heat, optics, photo electricity and X-rays will help in understanding the technology courses where emphasis is laid on the applications.

**III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)**

Students will be able to achieve and demonstrate the following CO's on completion of course-based learning

- CO1: Estimate errors in measurement and Apply laws of motion in various applications.
- CO2: Select relevant material in industries by analyzing its physical properties.
- CO3: Apply the concept of simple harmonic motion, resonance and ultrasonic waves for various engineering applications.
- CO4: Use basic principles of heat in related engineering problems.
- CO5: Use basic principles of optics in related engineering problems.
- CO6: Apply the concept of modern Physics (X-rays, LASER, Photocell) for various engineering

applications.

#### IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I GENERAL PHYSICS (CL Hrs-7, Marks-12)</b>				
1	<p><b>TLO 1.1</b> List fundamental and derived quantities with their unit. Explain the procedure of measuring the dimensions of a given object by using Vernier Calipers and Screw Gauge.</p> <p><b>TLO 1.2</b> Calculate the angular velocity of the given body. Derive equations of Angular motion.</p> <p><b>TLO 1.3</b> To Study range, angle of projection and maximum height of projectile.</p>	<p><b>1.1 Units and Measurements:</b> Introduction, Definition of unit, Fundamental and derived units, Different System of units, Dimensions of physical quantities, measurement errors.</p> <p><b>1.2 Angular Motion:</b> Definition, radius vector, angular displacement, angular velocity, angular acceleration and units, relation between linear and angular velocity, relation between linear acceleration and angular acceleration. Analytical Treatment.</p> <p><b>1.3 Projectile motion:</b> Projectile motion, trajectory, range of projectile, angle of projection, time of flight.</p>	Chalk and board Improved lecture, Tutorial Assignment Demonstration	CO1
<b>UNIT-II PROPERTIES OF MATTER (CL Hrs -10, Marks-14)</b>				
2	<p><b>TLO 2.1</b> Apply the concept of elasticity and plasticity to select the material for engineering applications.</p> <p><b>TLO 2.2</b> Apply the concept of Surface Tension to find the coefficient of Viscosity.</p> <p><b>TLO 2.3</b> Establish a relation between given types of moduli of elasticity.</p>	<p><b>2.1 Surface Tension:</b> Definition and unit, molecular theory of surface tension, Cohesive and adhesive forces, angle of contact and its significance, the shape of the liquid surface in a capillary tube, capillary action and examples, surface tension by capillary rise method (no derivation), effect of impurity and temperature on surface tension. analytical treatment.</p> <p><b>2.2 Viscosity:</b> Definition, velocity gradient and its unit, Newton's law of viscosity, terminal velocity, Stokes law, Stokes formula, coefficient of viscosity by Stokes method (no derivation), types of flow of liquid - streamline flow, turbulent flow, Reynold's number (significance), applications and analytical treatment.</p> <p><b>2.3 Elasticity:</b> Deforming Force and Restoring Force, Elasticity, Plasticity,</p>	Chalk and board Improved lecture, Tutorial Assignment Demonstration Educational Games	CO2

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		Rigidity. Stress and Strain and their types, elastic limit and Hooke's law, types of moduli of elasticity, analytical treatment.		
<b>UNIT-III WAVES &amp; OSCILLATIONS (CL Hrs-07, Marks-10)</b>				
3	<p><b>TLO 3.1</b> To study the properties of sound waves.</p> <p><b>TLO 3.2</b> Find the parameters required to analyze the given wave motion and simple harmonic motion.</p> <p><b>TLO 3.3</b> Explain the concept of resonance and its applications.</p> <p><b>TLO 3.4</b> Describe the properties of given ultrasonic waves.</p>	<p><b>3.1 Sound:</b> Sound waves, amplitude, frequency, time-period, wavelength and velocity of the wave, the relation between velocity, frequency and time-period of a wave. Analytical Treatment.</p> <p><b>3.2 SHM:</b> Simple Harmonic Motion, Uniform Circular Motion as Simple Harmonic Motion, Equation of Simple Harmonic Motion, Phase of Simple Harmonic Motion.</p> <p><b>3.3 Resonance:</b> Resonance concept in prehistoric times, the concept of different frequencies (Mantras) used to ignite different chakras in the body (IKS). Applications of resonance.</p> <p><b>3.4 Ultrasonic waves:</b> Properties of ultrasonic waves. Applications of ultrasonic waves.</p>	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO3
<b>UNIT- IV HEAT (CL Hrs-6, Marks-10)</b>				
4	<p><b>TLO 4.1</b> To study different Gas laws.</p> <p><b>TLO 4.2</b> Distinguish Between Good Conductors and Bad Conductors of Heat.</p> <p><b>TLO 4.3</b> Introduction of Thermodynamics</p>	<p><b>4.1 Gas Laws:</b> Explanation of Gas laws, Boyle's law, Charles law, Gay Lussac's law, General Gas Equation, analytical treatment, units of temperature <math>^{\circ}\text{C}</math>, <math>^{\circ}\text{K}</math>, <math>^{\circ}\text{F}</math> with their conversion, absolute scale of temperature.</p> <p><b>4.2 Heat:</b> modes of heat transfer, conduction, convection and radiation.</p> <p><b>4.3</b> Introduction of Thermodynamics</p>	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO4
<b>UNIT –V OPTICS (CL Hrs-6, Marks-10)</b>				
5	<p><b>TLO 5.1</b> State laws of reflection and refraction. Describe the phenomenon of total internal reflection.</p> <p><b>TLO 5.2</b> Distinguish between optical fibre communication systems and ordinary systems.</p>	<p><b>5.1 Light:</b> Introduction to reflection and refraction of light, laws of reflection and refraction, Snell's law, refractive index, physical significance of refractive index, critical angle, total internal reflection of light.</p>	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO5

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		<b>5.2 Fiber optics:</b> Propagation of light through optical fiber, the structure of the optical fiber, numerical aperture, acceptance angle, acceptance cone, types of optical fibers, applications of optical fiber, comparison of optical fiber communication with electrical cable communication, analytical treatment.		
<b>UNIT - VI MODERN PHYSICS (CL Hrs-9, Marks-14)</b>				
	<p><b>TLO 6.1</b> Explain the properties of photons based on Planck's hypothesis.</p> <p><b>TLO 6.2</b> Explain the construction and working of a given photoelectric device.</p> <p><b>TLO 6.3</b> Explain the method to produce X-rays with its properties and engineering applications.</p> <p><b>TLO 6.4</b> Differentiate between LASER and ordinary light.</p> <p><b>TLO 6.5</b> Describe the properties of nanomaterials.</p>	<p><b>6.1 Photoelectricity:</b> Planck's hypothesis, properties of photons. Photoelectric effect: threshold frequency, threshold wavelength, stopping potential, Work function, characteristics of the photoelectric effect, Einstein's photoelectric equation Photoelectric cell and LDR: Principle Working and applications.</p> <p><b>6.2 X-rays:</b> Production of X-rays by modern Coolidge tube, properties and engineering applications.</p> <p><b>6.3 LASER:</b> Laser: properties, absorption, spontaneous and stimulated emission, Population inversion, active medium, optical pumping, three energy level system, He-Ne Laser. Engineering applications of Laser.</p> <p><b>6.4</b> Introduction to Nanotechnology.</p>	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO6

**V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.**

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO1.1 Use of given instrument and i) Mention name and range of the given instrument. ii) Calculate the least count of the given instrument. iii) List the uses of the given instrument.	Identify the given instrument and i) Mention the name and range of the given instrument. ii) Calculate the least count of the given instrument. iii) List the uses of the given instrument.	2	CO1
2	LLO 2.1 Use a Vernier caliper to	Measurements of dimensions of the given	2	CO 1

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
	Measure the dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 2.2 Estimate the errors in measurement	object by Vernier caliper.		
3	LLO 3.1 Use a Micrometer Screw gauge to Measure the dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 3.2 Estimate the measurement errors.	Measurements of dimensions of given objects by micrometer screw gauge.	2	CO1
4	LLO 4.1 Study of Projectile motion.	Predict the range of the projectile from the initial launch speed and angle.	2	CO1
5	LLO 5.1 Use Capillary Rise Method to study Surface Tension.	Determine surface tension by capillary rise method.	2	CO2
6	LLO 6.1 Use Stokes's method to determine the coefficient of viscosity.	Measure the coefficient of viscosity of a given liquid using Stokes's method (Stokes law).	2	CO2
7	LLO 7.1 Use Hooke's Law to calculate Spring constant.	Calculate the spring constant using Hooke's law.	2	CO2
8	LLO 8.1 Use a resonance tube to determine the velocity of sound. (Concept of resonance).	Determine the velocity of sound by using a Resonance Tube. (Concept of resonance).	2	CO3
9	LLO 9.1 Use a simple pendulum to determine the acceleration due to gravity.	Determination of Acceleration due to Gravity by Simple Pendulum.	2	CO3
10	LLO 10.1 Use Boyle's Law to study the relation between pressure and volume for a given gas.	Verify Boyle's law and establish a relation between pressure and volume for a given gas.	2	CO4
11	LLO 11.1 Use the Refraction Phenomenon to determine the refractive index of the glass slab.	Determination of the refractive index of the glass slab.	2	CO5
12	LLO 12.1 Use of He-Ne laser beam, to study properties of LASER.	Study the properties and working of the laser using a He-Ne laser beam.	2	CO6
13	LLO 13.1 Use photoelectric cells to study the effect of : Intensity of light on photoelectric current.	Study the effect of the Intensity of light on photoelectric current.	2	CO6



Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
14	LLO 14.1 Use photoelectric cells to study the effect of : Applied potential on photoelectric current.	Study effect of Applied potential on photoelectric current. using Photoelectric cell	2	CO6
15	LLO 15.1 Study of Divergence of LASER.	Determine the divergence of laser beam	2	CO6

**Note:** A suggestive list of practical LLOs is given in the table, more such practical LLOs can be added to attain the COs and competency. A judicious mix of a minimum of 12 or more for physics practical LLOs needs to be performed so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry. ii. Hence, the 'Process' and 'Product' related skills associated with each LLOs of the laboratory work are to be assessed according to a suggested sample of Performance Indicators (Weightage in %) as follows:

- 1) Preparation of experimental set up 20%
- 2) Setting and operation 20%
- 3) Safety measures 10%
- 4) Observations and Recording 10%
- 5) Interpretation of result and Conclusion 20%
- 6) Answer to sample questions 10%
- 7) Submission of the report in time 10%.

#### VI. SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT(SELF-LEARNING)

Only one Micro Project is planned to be undertaken by a student assigned to him/her at the beginning of the semester. She/He ought to submit it by the end of the semester to develop industry-oriented COs. Each micro-project should encompass two or more COs. The Micro-Project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. The assessment of the micro-project is to be done under Self Learning Assessment (SLA). The Micro Project is preferably assigned to a group of (4-6) students or an individual taking into consideration the capabilities and circumstances at the time.

A suggested list is given here. A similar micro-project/ Assignment could be added by the concerned faculty.

#### Micro project:

- Vernier calipers: Prepare prototype vernier caliper of desired least count using card sheet
- Properties of matter: Prepare a chart of different viscous liquids.
- Sound: Prepare a chart of the velocity of sound in different materials.
- Heat: Collect good and bad conducting materials of heat
- Mobile applications: Use mobile applications for conversions of different physical quantities.
- Optical Fiber and TIR: Prepare model to demonstrate total internal reflection
- Physical quantities: Prepare a Chart on comparison of systems of units for different physical quantities.

- LASER: Prepare a chart to study Total Internal Reflection.
- X-rays/Photoelectric cell: Prepare a chart showing the properties and applications of X-rays and Photoelectric cells.

**Assignment:**

- Convert the units of a given physical quantity from one system of units to another.
- Prepare a chart to summarize units and measurements.
- Distinguish between transverse waves and longitudinal waves based on frequencies explain infrasonic waves, audible sound waves and ultrasonic waves.
- Collect different elastic materials and mention their Young's modulus.
- Demonstrate the variation of the angle of refraction with respect to the refractive index.
- Use a digital vernier caliper and micrometer screw gauge for measurements (lab-based).
- Applications of optical fibers in, engineering.
- Applications of X-Ray in engineering.
- Applications of LASER in engineering.
- Applications of Photoelectricity in engineering.

**VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED**

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Vernier Calliper : Range: 0-15 cm, Resolution 0.01 cm.	2
2	Micrometer screw gauge: Range 0-25 mm, Resolution 0.01 mm.	3
3	Simple pendulum, Stop Watch.	4
4	Glass Slab 75x50x12mm.	10
5	Travelling microscope: Range: 0.05-22 cm, Resolution 0.001 cm, Capillary tube	5
6	Battery eliminator (0-12 V, 2 A)	11,12,13
7	Voltmeter(0-10 V), ammeter (0-5 A)	1
8	Boyle's law apparatus.	10
9	Stoke's apparatus, Wooden scale, Small metal sphere.	6
10	Hooke's law apparatus	7
11	Resonance tube, Tuning fork set, Rubber pad.	8
12	Photoelectric cell.	12,13
13	He-Ne laser kit	11

**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE****(Specification Table)**

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R - Level	U - Level	A - Level	Total Marks
1	I	General Physics	CO1	7	3	4	5	12
2	II	Properties of Matter	CO2	10	4	4	6	14
3	III	Waves And Oscillations	CO3	7	3	3	4	10
4	IV	Heat	CO4	6	3	4	3	10
5	V	Optics	CO5	6	3	4	3	10
6	VI	Modern Physics	CO6	9	4	5	5	14
<b>Grand Total</b>				<b>45</b>	<b>20</b>	<b>24</b>	<b>26</b>	<b>70</b>

**IX. ASSESSMENT METHODOLOGIES/TOOLS**

<b>Formative assessment (Assessment for Learning)</b>	<b>Summative Assessment (Assessment of Learning)</b>
Two Unit Tests of 30 marks and the average of two unit tests. For Laboratory Learning 25 MARKS	End Semester assessment of 25 marks for laboratory learning. End Semester assessment of 70 marks (Online)

**X. SUGGESTED COs- POs MATRIX FORM**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline - Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	-	1	1	1	2			
CO2	3	2	1	2	1	1	2			
CO3	3	1	1	1	1	1	2			
CO4	3	1	1	1	1	1	2			
CO5	3	1	1	1	1	1	2			
CO6	3	1	1	2	2	1	2			

**Legends:-High:03, Medium:02, Low:01, NoMapping:-**  
\*PSOs are to be formulated at the institute level

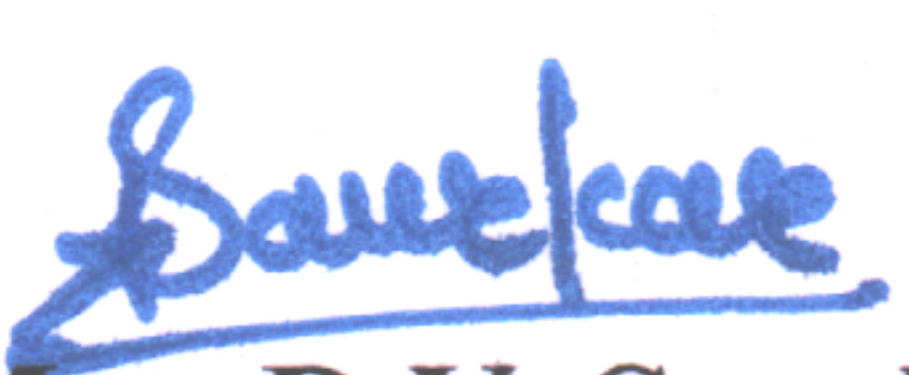
## XI. SUGGESTED LEARNING MATERIALS/BOOKS


Sr.No.	Author	Title	Publisher with ISBN Number
1	Narlikar J. V. ;Joshi , A. W.; Mathur, Anuradha ; et al	Physics Textbook Part I - Class XI	National Council of Education Research and Training, New Delhi, 2010, ISBN: 8174505083
2	Narlikar, J.V.;Joshi , A. W.; Mathur, Anuradha ; et al	Physics Textbook Part II - Class XI	National Council of Education Research and Training, New Delhi, 2015, ISBN: 8174505660
3	Narlikar J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part I - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN: 8174506314
4	Narlikar, J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part II - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN: 8174506713


## XII. LEARNING WEBSITES &amp; PORTALS

Sr.No	Link/Portal	Description
1	<a href="http://www.sciencejoywagon.com/physicszone">www.sciencejoywagon.com/physicszone</a>	Electricity, Magnetism and Semiconductors, basic fiber optics
2	<a href="https://phet.colorado.edu">https://phet.colorado.edu</a>	Electricity, Magnetism and Semiconductors, Thermometry and basic fiber optics
3	<a href="http://www.physicsclassroom.com">www.physicsclassroom.com</a>	Concepts of basic physics
4	<a href="http://nptel.ac.in/course.php?disciplineId=104">http://nptel.ac.in/course.php?disciplineId=104</a>	Concepts of basic physics
5	<a href="http://hperphysics.phy-astr.gsu.edu/hbase/hph.html">http://hperphysics.phy-astr.gsu.edu/hbase/hph.html</a>	Concepts of basic physics
6	<a href="https://www.youtube.com/results?search_query=amruta+university+physics+expts">https://www.youtube.com/results?search_query=amruta+university+physics+expts</a>	Concepts of basic physics
7	<a href="https://www.youtube.com/results?search_query=physics+class+11+chapter+1">https://www.youtube.com/results?search_query=physics+class+11+chapter+1</a>	Concepts of basic physics
8	<a href="https://www.youtube.com/watch?v=zRGh9_a1J7s">https://www.youtube.com/watch?v=zRGh9_a1J7s</a>	Concepts of basic physics
9	<a href="https://iksindia.org">https://iksindia.org</a>	IKS physics
10	<a href="https://www.ancient-origins.net/history-famous-people/indian-sageacharya-kanad-001399">https://www.ancient-origins.net/history-famous-people/indian-sageacharya-kanad-001399</a>	IKS Philosophy of atom by Acharya Kanad.


Name &amp; Signature:

  
**Mrs. D.V. Saurkar**  
 Lecturer in Physics

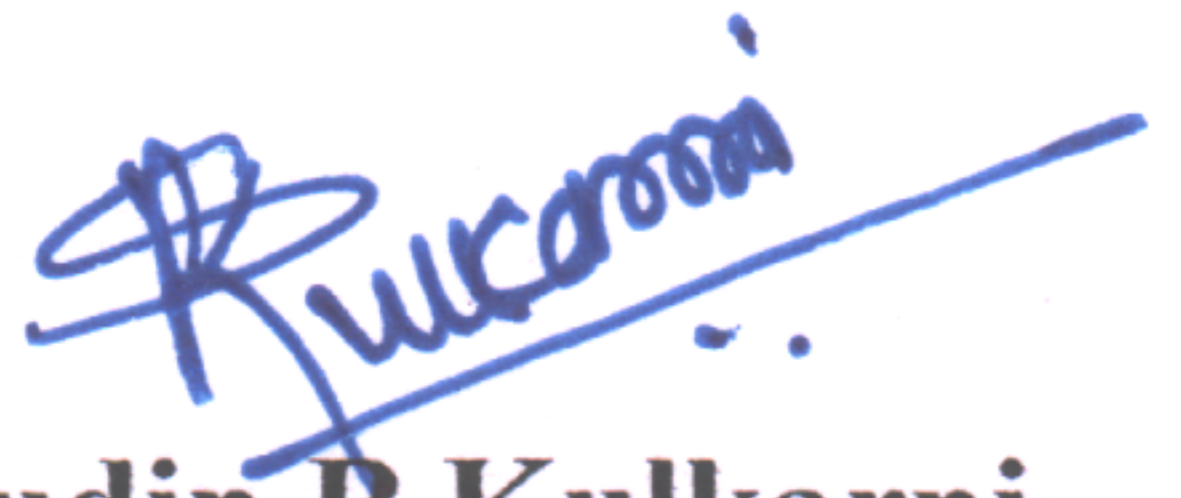
  
**Mr. N.S. Salave**  
 Lecturer in Physics  
 (Course Experts)

  
**Mr. A.D. Ghorpade**  
 Lecturer in Physics

Name &amp; Signature:

  
**Mrs. Namita S. Kadam**  
 (Programme Head)

Name &amp; Signature:

  
**Mr. Sudin B Kulkarni**  
 (CDC In-charge)

**GOVERNMENT POLYTECHNIC, PUNE**  
**'120 – NEP' SCHEME**

<b>PROGRAMME</b>	<b>DIPLOMA IN CE/EE/ET/ME/MT/CM/IT</b>
<b>PROGRAMME CODE</b>	<b>01/02/03/04/05/06/07</b>
<b>COURSE TITLE</b>	<b>APPLIED MATHEMATICS</b>
<b>COURSE CODE</b>	<b>SC11207</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>BASIC MATHEMATICS (SC11205/SC11206)</b>

**I. LEARNING & ASSESSMENT SCHEME**

Course Code	Course Title	Course Type	Learning Scheme						Credits	Paper Duration Hrs.	Assessment Scheme										Total Marks
			Actual Contact Hrs./Week			SLH	NLH	Theory			Based on LL & TSL				Based on SL						
			CL	TL	LL			FA-TH			SA-TH	Total		FA-PR		SA-PR		SLA			
						Max	Min					Max	Min	Max	Min	Max	Min				
SC11207	<b>APPLIED MATHEMATICS</b>	AEC	3	1	-	-	4	2	3	30	70	100	40	-	-	-	-	-	-	-	100

**Total IKS Hrs for Term: 6 Hrs**

**Abbreviations:** CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS – Indian Knowledge System, SLA- Self Learning Assessment

**Legends:** @-Internal Assessment, #- External Assessment, \*# - Online Examination, @\$ - Internal Online Examination

**Note:**

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

- If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as '**Detained**' in that semester.
- If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as '**fail**' and will have to repeat and resubmit SLA work.
- Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. \* 15 Weeks**
- 1 credit** is equivalent to **30 Notional hours**.
- \* Self-learning hours shall not be reflected in the Timetable.
- \*Self-learning includes micro-projects/assignments/other activities.

**II. RATIONALE:**

An Applied Mathematics course, covering integration, definite integration, differential equations, numerical methods, and probability distribution, equips engineering students with essential problem-solving tools. It enables them to model and analyze complex systems, make informed decisions and address real-world engineering challenges effectively.

**III. COURSE-LEVEL LEARNING OUTCOMES(CO'S)**

Students will be able to achieve and demonstrate the following CO's on completion of course-based learning

CO1: Apply Solve the broad-based engineering problems of integration using suitable methods.

CO2: Use definite integration to solve given engineering-related problems.

CO3: Apply the concept of differential equations to find the solutions of given engineering problems.

CO4: Employ numerical methods to solve programme-specific problems.

CO5: Use probability distributions to solve elementary engineering problems.

## IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>UNIT-I Indefinite Integration (CL Hrs-15, Marks-20)</b>				
1	<p>TLO1.1 Solve the given simple problem(s) based on rules of integration.</p> <p>TLO1.2 Evaluate the given simple integral(s) using the substitution method.</p> <p>TLO1.3 Integrate given simple functions using the integration by parts</p> <p>TLO1.4 Solve the given simple integral by partial fractions</p>	<p><b>Unit - I Indefinite Integration</b></p> <p>1.1 Simple Integration: Rules of integration and integration of standard functions</p> <p>1.2 Integration by substitution.</p> <p>1.3 Integration by parts.</p> <p>1.4 Integration by partial fractions (only linear non-repeated factors at the denominator of the proper fraction).</p>	<p>Improved Lecture</p> <p>Demonstration</p> <p>Chalk-Board</p> <p>Presentations</p> <p>Video Demonstrations</p>	<b>CO1</b>
<b>Unit - II Definite Integration (CL Hrs-08, Marks-12)</b>				
2	<p>TLO2.1 Solve given examples based on Definite Integration.</p> <p>TLO2.2 Use properties of definite integration to solve given problems</p>	<p><b>Unit - II Definite Integration</b></p> <p>2.1 Definite Integration: Definition, and rules of definite integration with simple examples.</p> <p>2.2 Properties of definite integral (without proof) and simple examples</p>	<p>Video Simulation</p> <p>Chalk-Board</p> <p>Improved Lecture</p> <p>Presentations</p>	<b>CO2</b>
<b>Unit - III Differential Equation (CL Hrs-08, Marks-12)</b>				
3	<p>TLO3.1 Find the order and degree of given differential equations.</p> <p>TLO3.2 Form simple differential equations for given elementary engineering problems.</p> <p>TLO3.3 Solve given differential equations using the methods of Variable separable and Exact Differential Equations (Introduce the concept of a partial differential equation).</p> <p>TLO3.4 Solve the given Linear Differential Equation.</p>	<p><b>Unit - III Differential Equation</b></p> <p>3.1 Concept of Differential Equation.</p> <p>3.2 Order, degree and formation of Differential equations</p> <p>3.3 Methods of solving differential equations: Variable separable form, Exact Differential Equation, Linear Differential Equation.</p>	<p>Video Demonstrations</p> <p>Presentations</p> <p>Chalk-Board</p> <p>Improved Lecture</p> <p>Flipped Classroom</p>	<b>CO3</b>

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
<b>Unit - IV Numerical Methods (CL Hrs-06, Marks-14)</b>				
4	TLO4.1 Find roots of algebraic equations by using appropriate methods. TLO4.2 Solve the system of equations in three unknowns by iterative methods TLO4.3 Solve problems using the Bakhshali iterative method for finding approximate squareroots. (IKS)	<b>Unit - IV Numerical Methods</b> 4.1 Solution of algebraic equations: Bisection method, Regula falsi method and Newton–Raphson method. 4.2 Solution of simultaneous equations containing three Unknowns by iterative methods: Gauss-Seidel and Jacobi's method. 4.3 Bakhshali iterative method for finding the approximate square root. (IKS)		<b>CO4</b>
<b>Unit - V Probability Distribution (CL Hrs-08, Marks-12)</b>				
5	TLO5.1 Solve given problems based on repeated trials using Binomial distribution TLO5.2 Solve given problems when the number of trials is large and the probability is very small. TLO5.3 Utilize the concept of normal distribution to solve related engineering problems	<b>Unit - V Probability Distribution</b> 5.1 Binomial distribution. 5.2 Poisson's distribution. 5.3 Normal distribution.		<b>CO5</b>

#### V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO 1.1 Solve simple problems of Integration by substitution	*Integration by substitution	1	CO1
2	LLO 2.1 Solve integration using parts	*Integration by parts	1	CO1
3	LLO 3.1 Solve integration by partial fractions(only linear non-repeated factors at the denominator of the proper fraction).	Integration by partial fractions.	1	CO1
4	LLO 4.1 Solve examples on Definite Integral based on given methods.	Definite Integral based on given methods.	1	CO2
5	LLO 5.1 Solve problems on properties of definite integral.	*Properties of definite integral	1	CO2
6	LLO 6.1 Solve given problems for finding the area under the curve and volume of revolution.	* #Area under the curve and volume of revolution.(Only for Civil, Mechanical Metallurgical Engineering)	1	CO2

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
7	LLO 7.1 Solve examples on meanvalue and root mean square value.	* #Mean value and root mean square value. (Only for Information Technology, Computer, Electrical and Electronics Engineering)	1	CO2
8	LLO 8.1 Solve examples on order, degree and formation of differential equations.	Order, degree and formation of the differentialequation.	1	CO3
9	LLO 9.1 Solve the first-order first-degree differential equation using the variable separable method.	Variable separable method.	1	CO3
10	LLO 10.1 Solve the first-order first-degree differential equation using exact differential equation and linear differential equation.	*Exact differential equation and linear differential equation.	1	CO3
11	LLO 11.1 Solve engineering application problems using differentialequations.	*Applications of differential equations.(Take programme specific problems)	1	CO3
12	LLO 12.1 Solve problems on the Bisection method and Regula falsi method.	*Bisection method and Regula falsi method.	1	CO4
13	LLO 13.1 Solve problems on the Newton-Raphson method.	Newton-Raphson method.	1	CO4
14	LLO 14.1 Solve problems on Jacobi's method and Gauss-Seidel Method.	Jacobi's method and Gauss-Seidel Method.	1	CO4
15	LLO 15.1 Use Bakhshali iterative methods for finding the approximate value of the square root. (IKS)	*Bakhshali iterative methods for finding the approximate value of square root. (IKS)	1	CO4
16	LLO 16.1 Solve engineering problems using Binomial distribution.	*Binomial Distribution	1	CO5
17	LLO 17.1 Solve engineering problems using Poisson distribution.	*Poisson Distribution	1	CO5
18	LLO 18.1 Solve engineering problems using Normal distribution.	Normal Distribution	1	CO5
19	LLO 19.1 Solve problems on Laplace transform and properties of Laplace transform.	* # Laplace transform and properties of Laplacetransform.(Only for Electrical and Electronics Engineering)	1	CO2
20	LLO 20.1 Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform.	* # Inverse Laplace transform and properties ofInverse Laplace transform.(Only for Electrical and Electronics Engineering)	1	CO2

**Note: Out of the above suggestive LLOs –**

1. '\*' Marked Practicals (LLOs) Are mandatory.
2. A minimum of 80% of the above list of lab experiments are to be performed.
3. A judicious mix of LLOs is to be performed to achieve the desired outcomes



**VI. SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT (SELF-LEARNING)**

Micro-project

NA

Assignment

NA

**VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED**

Sr. No	EquipmentNamewithBroadSpecifications	Relevant LLO Number
1	Open-source software like SageMaths, MATHS3D, GeoGebra, Graph, DPLOT and Graphing Calculator (GraphEq2.13), and ORANGE can be used for Algebra, Calculus, Trigonometry and Statistics respectively.	All

**VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)**

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Indefinite Integration	CO1	15	2	6	12	20
2	II	Definite Integration	CO2	8	2	4	6	12
3	III	Differential Equation	CO3	8	2	4	6	12
4	IV	Numerical Methods	CO4	6	2	4	8	14
5	V	Probability Distribution	CO5	8	2	4	6	12
<b>Grand Total</b>				<b>45</b>	<b>10</b>	<b>22</b>	<b>38</b>	<b>70</b>

**IX. ASSESSMENT METHODOLOGIES/TOOLS**

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests	1. End Term Exam

**X. SUGGESTED COS- POS MATRIX FORM**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	-	-	1	-	1			
CO2	3	1	-	-	1	-	1			
CO3	3	2	1	1	1	1	1			
CO4	2	3	2	2	1	1	1			
CO5	2	2	1	1	2	1	2			

**Legends:-High:03, Medium:02, Low:01, No Mapping:-** \*PSOs are to be formulated at the institute level.

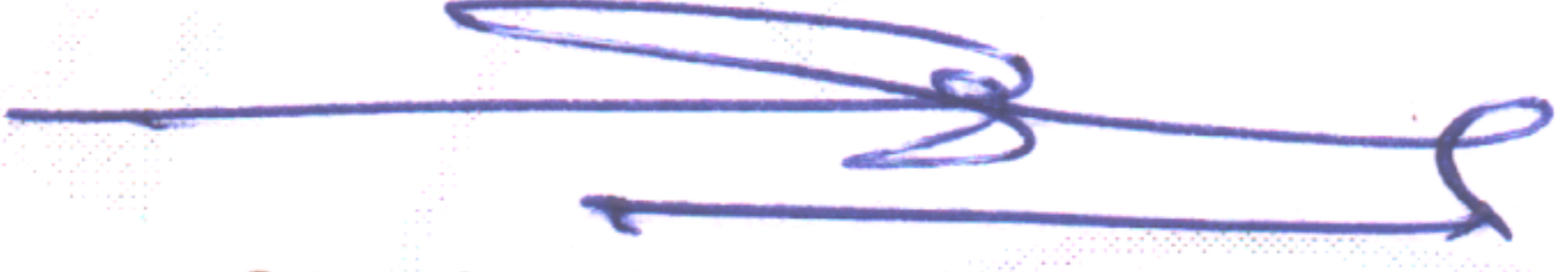


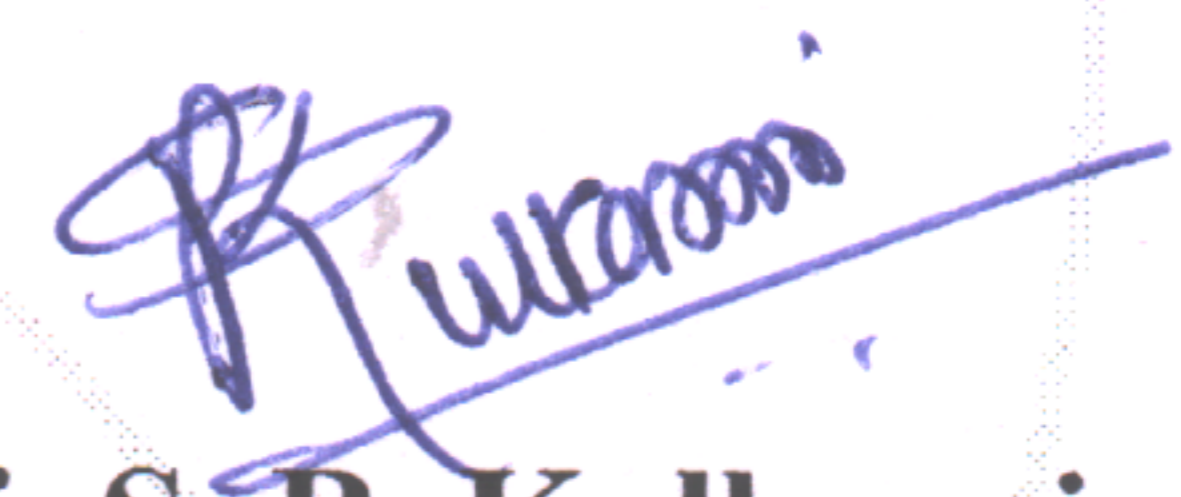
**XI.SUGGESTED LEARNING MATERIALS/BOOKS**

Sr. No	Author	Title	Publisher
1	Grewal B. S.	Higher Engineering Mathematics	Khanna publication New Delhi, 2013 ISBN: 8174091955
2	Dutta. D	A textbook of Engineering Mathematics	New Age publication New Delhi, 2006 ISBN: 978- 81-224-1689-3
3	Kreysizg, Ervin	Advance Engineering Mathematics	Wiley publication New Delhi 2016 ISBN: 978-81- 265-5423-2
4	Das H.K.	Advance Engineering Mathematics	S Chand publication New Delhi 2008 ISBN: 9788121903455
5	S. S. Sastry	Introductory Methods of Numerical Analysis	PHI Learning Private Limited, New Delhi. ISBN-978-81-203-4592-8
6	C. S. Seshadri	Studies in the History of Indian Mathematics	Hindustan Book Agency (India) P 19 Green Park Extension New Delhi. ISBN 978-93-80250-06-9
7	Marvin L. Bittinger DavidJ.Ellenbogen Scott A. Surgent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
8	Gareth James, Daniela Witten,Trevor Hastie RobertandTibshirani	An Introduction to StatisticalLearning with Applications in R	Springer New York Heidelberg Dordrecht LondonISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook)

**XIII. LEARNING WEBSITES & PORTALS**

Sr. No	Link/Portal	Description
1	<a href="http://nptel.ac.in/courses/106102064/1">http://nptel.ac.in/courses/106102064/1</a>	Online Learning Initiatives by IITs and IISc
2	<a href="https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig">https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig</a>	Concept of Mathematics through video lectures and notes
3	<a href="https://www.wolframalpha.com/">https://www.wolframalpha.com/</a>	Solving mathematical problems, performing calculations, and visualizing mathematical concepts.
4	<a href="http://www.sosmath.com/">http://www.sosmath.com/</a>	Free resources and tutorials
5	<a href="http://mathworld.wolfram.com/">http://mathworld.wolfram.com/</a>	Extensive math encyclopedia with detailed explanationsof mathematical concepts
6	<a href="https://www.mathsisfun.com/">https://www.mathsisfun.com/</a>	Explanations and interactive lessons covering variousmath topics, from basic arithmetic to advanced
7	<a href="http://tutorial.math.lamar.edu/">http://tutorial.math.lamar.edu/</a>	The comprehensive set of notes and tutorials covers awide range of mathematics topics.
8	<a href="https://www.purplemath.com/">https://www.purplemath.com/</a>	Purplemath is a great resource for students seeking helpwith algebra and other foundational mathematics to improve learning.
9	<a href="https://www.brilliant.org/">https://www.brilliant.org/</a>	Interactive Learning in Mathematics

Sr. No	Link/Portal	Description
10	<a href="https://www.edx.org/">https://www.edx.org/</a>	Offers a variety of courses
11	<a href="https://www.coursera.org/">https://www.coursera.org/</a>	Coursera offers online courses in applied mathematics from universities and institutions around the globe.
12	<a href="https://ocw.mit.edu/index.htm">https://ocw.mit.edu/index.htm</a>	The Massachusetts Institute of Technology (MIT) offers free access to course materials for a wide range of mathematical courses.

Name & Signature:	
 <b>Shri. Vitthal B. Shinde</b> Lecturer in Mathematics	 <b>Shri. Sachin B. Yede</b> Lecturer in Mathematics
<b>(Course Experts)</b>	
Name & Signature:	Name & Signature:
 <b>Smt. N. S. Kadam</b> (Programme Head)	 <b>Shri. S. B. Kulkarni</b> (CDC In-charge)