

## GOVERNMENT POLYTECHNIC, PUNE

## '120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN ET
PROGRAMME CODE	03
COURSE TITLE	ELECTRICAL CIRCUITS AND NETWORK
COURSE CODE	ET31201
PREREQUISITE COURSE CODE & TITLE	NA
CLASS DECLARATION COURSE	NO

## I. LEARNING &amp; ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme						Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH	Paper Duration		Theory				Based on LL & TSL				Based on SLA	Total Marks		
			CL	TL	LL					Practical											
										FA-TH	SA-TH	Total		FA-PR		SA-PR					
														Max	Min	Max	Min			Max	Min
ET31201	ELECTRICAL CIRCUITS AND NETWORK	AEC	3	2	2	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.

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 course.
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:

In industry, to build and test electronic/electrical circuits in different situations knowledge of electric circuits and networks is very important. This course is intended to develop the skills to diagnose and rectify the electric network and circuits-related problems in the industry. the concept and principles of circuit analysis lay the foundation to understand courses of 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:** Check the functionality using the principle of circuit analysis.  
**CO2:** Apply the nodal & mesh method of circuit analysis  
**CO3:** Use network theorems to determine the various parameters in circuits.  
**CO4:** Use Two port networks to determine circuit parameters.  
**CO5:** Check the resonance condition of the electric/electronics circuit.  
**CO6:** Design and analyze filters, attenuators and equalizers.

## 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. LAWS AND DEFINITION (CL Hrs-06, Marks-08)</b>				
1	<b>TLO 1.1:</b> Use Kirchhoff's law to solve the given network. <b>TLO 1.2:</b> Apply the Voltage divider rule & current divider rule. <b>TLO 1.3:</b> Use source transformation techniques for the given circuit <b>TLO 1.4:</b> Convert given Delta connection to the star Connection and vice-versa.	1.1 Kirchhoff's current and voltage Law. 1.2 Calculation of Voltage, Current & power in Series & Parallel components, Types of Sources, and V-I relations of R, L & C. 1.3 Voltage divider Rule & current divider Rule. 1.4 Star to delta & delta to star Transformations. 1.5 Source Transformations. 1.6 Types of Network Elements - (Only Definitions) Active / Passive, Unilateral / Bilateral, Lumped / Distributed, Linear / Nonlinear Elements.	Classroom Learning, Reference Books	CO1
<b>UNIT 2. MESH AND NODAL ANALYSIS (CL Hrs-08, Marks-12)</b>				
2	<b>TLO 2.1:</b> Use mesh analysis to solve the given network. <b>TLO 2.2:</b> Solve the given network using nodal analysis <b>TLO 2.3:</b> Diagnose the fault in the given circuit using the relevant technique.	2.1 Mesh analysis 2.2 Nodal analysis 2.3 Duality-concept.	Classroom Learning, Reference Books	CO2
<b>UNIT 3. NETWORK THEOREMS (CL Hrs-10, Marks-12)</b>				
3	<b>TLO 3.1:</b> Use Superposition theorem to calculate the given parameter in the given circuit. <b>TLO 3.2:</b> Apply Thevenin's theorem to calculate the given parameter in the given circuit. <b>TLO 3.3:</b> Use Norton's theorem to calculate the given parameter in the given circuit. <b>TLO 3.4:</b> Calculate load impedance using the maximum power transfer theorem For the given circuit. <b>TLO 3.5:</b> Use the Reciprocity theorem to analyze a given circuit.	3.1 Superposition Theorem 3.2 Thevenin's Theorem 3.3 Norton's Theorem 3.4 Maximum Power Transfer Theorem 3.5 Reciprocity Theorem 3.6 Millman's Theorem	Classroom Learning Reference Books	CO3

UNIT- IV TWO PORT NETWORK (CL Hrs-08, Marks-14)				
4	<b>TLO 4.1:</b> Calculate Z, Y and H Parameters for the given circuit. <b>TLO 4.2:</b> Find ABCD Parameters for the given circuit. <b>TLO 4.3:</b> Find the Interrelationship between Z and Y parameters.	4.1 Impedance (Z) parameters 4.2 Admittance (Y) parameters 4.3 Hybrid parameters 4.4 Transmission (ABCD) parameters. 4.5 Inter-relationship between Z and Y Parameter.	Classroom Learning, Reference books	CO4
UNIT - V RESONANT CIRCUIT (CL Hrs-08, Marks-12)				
5	<b>TLO 5.1:</b> Find Expression for the resonant frequency of Series resonant circuits. <b>TLO 5.2:</b> Determine bandwidth and quality factor for given series and parallel resonant circuit <b>TLO 5.3:</b> Find Expression for the resonant frequency of parallel resonant circuits.	5.1 Series A.C Circuits: R-L, R-C and R-L-C circuits, impedance, reactance, phasor diagram, power factor, apparent power, reactive power. 5.2: Series resonant circuits: Expression for the resonant frequency, the effect of Q on bandwidth, the relation between Frequency (Fr), Q factor and BW. 5.3 parallel A.C. Circuits: Resistance in parallel with pure inductance and capacitance, series combination of resistance and inductance in parallel with capacitance. 5.4 parallel resonant circuits: Expression for the resonant frequency, the effect of Q on bandwidth, and the relation between frequency (Fr), Q and BW. Voltage magnification factor, Q- factor, Bandwidth.	Classroom Learning, Reference Books	CO5
UNIT –VI FILTER AND ATTENUATOR (CL Hrs-05, Marks12)				
6	<b>TLO 6.1:</b> State need of filter and attenuator. <b>TLO 6.2:</b> Construct all the types of filters for the given network	6.1 Definition, Types, needs, and applications of filter, Constant-K type High pass, Constant-K type low pass, Constant-K type band pass, Constant-K type Band rejects filters. 6.2 Attenuators Equalizers: Definition, Types, applications (numerical-based on it).	Classroom Learning Reference Books	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*	Determine the current through the given electric network by applying KCL.	Verification of KCL	02	CO1
2*	Determine voltage at a particular branch of the given electric network by applying KVL.	Verification of KVL	02	CO1

Sr No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles/Tutorial Titles	Number of hrs.	Relevant COs
3*	Determine voltage at a particular node of the given electric network by applying Nodal analysis.	Measurement of Node voltages	02	CO2
4*	Determine the current through the given branch of an electric network by applying mesh analysis.	Measurement of loop currents.	02	CO2
5*	Determine the current through the given branch and voltage across the given element of the circuit by applying the Superposition theorem.	To verify the Superposition theorem	02	CO3
6	Determine equivalent circuit parameters in a given circuit by applying Thevenin's theorem.	To verify Thevenin's Theorem	02	CO3
7*	Determine load resistance for maximum power transfer for a given circuit by applying the Maximum Power Transfer theorem.	To verify the Maximum Power Transfer theorem	02	CO3
8*	Determine open circuit (Z) parameters for the given Network.	Calculate Z Parameters of two ports Network	02	CO4
9*	Determine Short circuit (Y) parameters for the given Network.	Calculate Y Parameters of two ports Network	02	CO4
10*	Determine Transmission (ABCD) parameters for the given Network.	Calculate ABCD Parameters of two ports Network	02	CO4
11*	Create resonance in a given R-L-C circuit by varying L and C or by using a variable frequency supply.	To plot the frequency response of the Series resonance circuit.	02	CO5
12	Design the circuit for parallel resonance circuit and plot the frequency response of parallel resonance circuit.	To plot the frequency response of parallel resonance circuit.	02	CO5
13*	Design and Analyze Low Pass Filter Characteristics.	Study of Low Pass Filter Characteristic	02	CO6
14*	Design and Analyze High Pass Filter Characteristics.	Study of High Pass Filter Characteristic	02	CO6

Note: A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of a minimum of 12 or more practical needs to be performed. Out of which, the practicals marked as ‘\*’ are compulsory.



**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 that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs (Affective Domain Outcomes). Each student will have to maintain an activity chart consisting of individual contributions to the project work and give a seminar presentation of it before submission. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Select suitable components for the given circuit and prepare the same on the breadboard. Verify Kirchhoff's Voltage Law and Kirchhoff's Current Law theoretically and practically
- Select suitable components for the given circuit and prepare the same on the breadboard. Verify current and voltage in each component theoretically and practically
- Select suitable components for the given circuit and prepare the same on the breadboard. Verify the voltage divider rule and current divider rule theoretically and practically
- Prepare a PowerPoint presentation on source transformation, star delta transformation, mesh analysis, and nodal analysis and give a presentation in the classroom.
- Select suitable components for the given circuit and prepare the same on the breadboard. Verify the following network theorems theoretically and practically. i) Superposition theorem ii) Thevenin's theorem iii) Norton's theorem iv) Maximum power transfer theorem
- Design and prepare two-port networks on a breadboard for given values of open circuit Z parameter.
- Design and prepare two-port networks on a breadboard for given values of short circuit Y parameter.
- Prepare a series RL C circuit using variable R, L and C combinations on the breadboard. Tune the circuit for resonance conditions. Measure the response, and calculate the bandwidth and Q factor for the circuit.

**Assignment/Activity**

- Make a chart to compare all types of Theorems.
- Make library /internet survey of electrical circuits and network.
- Give a seminar on any relevant topic.
- Undertake a market survey for different electronic circuits and make a report.
- Use Various Meters to test electric/electronic equipment and components.
- Prepare a PowerPoint presentation or animation to understand different circuit behaviour.

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

Sr.No.	Equipment Name with Broad Specifications	Relevant LLO Number
1	Variable DC Power supply 0-30V with display for voltage and current	1,2,3,4,5,6,7,8,9,10
2	Digital Multimeter:3/1/2-digit display,9999 counts digital	1,2,3,4,5,6,7,8,9,10
3	CRO	11,12,13,14
4	Function Generator	11,12,13,14
5	Different types of cables and connectors	All
6	Ammeters	1,2,3,4,5,6,7,8,9,10
7	Voltmeter	1,2,3,4,5,6,7,8,9,10

**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	LAWS AND DEFINITION	CO1	06	2	2	4	08
2	II	MESH AND NODAL ANALYSIS	CO2	08	2	4	6	12
3	III	NETWORK THEOREMS	CO3	10	2	4	6	12
4	IV	TWO PORT NETWORK	CO4	08	4	4	6	14
5	V	RESONANT CIRCUITS	CO5	08	2	4	6	12
6	VI	FILTER AND ATTENUATORS	CO6	05	2	4	6	12
<b>Grand Total</b>				<b>45</b>	<b>14</b>	<b>22</b>	<b>34</b>	<b>70</b>

**IX. ASSESSMENT METHODOLOGIES / TOOLS**

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

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


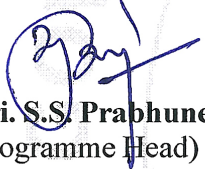


Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	3	2	2	--	--	2	3	2	3
CO2	3	3	2	2	--	--	2	3	1	3
CO3	3	3	2	2	--	--	2	3	1	2
CO4	3	3	--	3	--	--	2	3	-	3
CO5	3	2	2	2	1	--	3	3	2	2
CO6	3	3	2	1	2	2	3	2	1	-
<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
1	Mittal V.N	Basic Electrical Engineering.	Tata McGraw-Hill, New Delhi, ISBN:978-0-0700885725
2	Sudhakar, A Palli Shyammohan S	Circuit and Network	Mcgraw Hill, ISBN- 978-0-07-3404585
3	Theraja, B. L.	A Textbook of Electrical Technology vol.1	Publishing, 2007, ISBN 10: 8121925568ISBN 13: 9788121925563
4	Gupta B.R,	Fundamentals of Electrical Networks	S.Chand and Co, New Delhi.2005, ISBN :978-81-219-2318-7
5	Paranjothi S.R	Electric Circuit Analysis	New Age Publisher, New Delhi,2011 ISBN :978-81-224-3154-4
6	Electric Circuits	Bell, David A	Oxford University Press New Delhi,2009 ISBN:9780195425246

**XII. LEARNING WEBSITES & PORTALS**

Sr.No.	Link/Portal	Description
1.	<a href="https://www.corsi.univr.it/documenti/OccorrenzaIns/matdid/matdid441904.pdf">https://www.corsi.univr.it/documenti/OccorrenzaIns/matdid/matdid441904.pdf</a>	D.C. Circuits
2.	<a href="https://archive.nptel.ac.in/courses/117/106/117106108/">https://archive.nptel.ac.in/courses/117/106/117106108/</a>	Basic Electric Circuit.
3.	<a href="https://www.multisim.com">https://www.multisim.com</a>	Software for Designing circuits.
4.	<a href="https://www.allaboutcircuits.com/textbook/direct-current/chpt-10/introduction-network-theorems/">https://www.allaboutcircuits.com/textbook/direct-current/chpt-10/introduction-network-theorems/</a>	Network Theorems
5.	<a href="https://www.udemy.com/course/crash-course-electric-circuits-for-electrical-engineering">https://www.udemy.com/course/crash-course-electric-circuits-for-electrical-engineering</a>	Flip classroom learning material
6.	<a href="https://www.tutorialspoint.com/network_theory/network_theory_filters.html">https://www.tutorialspoint.com/network_theory/network_theory_filters.html</a>	Attenuators and Filters

Name & Signature:  <b>Smt. R.S. Deulkar</b> Lecturer in E & TC Engineering (Course Experts)		
Name & Signature:  <b>Shri. S.S. Prabhune</b> (Programme Head)	 <b>Dr. S.P. Narote</b> (Programme Head)	Name & Signature:  <b>Shri. S.B. Kulkarni</b> (CDC In-charge)



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

<b>PROGRAMME</b>	<b>DIPLOMA IN ET</b>
<b>PROGRAMME CODE</b>	<b>03</b>
<b>COURSE TITLE</b>	<b>LINEAR INTEGRATED CIRCUITS</b>
<b>COURSE CODE</b>	<b>ET31204</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>NA</b>
<b>CLASS DECLARATION COURSE</b>	<b>NO</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					Practical												
										FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA				
			Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min						
ET31204	LINEAR INTEGRATED CIRCUITS	DSC	4	--	2	2	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:**

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- 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 operational Amplifier (Op-Amp) is the most versatile Linear Integrated Circuit (IC) used to develop various applications in electronic circuits and equipment. Hence this course is intended to develop the skills to build, test, diagnose and rectify the Op-Amp-based electronic circuits. This course deals with various aspects of Linear Integrated circuits used in various industrial, consumer and domestic applications

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

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

- CO1: Use Op-Amp in linear electronic circuits.
- CO2: Use various configurations of Op-Amp for different applications.
- CO3: Troubleshoot various linear applications of Op-Amp for the given specifications
- CO4: Maintain filters and oscillators used in various electronic circuits.
- CO5: Troubleshoot specified applications using various linear ICs.

## 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. FUNDAMENTALS OF OPERATIONAL AMPLIFIER</b> ( CL Hrs-12, Marks-10)				
1.	<p><b>TLO 1.1.</b> Describe the block diagram of Op-Amp.</p> <p><b>TLO 1.2</b> Explain the working of the given type of Op-Amp configuration.</p> <p>Describe the block diagram of Op-Amp.</p> <p><b>TLO 1.3.</b>State function of each pin of IC's 741.</p> <p><b>TLO 1.4.</b> Select the parameters to be considered for the given applications of the Op-Amp.</p>	<p>1.1 Importance of Op-Amp: Block diagram of Op-Amp</p> <p>1.2 Function of each block of Op-amp with the circuit such as balanced, Unbalanced, differential amplifiers with a simple current source, level shifter and complementary push-pull amplifier. Equivalent Circuit</p> <p>1.3 OPAMP IC's: 741-pin diagram and pin function.</p> <p>1.4. Parameters of Op-Amp: Input offset voltage, Input offset current, Input bias current, differential input resistance, Input capacitance, Input voltage range, offset voltage adjustment range, Common Mode Rejection Ratio (CMRR), Supply Voltage Rejection Ratio(SVRR), large signal voltage gain and transfer characteristics, supply voltages, supply current, output voltage swing, output resistance, slew rate, gain-bandwidth product, output shortcircuit current. Open loop and closed loop configuration of the op-amp, its comparison. Ideal op-amp: electrical characteristics. Ideal and practical voltage transfer curve.</p>	Classroom Learning, Reference books, NPTEL	<b>CO1</b>
<b>UNIT-II OP-AMP CONFIGURATION</b> (CL Hrs-12, Marks-12)				
2	<p><b>TLO 2.1:</b> Differentiate open and close loop configuration</p> <p><b>TLO 2.2:</b> Identify inverting and non-inverting configuration</p> <p><b>TLO 2.3:</b> Calculate the output voltage of the given arithmetic circuit using Op-Amp.</p> <p><b>TLO 2.4:</b> Construct integrator and differentiator.</p>	<p>2.1 Open loop and closed loop configuration of Op-Amp, its comparison. Virtual ground, virtual short concept.</p> <p>2.2 Open loop configuration - Inverting, Non-inverting Close loop configuration - Inverting, non-inverting, differential amplifier, unity gain amplifier (voltage follower), inverter(sign changer)</p> <p>2.3 Inverting and non-inverting configuration Adders (summing amplifier, scaling Amplifier, averaging amplifier) Subtractor. Numerical based on designing of the above circuit. <b>2.4</b> Basic Integrator, Basic Differentiator. The basic concept of frequency compensation of Op-Amp and Offset nulling.</p>	Classroom Learning, Reference books, NPTEL	<b>CO2</b>

<b>UNIT-III LINEAR APPLICATION OF OP-AMP (CL Hrs-14, Marks-18)</b>				
3	<p><b>TLO 3.1:</b> Explain with sketches the working of an Instrumentation amplifier for the given application</p> <p><b>TLO 3.2:</b> Explain IC LM-324</p> <p><b>TLO 3.3:</b> Select the relevant op-Amp converter for the given application with justification.</p> <p><b>TLO 3.4:</b> Select the op-Amp-based comparator for the given application with justification.</p> <p><b>TLO 3.5:</b> Explain with sketches the working of an Op-Amp for the given application.</p>	<p>3.1 Instrumentation amplifier using three OPAMP requirements, circuit diagram, circuit operation, derivation of output voltage equation, advantages &amp; applications.</p> <p>3.2 Pin diagram pin functions and specifications of IC LM 324</p> <p>3.3 Voltage to current converter (with floating load, with grounded load) Current to voltage converter.</p> <p>3.4 Concept of comparator: zero crossing detector, Schmitt trigger, window detector, phase detector, active peak detector, peak to peak detector.</p> <p>3.5 Sample and hold circuit.</p> <p>Logarithmic and antilogarithmic amplifiers (using Diodes) analog divider and analog multiplier.</p>	Classroom Learning, Reference books, NPTEL	<b>CO3</b>
<b>UNIT-IV FILTERS AND OSCILLATORS (CL Hrs-14, Marks-18)</b>				
4	<p><b>TLO 4.1:</b> Distinguish the types of filter</p> <p><b>TLO 4.2:</b> Explain the active and passive filter</p> <p><b>TLO 4.3:</b> Identify the given type of filter based on frequency response.</p> <p><b>TLO 4.4:</b> Calculate the cut-off frequency for the given type of filter.</p> <p><b>TLO 4.5:</b> Explain the concept of oscillator</p> <p><b>TLO 4.6:</b> Explain different types of oscillators using IC741.</p>	<p>4.1 Introduction to filters, Classification of filters.</p> <p>4.2 Concept of passive and active filters Merits and demerits of active filters over passive filters</p> <p>Ideal and actual characteristics, terms: - cut-off frequency, Passband, Stopband, center frequency, roll-off rate, BW, Q-factor, first-order and second-order Butterworth filters,</p> <p>4.3 Filter types and their frequency response Low pass filter, High pass filter, Band pass filter( wideband pass, narrow band pass filter) Band reject filter(wide band reject, Narrow band reject filter), All pass filter.</p> <p>4.4 Numerical based on the design of different filters</p> <p>4.5 Concept of Oscillators</p> <p>4.6 Oscillator types using IC 741: Phase shift oscillators, Wien bridge oscillators, Colpitts oscillators, Hartley oscillators.</p>	Classroom Learning, Reference books, NPTEL	<b>CO4</b>

**UNIT –V TIMERS (CL Hrs-8, Marks-12)**

5	<b>TLO 5.1:</b> Explain the block diagram and pin diagram of IC 555.	5.1 Introduction to timer IC 555. Block diagram of IC 555 and its pin diagram & function of each pin.	Classroom Learning, Reference books, NPTEL	<b>CO5</b>
	<b>TLO 5.2:</b> Explain with sketches the working of IC 555 for the given application.	5.2 Monostable multivibrator, astable multivibrator, Bistable multivibrator, 5.3 IC556 features, pin diagram and specifications		
	TLO 5.3: Describe the pin function and specification of the IC 556	5.4 Phase Lock Loop: Principle of operation, block diagram of PLL. Applications of PLL as a multiplier, FM demodulator. Pin diagram and pin functions of IC 565(PLL).		
	TLO 5.4: Understand industrial applications of IC 555,565.	voltage controlled oscillator		

**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*	To measure the differential input resistance, input offset voltage, common mode rejection ratio(CMRR) of IC741	To measure the differential input resistance, input offset voltage, common mode rejection ratio(CMRR) of IC741	02	CO1
2	Observe output waveform and test the performance of Inverting and non-inverting amplifier	To assemble inverting and non-inverting amplifier and draw input-output waveforms.	02	CO2
3*	Test the performance of Inverting and non-inverting Adder circuit	To assemble the adder using OPAMP	02	CO2
4*	Test the performance of the subtractor circuit	To assemble subtractor using OPAMP	02	CO2
5	Observe the output waveform and test the performance of the integrator	Build /Test active integrator for different types of input	02	CO2
6	Observe output waveform and test the performance of differentiator	Build /Test active differentiators for different types of input	02	CO2
7*	Test V to I converter and I to V converter using IC741c	Build/Test V to I converter and I to V converter using IC741c	02	CO3
8*	Observe output waveform and test the performance of Zero crossing detector	Build/Test zero crossing detector using IC741	02	CO3
9	Build/ Test Instrumentation amplifier using IC LM324	Build/Test Instrumentation amplifier using IC LM324	02	CO3



Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles/Tutorial Titles	Number of hrs.	Relevant COs
10	Plot the frequency response of the first-order Butterworth low-pass filter.	Plot the frequency response of the first-order Butterworth low-pass filter.	02	CO4
11*	Plot the frequency response of the first-order Butterworth high-pass filter.	Plot the frequency response of the first-order Butterworth low-pass filter.	02	CO4
12*	Observe the waveform and measure the frequency of the Wein bridge oscillator.	Observe the waveform and measure the frequency of the Wein bridge oscillator using IC741.	02	CO4
13	Observe/simulate the waveform and measure the frequency of Hartley/colpitis oscillator.	Observe/simulate the waveform and measure the frequency of the Hartley /colpitis oscillator using IC741.	02	CO4
14	Build/ Test Astable Multivibrator using IC555 for the given specification	Build/ Test Astable Multivibrator using IC555 for the given specification	02	CO5
15*	Build/ Test a Monostable Multivibrator using IC555 for a given specification.	Build/ Test a Monostable Multivibrator using IC555 for a given specification	02	CO5
16	Plot the characteristics of PLL	Plot the characteristics of PLL	02	CO5

**Note:** A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of a minimum of 12 or more practical needs to be performed. Out of which, the practicals marked as ‘\*’ are compulsory.

## 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 that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs.(Affective Domain Outcomes). Each student will have to maintain an activity chart consisting of individual contributions to the project work and give a seminar presentation of it before submission. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Build a circuit for an op-amp to measure CMRR, input & output offset voltage.
- Build a differential amplifier circuit using op-amp IC741.
- Develop voltage follower circuit.
- Build a practical integrator circuit.
- Build a practical differentiator circuit.

- f. Build Instrumentation Amplifier(ICLM324) for measurement of temperature using thermocouple/RTD/Thermistor.
- g. Develop a temperature control dc fan using IC741.
- h. Develop a sequential timer circuit using multiple timers.
- i. Develop any one type of filter circuit using op-amp.
- j. Develop water level controller using IC555.
- k. Develop a tone generator using IC555.
- l. Develop PWM LED Dimmer/Brightness Control using IC555.
- m. Develop FSK modulator and demodulator using PLL IC565.
- n. Simulate using software LT spice/ P spice / Scilab, /Matlab /Octave or any other open source software linear IC applications

#### Assignment/Activity

- Prepare journals based on practicals performed in the laboratory.
- Study of the datasheet of different linear ICs.
- Refer to the technical magazine to collect information on the op-Amp-based linear circuit and its application
- Prepare a PowerPoint presentation to understand different OP-Amp-based circuit behaviour.
- Make a chart to compare all types of filters with their frequency responses.

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

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Variable DC power supply 0-30V, 2 Amp, SC protection, display for voltage and current	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16
2	Cathode Ray Oscilloscope Dual trace 20 MHz, 1M $\Omega$ , Input Impedance	2,5,6,8,9,10,11,12,13,14,15,16
3	Function Generator 0-2MHz with Sine, square, and triangular output	2,5,6,8,10,11,12,13,14,15,16
4	Digital Multimeter: 3 1/2-digit display, 9999 counts digital	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	FUNDAMENTALS OF OPERATIONAL AMPLIFIER (OP-AMP)	CO1	12	2	6	2	10
2	II	OP-AMP CONFIGURATION	CO2	12	2	4	6	12
3	III	LINEAR APPLICATION OF OP-AMP	CO3	14	4	6	8	18
4	IV	FILTERS AND OSCILLATORS	CO4	14	4	8	6	18
5	V	TIMERS	CO5	8	2	6	4	12
Grand Total				60	14	30	26	70

**IX. ASSESSMENT METHODOLOGIES / TOOLS**

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

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

Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes*(PSO)		
	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	2	3	3	3	1	2	2	2	2	2
CO2	2	3	3	3	1	2	2	3	3	3
CO3	2	3	3	3	1	2	2	3	3	3
CO4	2	3	3	3	1	2	2	3	2	3
CO5	2	2	3	2	1	2	2	3	2	3

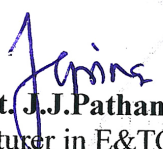

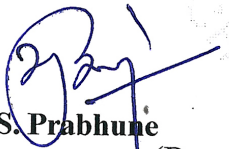


**Legends:- High:03, Medium:02, Low:01, No Mapping: -**  
 \*PSOs are to be formulated at the institute level

**XI. SUGGESTED LEARNING MATERIALS / BOOKS**

Sr.No	Author	Title	Publisher
1	Op-Amps and Linear Integrated Circuit	Gayakwad, Ramakant A.	A, P I Learning, New Delhi. ISBN:9788120320581
2	Operational Amplifiers and Linear ICs	Bell, David A	Oxford University Press, New Delhi India, 2011. ISBN: 9780195696134
3	Design with Operational Amplifiers and Analog Integrated Circuit	Franco, Sergio	McGraw Hill Education. New Delhi, 2014. ISBN:9780078028168
4	Linear Integrated Circuits	Shivakumar, Senthil.	M, S. Chand publishing New Delhi, 2014. ISBN:9788121916
5	Operational Amplifiers with Linear Integrated Circuit	Stanley, Willam D	Pearson Education India, New Delhi 2002. ISBN:9788131708453
6	Linear Integrated Circuits	Shalivahanan .S	McGraw Hill Education. New Delhi, 2008. ISBN:9780070648180
7	Linear Integrated Circuits	Roy Choudhary, D. Jain	Sail B, New Age International/Publisher, New Delhi, 2003. ISBNP:8122414702

## XII. LEARNING WEBSITES &amp; PORTALS

Sr.No	Link/Portal	Description
1.	<a href="http://www.jamia-physics.net/lecnotes/lab/opamp.pdf">http://www.jamia-physics.net/lecnotes/lab/opamp.pdf</a>	Op-amp IC 741 pin diagram and Information
2.	<a href="http://freevidelectures.com/Course/3062/Electronics-1/37">http://freevidelectures.com/Course/3062/Electronics-1/37</a>	Video lecture on OPAMP
3.	<a href="http://www.khanacademy.org/science/electrical-engineering/ee-amplifiers">http://www.khanacademy.org/science/electrical-engineering/ee-amplifiers</a>	Op-amp types and different circuits
4.	<a href="http://www.jamia-physics.net/lecnotes/lab/555.pdf">http://www.jamia-physics.net/lecnotes/lab/555.pdf</a>	IC 555 Pin Diagram and Related Information
5.	<a href="http://www.engineersgarge.com/electronic-components/ne555-timer-ic-datasheet">www.engineersgarge.com/electronic-components/ne555-timer-ic-datasheet</a>	Datasheet IC555
6.	<a href="http://www.Electronicsshub.org/voltage-controlled-oscillators-VCO/">http://www.Electronicsshub.org/voltage-controlled-oscillators-VCO/</a>	Voltage Controlled Oscillator
7.	<a href="http://www.Talkingelectronics.com/projects/OP-AMP/OP-AMP-1.html">http://www.Talkingelectronics.com/projects/OP-AMP/OP-AMP-1.html</a>	Op-amp Theory

<b>Name &amp; Signature:</b> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">   <b>Smt. J.J. Pathan</b>  Lecturer in E&amp;TC </div> <div style="text-align: center;">   <b>Smt. C.D. Pophale</b>  Lecturer in E&amp;TC </div> </div> <p style="text-align: center;"><b>(Course Experts)</b></p>		
<b>Name &amp; Signature:</b> <div style="text-align: center;">   <b>Shri. S.S. Prabhune</b>  (Programme Heads) </div>	<b>Name &amp; Signature:</b> <div style="text-align: center;">   <b>Dr. S.P. Narote</b>  (Programme Heads) </div>	<b>Name &amp; Signature:</b> <div style="text-align: center;">   <b>Shri. S.B. Kulkarni</b>  (CDC In-charge) </div>



**GOVERNMENT POLYTECHNIC, PUNE**  
**‘120 – NEP’ SCHEME**

<b>PROGRAMME</b>	<b>DIPLOMA IN ET</b>
<b>PROGRAMME CODE</b>	<b>03</b>
<b>COURSE TITLE</b>	<b>PRINCIPLES OF ELECTRONIC COMMUNICATION</b>
<b>COURSE CODE</b>	<b>ET31203</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		Theory				Based on LL & TSL				Based on SL				
			CL	TL	LL					Practical				Based on SL								
										FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA				
												Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
ET31203	PRINCIPLES OF ELECTRONIC COMMUNICATION	DSC	3	1	2	0	6	3	3	30	70	100	40	25	10	25@	10	--	--	150		

**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 course.
- 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 engineers have to deal with various electronic communication circuits while maintaining various electronic communication systems. The study of basic operating principles and handling of various electronic communication systems will help them to troubleshoot and maintain electronic communication systems used for various types of communication. This course is developed in such a way that students will be able to apply the domain knowledge to solve broad communication engineering application problems in the electronic communication engineering field.

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

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

- CO1: Use relevant frequency ranges for different communication systems.  
 CO2: Use relevant modulation techniques for specified applications.  
 CO3: Maintain transmitter and receiver circuits of AM and FM.  
 CO4: Use relevant media for transmission and reception of signals.  
 CO5: Use the relevant type of antenna for 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: BASICS OF ELECTRONIC COMMUNICATION (CL Hrs-04, Marks-08)</b>				
1.	<p><b>TLO 1.1:</b> Interpret the working of each block of the basic communication system.</p> <p><b>TLO 1.2:</b> Identify the relevant frequency band of the electromagnetic spectrum for specified application.</p> <p><b>TLO 1.3:</b> Compare features of given types of transmission modes.</p> <p><b>TLO 1.4:</b> List different types of noises.</p> <p><b>TLO 1.5:</b> Differentiate properties of the given types of noises.</p>	<p>1.1 The elements of a basic electronic communication system</p> <p>1.2 Electromagnetic spectrum</p> <p>1.3 Transmission modes: Simplex, half duplex and full duplex, Synchronous and Asynchronous.</p> <p>1.4 Noise: Definition, S/N ratio, Sources of noise, types of noise (External &amp; Internal)</p>	Classroom Learning, Reference books, NPTEL	<b>CO1</b>
<b>UNIT-II AM AND FM MODULATION (CL Hrs-12, Marks-16)</b>				
2	<p><b>TLO 2.1:</b> Interpret the necessity of a given type of modulation technique.</p> <p><b>TLO 2.2:</b> Compare the working of a given type of AM generation technique.</p> <p><b>TLO 2.3:</b> Describe with a sketch the given parameters of the AM signal.</p> <p><b>TLO 2.4:</b> Calculate modulation index and power distributions of the given AM signal.</p> <p><b>TLO 2.5:</b> Calculate the modulation index and power distributions of the given AM signal.</p> <p><b>TLO 2.6:</b> Describe with a sketch the given parameters of FM and PM signal.</p> <p><b>TLO 2.7:</b> Calculate the modulation index of the FM signal.</p>	<p>2.1 Need for modulation</p> <p>2.2 Types of modulation techniques Amplitude Modulation: Mathematical representation of amplitude modulated wave, modulation index, bandwidth requirement, Representation of AM signal in time and frequency domain, types of AM concerning frequency spectrum (DSB, SSB and VSB), Power relations in AM wave.</p> <p>2.3 Frequency Modulation: Representation of FM signal in the time domain and frequency domain, frequency deviation ratio, modulation index(<math>\beta</math>), mathematical representation of FM, Bandwidth requirements, types of frequency modulation (NB and WBFM)</p> <p>2.4 Phase Modulation</p>	Classroom Learning, Reference books, NPTEL	<b>CO2</b>

UNIT-III TRANSMITTER & RECEIVERS (CL Hrs-12, Marks-16)				
3	<p><b>TLO 3.1</b> Explain with sketches the working of a given type of AM generation technique.</p> <p><b>TLO 3.2:</b> Explain the function of a given block of AM superheterodyne receiver.</p> <p><b>TLO 3.3:</b> Explain with sketches the given type of AM demodulation technique.</p> <p><b>TLO 3.4:</b> Explain with sketches the principle of the given type of FM generation technique.</p> <p><b>TLO 3.5:</b> Compare the working of given types of FM detectors.</p>	<p>Generation of AM.</p> <p>3.1 Block diagram of AM superheterodyne receiver and its working with waveforms</p> <p>3.2 Demodulation of AM signal: Diode detector and practical diode detector</p> <p>3.3 Automatic gain control and its types.</p> <p>3.4 Concept of pre-emphasis and De-emphasis</p> <p>3.5 Generation of FM using direct (Varactor diode and reactance modulator) and indirect method (Armstrong method)</p> <p>3.6 Block diagram of FM receiver and its working with waveforms</p> <p>3.7 FM detector types: Simple slope detector, Balanced slope detector, Phase discriminator, Ratio detector and PLL as FM Demodulator.</p>	<p>Classroom Learning, Reference books, NPTEL</p>	<p><b>CO3</b></p> <p><b>CO3</b></p>
UNIT- IV WAVE PROPAGATION (CL Hrs-07, Marks-14)				
4	<p><b>TLO 4.1:</b> Describe the properties of given types of electromagnetic waves.</p> <p><b>TLO 4.2:</b> Describe with sketches the propagation mode of a given type of radio wave.</p> <p><b>TLO 4.3:</b> Describe the properties of the specified Ionospheric layer.</p> <p><b>TLO 4.4:</b> Explain the parameters and properties of the given types of wave propagation.</p> <p><b>TLO 4.4:</b> For the given application, identify the type of wave propagation to be used.</p>	<p>4.1 Concept of propagation of radio waves</p> <p>4.2 Ground Wave propagation</p> <p>4.3 Skywave: Ionospheric layers, Concept of actual height and virtual height, Critical frequency, skip distance, skip zone, concept of fading, maximum usable frequency, multiple hop sky wave propagation</p> <p>4.4 Space Wave propagation: line of sight, multipath space wave propagation, optical and radio horizon, shadow zones</p> <p>4.5 Duct propagation(microwave)</p> <p>4.6 Troposphere scatter propagation.</p>	<p>Classroom Learning, Reference books, NPTEL</p>	<p><b>CO4</b></p>

**UNIT –V ANTENNAS (CL Hrs-10, Marks-16)**

5	<p><b>TLO 5.1:</b> Explain with sketches the working principle of the given type of antenna.</p> <p><b>TLO 5.2:</b> Compare the sketches working of the given type of antenna based on the radiation pattern.</p> <p><b>TLO 5.3:</b> Explain antenna parameters of the given type of antenna.</p> <p><b>TLO 5.4:</b> Choose the type of antenna required with the broad specification for the given applications.</p>	<p>5.1 Antenna fundamentals: Resonant antenna and Non-resonant antennas</p> <p>5.2 Antenna parameters: Radiation pattern, polarization, bandwidth, beam width, antenna resistance, directivity and power gain, antenna gain</p> <p>5.3 Dipole antenna: Half wave dipole antenna (Resonant Antenna) &amp; its Radiation pattern. Folded dipole antenna and its radiation pattern. The radiation pattern for Dipole Antenna of different lengths.</p> <p>5.4 Loop antenna, Telescopic antenna, Yagi-Uda antenna, Microwave antenna – Dish antenna, Horn antenna and Microstrip patch antennae- Rectangular, square and circular (Structure, radiation pattern and application of antennas.)</p>	Classroom Learning, Reference books, NPTEL	<b>CO5</b>
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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*	Use simple wires, switches and LEDs to establish simple and half-duplex communication links.	Use simple wires, switches and LEDs to establish simplex and half-duplex communication links.	02	CO1
2	Use simple wires, switches and LEDs to establish a full duplex communication link.	Use simple wires, switches and LEDs to establish a full duplex communication link.	02	CO1
3*	Observe the AM-modulated waveforms generated for different carrier frequencies.	Observe the AM-modulated waveforms generated for different carrier frequencies.	02	CO2
4	Generate AM wave and measure its modulation index.	Generate AM wave and measure its modulation index.	02	CO2
5*	Use any simulation software to generate AM wave	Use any simulation software to generate AM wave	02	CO2
6	Use voltage controlled oscillator to generate FM wave and measure the frequency deviation	Use voltage controlled oscillator to generate FM wave and measure the frequency deviation	02	CO2
7*	Generate FM wave and measure its modulation index.	Generate FM wave and measure its modulation index.	02	CO2
8	Use any simulation software to generate FM waves.	Use any simulation software to generate FM waves.	02	CO2



9*	Use the AM demodulator circuit to detect the received AM signal.	Use the AM demodulator circuit to detect the received AM signal.	02	CO3
10	Use IC 564 / IC 565 for FM demodulation and trace its input and output waveforms.	Use IC 564 / IC 565 for FM demodulation and trace its input and output waveforms.	02	O3
11*	Use any simulation software to measure 1 MUF for the given critical frequency and incident angle. 2 Radio horizon for given given height of transmitting and receiving antenna.	Use any simulation software to measure 1 MUF for the given critical frequency and incident angle. 2 Radio horizon for given given height of transmitting and receiving antenna.	02	O5
12*	Use a field meter to plot the radiation pattern of a given dipole antenna.	Use a field meter to plot the radiation pattern of a given dipole antenna.	02	CO5
13	Use a field meter to plot the radiation pattern of a given Yagi-Uda antenna.	Use a field meter to plot the radiation pattern of a given Yagi-Uda antenna.	02	CO5
14*	Use any simulation software to plot the radiation pattern of the given type of antenna.	Use any simulation software to plot the radiation pattern of the given type of antenna.	02	CO5
<b>Note:</b> A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of a minimum of 12 or more practical needs to be performed. Out of which, the practicals marked as ‘ * ’ are compulsory.				

## 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 that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs (Affective Domain Outcomes). Each student will have to maintain an activity chart consisting of individual contributions to the project work and give a seminar presentation of it before submission. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Modulation: Build a circuit for Modulation using IC MC1496/8038 on a general-purpose PCB and prepare a report.
- FM Transmitter: Build a circuit on general-purpose PCB for FM Transmitter using IC 8038/Transistor BF 549 and prepare a report.
- Channel frequencies: Find different Channel frequencies associated with AM and FM Stations.
- Antenna: Simulate a Microstrip patch antenna for frequency 2.4 GHz using HFSS (High-frequency structure simulator) software.

- Tuning of IFT: Build a circuit on general-purpose PCB for tuning IFT at 455 KHz.
- Prepare a report based on types, radiation patterns and application of antenna.

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

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	CRO Dual trace/DSO	3 to 10
2	RF signal generator	3 to 10
3	Regulated power supply	1 to 10
4	Different types of cables and connectors	1 to 10
5	Digital Multimeter	3 to 10
6	AM trainer kit for DSB/SSB AM modulation and Demodulation	3,4,9
7	FM trainer kit for modulation and Demodulation	6,7,10
8	Antenna trainer kit	11,12,13
9	Software for the program: MATLAB, SCILAB	5,8,11,14

## 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	Basics of Electronic Communication	CO1	4	2	4	2	8
2	II	AM and FM modulation	CO2	12	4	8	4	16
3	III	Transmitters and Receivers	CO3	12	4	6	6	16
4	IV	Wave Propagation	CO4	7	4	6	4	14
5	V	Antennas	CO5	10	4	6	6	16
<b>Grand Total</b>				<b>45</b>	<b>18</b>	<b>40</b>	<b>22</b>	<b>70</b>

## IX. ASSESSMENT METHODOLOGIES / TOOLS

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

**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
<b>CO1</b>	2	2	3	2	-	2	2	3	-	-
<b>CO2</b>	2	2	2	2	-	2	2	3	-	-
<b>CO3</b>	2	2	3	2	-	2	2	3	-	-
<b>CO4</b>	3	2	2	2	-	2	2	3	-	-
<b>CO5</b>	2	2	2	2	-	2	2	3	-	-

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

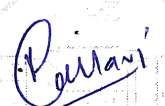
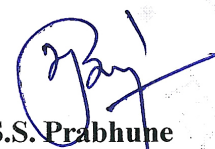


\*PSOs are to be formulated at the institute level

**XI. SUGGESTED LEARNING MATERIALS / BOOKS**

Sr.No	Author	Title	Publisher
1	Kennedy George, Davis Bernard, Prasanna SRM	Electronics Communication Systems	Mc-Graw Hill 5 <sup>th</sup> edition, New Delhi, 2011 ISBN:9780071077828
2	Frenzel Louis E.	Principles of Electronics Communication Systems	Mc-Graw Hill 5 <sup>th</sup> edition, New Delhi, 2007 ISBN:9780073222783
3	Constantine A. Balanis	Antenna Theory: Analysis and Design	Wiley-Student edition India, New Delhi 2016 ISBN:9788126524228

**XII. LEARNING WEBSITES & PORTALS**

Sr.No	Link/Portal	Description
1.	<a href="http://www.nptel.com">www.nptel.com</a>	All relevant materials of PEC
2.	<a href="http://www.turbofuture.com/Elements">http://www.turbofuture.com/Elements</a> of Electronics Communication system	Basics of Communication
3.	<a href="http://www.antenna-theory.com/basics/main.php">www.antenna-theory.com/basics/main.php</a>	Antennas
4.	<a href="http://www.circuitdiagram.org/am-radio-receiver-with-mk484.html">www.circuitdiagram.org/am-radio-receiver-with-mk484.html</a>	Radio receivers
5.	<a href="https://www.daenotes.com/electronics/communication-system/modulation-definition-explanation-types">https://www.daenotes.com/electronics/communication-system/modulation-definition-explanation-types</a>	Modulation types
6.	<a href="http://www.circuitstoday.com/single-chip-fm-radio-circuit">www.circuitstoday.com/single-chip-fm-radio-circuit</a>	Radio circuits

<b>Name &amp; Signature:</b>  <b>Smt. P.V. Lengare</b> Lecturer in E&TC (Course Experts)		
<b>Name &amp; Signature:</b>  <b>Shri. S.S. Prabhune</b> (Programme Head)	<b>Name &amp; Signature:</b>  <b>Dr.S.P.Narote</b>	<b>Name &amp; Signature:</b>  <b>Shri. S.B. Kulkarni</b> (CDC In-charge)

## GOVERNMENT POLYTECHNIC, PUNE

## '120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN ET
PROGRAMME CODE	03
COURSE TITLE	DIGITAL TECHNIQUES
COURSE CODE	ET31206
PREREQUISITE COURSE CODE & TITLE	NA
CLASS DECLARATION COURSE	NO

## I. LEARNING &amp; ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme						Credits	Assessment Scheme												
			Actual Contact Hrs./Week			SLH	NLH	Paper Duration		Theory				Based on LL & TSL				Based on SLA				Total Marks
														Practical								
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR						
						Max	Max											Max	Min	Max	Min	
ET31206	DIGITAL TECHNIQUES	DSC	4	1	2	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.

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 course.
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:

In the present scenario most of the electronic equipment like computers, mobiles, music systems, ATM, automation and control circuits and systems are based on digital circuits which the diploma electronic engineering pass outs have to test them. the knowledge of basic logic gates, combinational and sequential logic circuits using gates as well as digital ICS will enable the students to interpret the working of equipment's and maintain them. After completion of the course, students will be able to develop the digital circuits-based applications.

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

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

CO1: Use number system and codes for interpreting working of digital system.

CO2: Apply Boolean laws to realize logic circuits.

CO3: Develop combinational circuits for given application.

CO4: Develop sequential circuit's for given application.

CO5: Interpret function of data converter and memories in digital electronics 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 NUMBER SYSTEM AND CODES (CL Hrs-12, Marks-12)</b>				
1.	<p><b>TLO1.1:</b> Compare analog and digital signals.</p> <p><b>TLO 1.2:</b> Convert the given number from one number system to another number system.</p> <p><b>TLO1.3:</b> Perform arithmetic operations on binary numbers.</p> <p><b>TLO1.4:</b> Convert the given coded number into the other specified code.</p> <p><b>TLO1.5:</b> Perform BCD addition and subtraction for the given Decimal numbers.</p>	<p><b>1.1</b> Analog signal Vs Digital signal</p> <p><b>1.2</b> Number system: Types of Number Systems (Binary, Octal, Decimal, Hexadecimal), conversion of number systems.</p> <p><b>1.3</b> Binary Arithmetic: Addition, Subtraction (1's and 2's complement), Multiplication and Division</p> <p><b>1.4</b> Codes: BCD, Gray code, Excess-3 and ASCII code, Code conversions, Applications of codes.</p> <p>BCD Arithmetic: BCD Addition, Subtraction using 9's and 10's complement</p>	Classroom Learning, Reference books, NPTEL	CO1
<b>UNIT-II LOGIC GATES AND LOGIC FAMILIES (CL Hrs-12, Marks-12)</b>				
2	<p><b>TLO 2.1:</b> Draw symbol and truth table of given logic gates.</p> <p><b>TLO 2.2:</b> Implement basic gates and other gates with the help of universal gate</p> <p><b>TLO 2.3:</b> Simplify the given expression using Boolean laws and develop logic circuits.</p> <p><b>TLO 2.4:</b> Define the given characteristics parameters of the digital logic families.</p>	<p><b>2.1</b> Logic Gates: Symbol, logical expression, truth table, pin diagram of basic logic gates (AND, OR, NOT) Universal gates (NAND and NOR), Basic gate design using NAND and NOR gate, Special purpose gates (EX-OR, EX-NOR).</p> <p><b>2.2</b> Boolean algebra: of Boolean algebra, Duality Theorem, De-Morgan's theorems.</p> <p><b>2.3</b> Logic Families: Characteristics Parameters of logic Families- Noise margin, Power dissipation, Figure of merit, Fan in, Fan out, Speed of operation Current and Voltage parameters, Comparison of TTL, CMOS and ECL logic family.</p>	Classroom Learning, Reference books, NPTEL	CO2
<b>UNIT-III COMBINATIONAL LOGIC CIRCUITS (CL Hrs-15, Marks-18)</b>				
3	<p><b>TLO 3.1:</b> Develop logic circuits for standard SOP/POS form of the given logic expression.</p> <p><b>TLO 3.2:</b> Minimize the given</p>	<p><b>3.1</b> Standard Boolean expression: Sum of products [SOP] and Products of Sum [POS], Min-term and Max-term, SOP-POS form conversion, realization using NAND/NOR gates circuit.</p>	Classroom Learning, Reference books, NPTEL	CO3

	<p>logic expression using Kmap (up to 4 variables).</p> <p><b>TLO 3.3:</b> Design adder/subtractor using IC7483.</p> <p><b>TLO 3.4:</b> Design code converter using k map.</p> <p><b>TLO 3.5:</b> Describe working of specified Encoder and Decoder with help of block diagram and truth table.</p> <p><b>TLO 3.6:</b> Describe the working of Multiplexer and Demultiplexer.</p>	<p><b>3.2</b> Boolean Expression reduction using K-map: Minimization of Boolean expressions (up to 4 variables) using SOP and POS form</p> <p><b>3.3</b> Design of arithmetic circuits and code Converter using K- maps: Half and Full Adder, Half and Full Subtractor, IC 7483 As adder &amp; subtractor.</p> <p><b>3.4</b> Code Converter using K-map: Gray to Binary, Binary to Gray Code (up to 4bit).</p> <p><b>3.5</b> Encoder &amp; Decoder: Priority Encoder, Decimal to BCD Encoder, IC 7447 as BCD to 7 segment decoder, 1 digit BCD adder.</p> <p><b>3.6</b> ALU (Truth table &amp; Block Diagram) IC 74181 and IC 74183.</p> <p><b>3.6</b> Multiplexer and Demultiplexer: Study of IC 74151 MUX, Study of IC 74155 as DEMUX, Working, Truth table and applications of MUX and DEMUX. MUX tree, DEMUX tree, DEMUX as Decoder</p>		
<b>UNIT- IV SEQUENTIAL LOGIC CIRCUITS (CL Hrs-15, Marks-18)</b>				
4	<p><b>TLO 4.1</b> Differentiate between Latch and Flip Flop.</p> <p><b>TLO 4.2:</b> Explain basic memory cell and use relevant triggering technique for the given digital circuit.</p> <p><b>TLO 4.3:</b> Describe the truth tables for the given Flip flops, applications of Flip flop.</p> <p><b>TLO 4.4:</b> Use the given type of flip flop and its excitation table to design specific type of counter.</p> <p><b>TLO 4.5:</b> Describe the working of specified shift register with the help of timing diagram.</p> <p><b>TLO 4.6 :</b> Design specified modulo-N counter using Flip flops.</p> <p><b>TLO 4.7:</b> Design Ring /Twisted ring counter using given Flip-Flop.</p>	<p><b>4.1</b> Difference between Combinational and Sequential Logic circuits, Flip-Flops and Latch, Basic memory cell ,RS-Latch using NAND and NOR, Triggering methods. Edge trigger and Level Trigger.</p> <p><b>4.2</b> Flip-Flops: S-R, J-K, T and D, Truth table and logic circuits of each flip-flop, Excitation table, applications,</p> <p><b>4.3</b> Race around condition in JK flip-flop Master- Slave JK Flip Flop.</p> <p><b>4.4</b> Shift registers- Serial In Serial Out, Serial In Parallel Out, Parallel In Serial Out, Parallel In Parallel Out, 4-bit universal shift register.</p> <p><b>4.5</b> Counters- Synchronous and Asynchronous counters, Modulus of counter, Ripple counter, Ring Counter, Twisted Ring Counter, Up-down counter, Decade Counter, MOD-N counter.</p>	Classroom Learning, Reference books, NPTEL	CO4

**UNIT –V CONVERTER AND MEMORIES (CL Hrs-6, Marks-10)**

5	<p><b>TLO 5.1</b> Describe the working of the given type of DAC.</p> <p><b>TLO 5.2</b> Calculate the output voltage for the given digital input for specified DAC.</p> <p><b>TLO 5.3</b> Describe the working of the given type of ADC.</p> <p><b>TLO 5.4</b> Compare working of ROM, EPROM, EEPROM and Flash Memory.</p>	<p><b>5.1</b> Digital to Analog converter: Types of DAC: Weighted resistor method and R-2R Method (along with Mathematical derivation)</p> <p><b>5.2</b> Analog to Digital converter: Single slope ADC, Dual slope ADC, Successive Approximation ADC (Block diagram &amp; working) .</p> <p><b>5.3</b> Memories: Organization, RAM(RAM, DRAM), Volatile and Non-Volatile, ROM (PROM, EPROM, EEPROM), Flash Memory, Comparison of RAM and ROM, EPROM and Flash Memory.</p>	Classroom Learning, Reference books, NPTEL	<b>CO5</b>
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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*	Test the functionality of basic gates and universal gates.	Verify truth table of Basic gates and universal gates.	02	CO2
2	Test the functionality of the constructed Basic gates using universal gates.	i] Construct Basic gates using universal gates. ii] Construct Exclusive Gates using Universal Gates.	02	CO2
3*	Build the logic circuit on breadboard to verify the De - Morgan's theorems.	Verify De Morgan's Theorems	02	CO2
4*	Verify the truth table of Half and Full adder circuits for the given input.	Implement Half Adder, Full Adder Circuit.	02	CO3
5*	Verify the truth table of Half and Full subtractor circuits for the given input.	Implement Half Subtractor, Full Subtractor Circuit.	02	CO3
6*	Construct and test BCD to 7 segment using Digital IC.	Test the output of BCD to 7 Segment Decoder using Digital IC for the given inputs.	02	CO3
7	Construct and test priority encoder using Digital IC.	Test the output of priority encoder	02	CO3
8*	Build / test function of MUX Digital IC.	Build and test the functionality of 4:1/8:1 Multiplexer IC74151.	02	CO3
9*	Build / test function of MUX Digital IC.	Build and test the functionality of 1:4/1:8 De Multiplexer IC 74155	02	CO3
10*	Verify functionality of RS flip flop using NAND Gate.	Implement and verify the truth table of RS Flip flop.	02	CO4
11*	Verify functionality of master slave -JK Flipflop using Digital IC .	Implement and test the functionality of master slave- JK Flip Flop using Digital IC.	02	CO4

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
12*	Verify functionality D and T Flipflop using Digital IC.	Implement and test functionality of D and T flipflop using Digital IC	02	CO4
13*	Build and verify 4 bit ripple/ Decade counter.	Implement 4 bit ripple counter/Decade counter	02	CO4
14	Build and verify MOD-N counter.	Implement MOD-4 counter/Decade counter	02	CO4
15	Build and verify 4 bit universal shift register	Implement 4 bit universal shift register.	02	CO4
16*	Build R-2R resistive network on breadboard to convert given digital data into analog	Test the output of given R-2R type Digital to Analog Converter for the given input.	02	CO5

## VI.SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS

### Micro project

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs (Affective Domain Outcomes). Each student will have to maintain an activity chart consisting of individual contributions to the project work and give a seminar presentation of it before submission. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Implement 1:8 DEMUX using 1:4 /1:2 DE-MUX.
- Build a LED display bar.
- Build a circuit to test 7bit segment display.
- Build a 4bit parity generator and parity tester
- Build a circuit to implement 4 Bit adder
- Build a circuit to implement BCD to & 7 segment decoder.
- Build a circuit for LED flasher.
- Build a circuit to implement 4bit ripple counter.



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

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Variable DC Power supply 0-30V with display for voltage and current All 2 Digital Multimeter All 3 CRO 14 4 Pulse Generator 10,11,12,13,14 5 Different types of cables and connectors All 6 Digital IC Tester	1,2,4,5,6,7,8,9,10,11,12,13,14,15,16
2	2 Digital Multimeter	1,2,3,4,5,6,7,8,9,10,11,12,13,14,16
3	Pulse Generator	8,9,10,11,13,14
4	Different types of cables and connectors	9,15
5	Digital IC Tester	All Experiments

**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	Number systems and Codes	CO1	12	2	4	6	12
2	II	Logic Gates and Logic Families	CO2	12	2	4	6	12
3	III	Combinational Logic Circuits	CO3	15	4	6	8	18
4	IV	Sequential Logic Circuits	CO4	15	4	6	8	18
5	V	Data Converters and Memories	CO5	06	2	4	2	10
<b>Grand Total</b>				<b>60</b>	<b>14</b>	<b>24</b>	<b>30</b>	<b>70</b>

**IX. ASSESSMENT**

Formative assessment (Assessment for Learning)		Summative Assessment (Assessment of Learning)
1. Test	4. Terms work	1.End Term Exam 2.Micro-project
2. Assignment	5. Seminar/Presentation	
3. Self-learning		



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

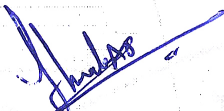
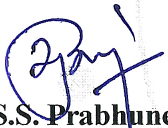


Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
<b>CO1</b>	2	2	1	-	2	2	2	2	2	3
<b>CO2</b>	2	2	2	-	2	2	2	3	2	3
<b>CO3</b>	3	2	3	2	2	2	2	3	2	3
<b>CO4</b>	3	2	3	2	2	2	2	3	2	3
<b>CO5</b>	2	-	2	2	2	2	2	3	2	3
<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
1	R P Jain	Modern Digital Electronics	Modern Digital Electronics R P Jain McGraw Hill Education Pvt. Ltd, 4th Edition,2012 ISBN 10: 0070669112 ISBN 13: 9780070669116
2	V. K. Puri	Digital Electronics	McGraw Hill ,New Delhi,2016 ISBN-97800746331751
3	Malvino.A.P, Leach, D.P, SahaG.,	Principles of Digital Electronics	McGraw Hill ,New Delhi,2014. ISBN :9780070141704
4	Mano, Morris,Ciletti, Michael D	Digital Design	Personal Education India,Delhi,2007 ISBN:9780131989245
5	Salivahanan S. Arivazhagan S	Digital Circuits And Design	Vikas Publishing House,New Delhi,2013 ISBN:9789325960411
6	Anil K. Maini	Digital Electronics, Principles and Integrated Circuits	Wiley India,Delhi,2007 ISBN:9780470032145

## XI. LEARNING WEBSITES &amp; PORTALS

Sr.No.	Link/Portal	Description
1.	<a href="https://studytronics.weebly.com/digital-electronics.html">https://studytronics.weebly.com/digital-electronics.html</a>	Basics of Digital Electronics
2.	<a href="https://www.udemy.com/course/basics-of-digital-techniques/">https://www.udemy.com/course/basics-of-digital-techniques/</a>	Introduction To Digital Number System & Logic Gates
3.	<a href="https://www.geeksforgeeks.org/synchronous-sequential-circuits-in-digital-logic/">https://www.geeksforgeeks.org/synchronous-sequential-circuits-in-digital-logic/</a>	Boolean Algebra and Logic Gates, Combinational and Sequential Logic Circuits
4.	<a href="https://onlinecourses.nptel.ac.in/noc19_ee51/preview">https://onlinecourses.nptel.ac.in/noc19_ee51/preview</a>	Digital Circuits
5.	<a href="https://de-iitr.vlabs.ac.in/">https://de-iitr.vlabs.ac.in/</a>	Virtual Labs for Digital Systems

<b>Name &amp; Signature:</b>  <b>Smt. A.P. Ghode</b> Lecturer in E&TC (Course Expert)		
<b>Name &amp; Signature:</b>  <b>Shri. S.S. Prabhune</b> (Programme Head)	<b>Name &amp; Signature:</b>  <b>Dr. S.P. Narote</b>	<b>Name &amp; Signature:</b>  <b>Shri. S.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	01/02/03/04/05/06/07/08
COURSE TITLE	INDIAN CONSTITUTION: CORE CONCEPTS AND VALUES
COURSE CODE	HU21203
PREREQUISITE COURSE CODE & TITLE	NA
CLASS DECLARATION COURSE	NO

## I. LEARNING &amp; ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme						Credits	Assessment Scheme												Total Marks
			Actual Contact Hrs./Week			SLHNLH				Paper Duration	Theory Practical				Based on LL & TSL				Based on SL			
															Practical							
			CL	TL	LL	FA-TH	SA-TH	Total			FA-PR		SA-PR		SLA							
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min													
HU21203	INDIAN CONSTITUTION: CORE CONCEPTS AND VALUES	VEC	1	--	--	1	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 course.
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.
1. 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:

Introducing a course on the Indian Constitution can provide students with a comprehensive understanding of the country's legal framework and democratic principles. Such a course could cover the historical context of its creation, the structure and functions of the government it establishes, and the fundamental rights and duties of citizens. It could also explore the significant amendments and judicial interpretations that have shaped its evolution over time. This foundational knowledge is not only for fostering informed and engaged citizens who can contribute to the nation's democratic processes but also enriches the educational experience by fostering a sense of national identity and ethical responsibility among future engineers. Furthermore, embedding Electoral Literacy and Voter Education in diploma engineering programs strategically empowers these future professionals with an awareness of their electoral privileges and the workings of democracy.

### 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:** Foster comprehension of the fundamental principles and goals embedded in the Indian constitution.  
**CO2:** Elaborate on the core rights and duties conferred upon Indian citizens by the Constitution.  
**CO3:** Comprehend the distribution of legislative, executive, and financial powers between the Union and the States.  
**CO4:** Understand the functioning of Indian democracy, encompassing its frameworks and mechanisms at local, state, and national levels.  
**CO5:** Cultivate the skills and perspectives required for active participation in electoral processes, the conscientious exercise of voting rights, and the promotion of informed democratic participation within society.

### 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 INDIAN CONSTITUTION(CL Hrs-03, Marks-NIL)</b>				
1.	<b>TLO 1.1</b> Understand the historical context and events leading to the drafting of the Indian Constitution. <b>TLO 1.2</b> Comprehend the essential features and understand the significance of the Indian Constitution in shaping India's democratic governance and societal ethos. <b>TLO 1.3</b> Analyze the vision and ideals articulated in the Preamble and their relevance in contemporary Indian society.	1.1 Historical background and making of the Indian Constitution 1.2 Salient features and significance of the Indian Constitution 1.3 Preamble: Vision and Ideals of the Indian Constitution	Presentations Case Studies and Analysis Role-Playing and Simulations Project-Based Learning	<b>CO1</b>
<b>UNIT - II FUNDAMENTAL RIGHTS, FUNDAMENTAL DUTIES AND DIRECTIVE PRINCIPLES (CL Hrs-04, Marks-NIL)</b>				
2	<b>TLO2.1</b> Understand the introduction and structure of Fundamental Rights in Part III of the Indian Constitution. <b>TLO2.2</b> Understand the principles of the Right to Equality, Right to Freedom, and Right to Life.	<b>2.1</b> Fundamental Rights: Introduction & its Scheme under Part -III <b>2.2</b> Right to Equality (Article 14-18) <b>2.3</b> Right to Freedom (Article 19-22) <b>2.4</b> Right to Life (Article 21) <b>2.5</b> Fundamental Duties and their Significance under Part IV-A <b>2.6</b> Directive Principles of State Policy under Part – IV: importance and	Presentations Case Studies and Analysis Role-Playing and Simulations Project-Based Learning	<b>CO2</b>



	<p><b>TLO2.3</b> Identify fundamental duties in general and in particular with the engineering field.</p> <p><b>TLO2.4:</b> Grasp the significance and practical application of Directive Principles of State Policy outlined in Part IV of the Indian Constitution.</p>	implementation.		
<b>UNIT- III UNION AND STATE EXECUTIVE(CL Hrs-03, Marks-NIL)</b>				
3	<p><b>TLO 3.1</b> 3.1: Gain insight into the structure and functions of the Union executives and the jurisdiction of the Supreme Court.</p> <p><b>TLO 3.2</b> 3.2: Understand the organization and responsibilities of the State Executives and the functions of the State Judiciary(High Courts).</p>	<p><b>3.1</b> Union Government, Union Legislature (Parliament), Lok Sabha and Rajya Sabha (with Powers and Functions), Union Executive, President of India (with Powers and Functions), Prime Minister of India (with Powers and Functions), Union Judiciary (Supreme Court), Jurisdiction of the Supreme Court.</p> <p><b>3.2</b> State Government, State Legislature (Legislative Assembly/ Vidhan Sabha, Legislative Council / Vidhan Parishad), Powers and Functions of the State Legislature, State Executive, Governor Of the State (with Powers and Functions), The Chief Minister Of the State (With Powers and Functions) State Judiciary (High Courts).</p>	<p>Presentations Case Studies and Analysis Role-Playing and Simulations Project-Based Learning</p>	<b>CO3</b>
<b>UNIT-IV AMENDMENTS AND EMERGENCY PROVISIONS(CL Hrs-03, Marks-NIL)</b>				
4	<p><b>TLO 4.1</b> Comprehend the meaning and significance of constitutional amendments, as well as the procedural rules detailed in Article 368 of the Indian Constitution.</p> <p><b>TLO 4.2</b> Recognize the roles of various branches of government in the amendment process,</p> <p><b>TLO 4.3</b> Examine the significant procedures and historical context of major constitutional amendments</p>	<p><b>4.1 Introduction to Constitutional Amendments:</b> Definition and significance of constitutional amendments. Constitutional provisions governing the amendment procedure (Article 368).</p> <p><b>4.2 Types of Amendments:</b> Simple majority amendments, Special majority amendments, Amendments requiring ratification by states.</p> <p><b>4.3 Role of the Executives Amendments:</b> Role of Parliament: Lok Sabha and Rajya Sabha, Role of President: Assent to amendments, Role of State Legislatures: Ratification of certain amendments.</p> <p><b>4.4 Major Constitutional</b></p>	<p>Presentations Case Studies and Analysis Role-Playing and Simulations Project-Based Learning</p>	<b>CO4</b>



		<b>Amendment procedures:</b> Major Constitutional Amendment procedures - 1st, 7th, 42nd, 44th, 73rd & 74th, 76th, 86th, 52nd & 91st, 102nd		
<b>UNIT –V ELECTORAL LITERACY (CL Hrs-02, Marks-NIL)</b>				
5	<b>TLO5.</b> Electoral Literacy: Develop understanding and proficiency in electoral processes, voter registration, rights and responsibilities of voters, electoral reforms, and initiatives promoting electoral literacy.	<b>5.1 Understanding the Electoral Process :</b> Overview of the electoral process: registration, voting, counting, and declaration of results, Role and functions of the Election Commission of India Types of elections: Lok Sabha, Rajya Sabha, State Legislative Assembly, Local Body elections <b>5.2 Voter Registration and Electoral Rolls:</b> Importance of voter registration Eligibility criteria for voter registration Process of voter registration: online, offline, and special drives Checking and updating voter details in electoral rolls <b>5.3 Rights and Responsibilities of Voters:</b> Understanding fundamental rights related to elections Responsibilities of voters towards ensuring free and fair elections Consequences of electoral malpractices and non-participation <b>5.4 Electoral Reforms and Initiatives:</b> Overview of electoral reforms aimed at enhancing transparency, inclusivity, and integrity of elections Role of technology in improving electoral processes: Voter Verifiable Paper Audit Trail (VVPAT), Online voter registration, e-voting Initiatives by the Election Commission and civil society organizations to promote electoral literacy	Presentations Case Studies and Analysis Role-Playing and Simulations Project-Based Learning	CO5

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

NOT APPLICABLE

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

- i) **Case Study Analysis:** Select a few landmark Supreme Court cases related to Fundamental Rights (e.g., Kesavananda Bharati v. State of Kerala, Maneka Gandhi v. Union of India) and analyze the court's interpretation and impact on these rights.
- ii) **Comparative Analysis:** Compare the provisions of the Right to Equality under Articles 14-18 with similar provisions in the constitutions of other countries. Highlight similarities, differences, and the reasoning behind them.
- iii) **Public Awareness Campaign:** Design a public awareness campaign to educate citizens about their Fundamental Rights and Duties. Create informative posters, social media content, and interactive workshops to engage people in discussions about constitutional rights and responsibilities.
- iv) Write a reflective essay discussing the historical context and debates surrounding the inclusion of Fundamental Rights in the Indian Constitution.
- v) Create a visual timeline depicting the evolution of laws related to equality in India, from independence to the present day. Include major legislative reforms and judicial decisions.
- vi) Conduct a comparative analysis of the implementation of Directive Principles in different states of India, identifying successful initiatives and areas needing improvement.
- vii) **Case Study Analysis:** Choose a recent constitutional or political issue that has been debated in Parliament. Analyze the roles played by the Lok Sabha and Rajya Sabha in addressing the issue and the impact of their decisions.
- viii) **Case Study Analysis: Analyze a landmark constitutional amendment in India (e.g., the 42nd Amendment) and its impact on governance, fundamental rights, and the balance of power between different branches of government.**
- ix) **Infographic Creation:** Create an infographic illustrating the process of amending the Indian Constitution as outlined in Article 368. Highlight key steps and requirements for different types of amendments.
- x) **Timeline Project:** Create a timeline highlighting major constitutional amendments in India, such as the 1st, 7th, 42nd, 44th, 73rd & 74th, 76th, 86th, 91st, and 102nd amendments. Include key provisions and the political context surrounding each amendment.
- xi) **Debate:** Organize a debate on the topic "Should the President have the power to refuse assent to constitutional amendments?" Encourage students to research and present arguments from legal, political, and ethical perspectives.
- xii) **Campaign Design:** Design a social media campaign to raise awareness about the importance of voter participation and responsible voting. Create visually engaging posters, infographics, and videos highlighting the consequences of electoral malpractices and non-participation.
- xiii) **Online Tutorial:** Create a step-by-step tutorial video or guide demonstrating the voter registration process, both online and offline. Include instructions for checking and updating voter details in electoral rolls.
- xiii) **Survey Project:** Conduct a survey to assess the awareness and accessibility of voter registration

facilities among different demographic groups in your locality. Analyze the results and propose strategies to improve voter registration rates.

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

NOT APPLICABLE

**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, Self-learning and Terms work Seminar/Presentation	—

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

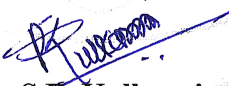
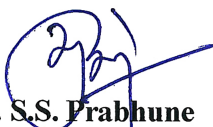


Course Outcomes (Cos)	Programme Outcomes(Pos)							Programme Specific Outcomes *(PSOs)	
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CO1	--	--	--	--	2	--	2		
CO2	--	--	--	--	3	--	2		
CO3	--	--	--	--	3	--	2		
CO4	--	--	--	--	3	--	2		
CO5	--	--	--	--	3	--	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
1	M. Laxmikanth	"Indian Polity"	McGraw Hill Education: ISBN-13: 978-9352603633
2	D. D. Basu	Introduction to the Constitution of India	LexisNexis: ISBN-13: 978-8180386477
3	Subhash C. Kashyap	Our Constitution: An Introduction to India's Constitution and Constitutional Law	National Book Trust, India ISBN-13: 78-8123748462
4	Arun K. Thiruvengadam	The Constitution of India: A Contextual Analysis	Oxford University Press ISBN-13: 978-0199467078
5	Oxford University Press	The Making of India's Constitution	Oxford University Press Oxford University Press

**XI. LEARNING WEBSITES & PORTALS**

Sr.No.	Link/Portal	Description
1	<a href="https://prsindia.org/">https://prsindia.org/</a>	In-depth analysis of parliamentary affairs, legislative processes, and policy Issues in India.
2	<a href="https://awmin.gov.in">https://awmin.gov.in</a>	Official repository providing access to the full text of the Indian Constitution.
3	<a href="https://constitution.org.in">https://constitution.org.in</a>	Interactive platform offering the text of the Constitution along with annotations and historical context.
4	<a href="https://indiankanoon.org">https://indiankanoon.org</a>	Legal search engine offering a vast database of Indian case law, including constitutional judgments.
5	<a href="https://nptel.ac.in">https://nptel.ac.in</a>	Offers video lectures and course materials on studies of law and the constitution.

Name & Signature:		
 <b>Mr. S.B. Kulkarni</b> Lecturer in Mechanical Engineering <b>(Course Experts)</b>		
Name & Signature:	Name & Signature:	Name & Signature:
 <b>Shri. S.S. Prabhune</b> (Programme Heads)	 <b>Dr.S.P.Narote</b>	 <b>Shri. S.B. Kulkarni</b> (CDC In-charge)



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

<b>PROGRAMME</b>	<b>DIPLOMA IN ET</b>
<b>PROGRAMME CODE</b>	<b>03</b>
<b>COURSE TITLE</b>	<b>PYTHON PROGRAMMING</b>
<b>COURSE CODE</b>	<b>ET51201</b>
<b>PREREQUISITE COURSE CODE &amp; TITLE</b>	<b>--</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			Practical													
								FA-TH			SA-TH	Total		FA-PR		SA-PR		SLA			
								Max			Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	
ET51201	Python Programmig	DSC	3	1	2	2	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 course.
- 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:**

In the present scenario most of the electronic equipment like computers, mobiles, music systems, ATM, automation and control circuits and systems are based on digital circuits which the diploma electronic engineering pass outs have to test them. the knowledge of basic logic gates, combinational and sequential logic circuits using gates as well as digital ICS will enable the students to interpret the working of equipment's and maintain them. After completion of the course, students will be able to develop the digital circuits-based applications.

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

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

- CO1: Acquire fundamental programming concepts using Python
- CO2: Acquire programming skills of python using looping, control statements and string manipulations.
- CO3: Construct Python data structures programs using tuples, dictionaries and set
- CO4: Apply core programming concepts of file handling, exception handling.
- CO5: Apply programming concepts for implementation of python packages.
- CO5: Apply programming concepts for automation of python scripts



## 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 Fundamentals of Python (CL Hrs-06, Marks-10)</b>				
1.	<b>TLO 1.1:</b> Install the given Python IDE and editor <b>TLO 1.2:</b> Identify the given variables, Keywords and constants in Python <b>TLO 1.3:</b> Use indentation, comments in the given program. <b>TLO 1.4:</b> Develop Python program to display the given text.	1.1 Features of Python – Interactive, object oriented, interpreter, platform independent 1.2 Get familiar and introduction of python 1.3 Python Installation and Working of it 1.4 Python building blocks- variables, basic Operators, understanding python blocks 1.5 Python Data Types, Declaring and using Numeric data types: int, float etc.	Classroom Learning, Reference books, NPTEL	<b>CO1</b>
<b>UNIT-II Control Flow Statements (CL Hrs-10, Marks-12)</b>				
2	<b>TLO 2.1:</b> Write simple Python program to evaluate the given arithmetic expression <b>TLO 2.2:</b> Use different types of operators for writing arithmetic expressions. <b>TLO 2.3:</b> Write a Python program using conditional statements for two way branching to solve given problem. <b>TLO 2.4 :</b> Write a Python program using while loop for multiway branching to solve the given problem.	2.1 Basic operators : Arithmetic, comparison, relational, assignment, logical, bitwise, etc... 2.2 Python Program Flow Control Conditional blocks 2.3 Conditional Statements(if, if else,.... nested if). 2.4 Simple for loops in python, For loop using ranges, string, list and dictionaries. 2.5 Use of while loops in python, Loop manipulation using pass, continue, break and else. Programming using Python conditional and loop blocks.	Classroom Learning, Reference books, NPTEL	<b>CO2</b>
<b>UNIT-III Data Structures in Python (CL Hrs-7, Marks-14)</b>				
3	<b>TLO 3.1:</b> Write python program to use and manipulate string for the given problem. <b>TLO 3.2:</b> Write python program to use and manipulate lists for the given problem. <b>TLO 3.3:</b> Write python program to use and manipulate tuples for the given problem. <b>TLO 3.4:</b> Write python program to use and Dictionaries lists for the given problem.	3.1 Python Complex data types: Using string data type and string operations. 3.2 Lists : Defining list and list slicing, accessing values in list, deleting values in lists, updating lists. Basic list operations. Built in list functions. 3.3 Tuples : Defining Tuples and Tuple slicing, accessing values in Tuples, deleting values in Tuples, updating Tuples. Basic Tuples operations. Built in Tuples functions. 3.4 Dictionaries: Defining Dictionary, accessing values in Dictionary, deleting values in Dictionary, updating Dictionary. Basic Dictionary operations. Built in Dictionary functions. 3.5 Python Functions, Organizing python codes using functions.	Classroom Learning, Reference books, NPTEL	<b>CO3</b>

UNIT- IV File I/O Handling (CL Hrs 6, Marks-12)				
4	<p><b>TLO 4.1 :</b> Write Python program to read the values from given data file.</p> <p><b>TLO 4.2 :</b> Write Python program to write the values on a given data file.</p> <p><b>TLO 4.3 :</b> Write Python program to read the values from given word file.</p> <p><b>TLO 4.4 :</b> Write Python program to write the values on a given word file.</p>	<p>4.1 Python File Operations: Types of files</p> <p>4.2 Creating and Reading text from data files.</p> <p>4.3 Writing files in python.</p> <p>4.4 Understanding read functions, read(), readline(), readlines().</p> <p>4.5 Understanding write functions, write() and writelines() Manipulating file pointer using seek Programming, using file operations.</p>	Classroom Learning, Reference books, NPTEL	CO4
UNIT –V Functions and Packages (CL Hrs-10, Marks-12)				
5	<p><b>TLO 5.1 :</b> Develop programs using built in functions</p> <p><b>TLO 5.2 :</b> Write a Python program to import the package and use it in the example.</p> <p><b>TLO 5.3 :</b> Write a python code to import matplotlib package and use it in the given example.</p> <p><b>TLO 5.4 :</b> Write a python code to import numpy package and use it in the given example.</p> <p><b>TLO 5.5 :</b> Write a python code to import pandas package and use it in the given example.</p>	<p>5.1 Introduction to Python User defined Function and modules</p> <p>5.2 Passing parameters to a function and returning values from a function</p> <p>5.3 Standard Library: Built-in Function and Packages</p> <p>5.4 Python packages</p> <p>a. Simple programs using the built-in matplotlib functions</p> <p>b. Simple programs using the built-in numpy. Functions</p> <p>c. Simple programs using the built-in pandas functions</p>	Classroom Learning, Reference books, NPTEL	CO5
UNIT –VI Automation in Python (CL Hrs-6, Marks-10)				
6	<p><b>TLO 6.1 :</b> Develop automate program to organize files by their extensions</p> <p><b>TLO 6.2 :</b> Write a Python automation program to check disk usage.</p> <p><b>TLO 6.3 :</b> Write a python automation code that process and cleans a CSV file.</p> <p><b>TLO 6.4 :</b> Write a python code to automatically convert PDF file to image using PyMuPDF library.</p>	<p>6.1 Introduction to Python Automation User defined Function and modules</p> <p>6.2 Right Tools and libraries Standard Library: Built-in Function and Packages</p> <p>6.3 Writing and Testing the script</p> <p>6.4 Schedule the script</p> <p>6.5 Automation task of file management: read/write files and file organization</p> <p>6.6 Python automation to check disk usage.</p> <p>6.7 Automation to clear CSV file</p>	Classroom Learning, Reference books, NPTEL	CO5

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

Sr. No.	Name of Experiment/Assignment	COs	Hrs
1	Installation of Python and configuration of Python IDE	1	02
2	a. Write python program to print Hello World b. Write python program to Hello World using string variable	1	
3	Create a program that asks the user to enter their name and their age. Print out a message addressed to them that tells them the year that they will turn 100 years old.	1	02
4	a. Write a function that takes a character (i.e. a string of length 1) and returns True if it is a vowel, False otherwise. b. Define a function that computes the length of a given list or string.	2	02
5	a. Write simple Python program to implement arithmetic and logical operators (any two programs) b. Write a program to display all prime numbers within a range	2	02
6	Write a Python program to count the number of even and odd numbers from a series of numbers.	2	
7	Write Python program to demonstrate use of conditional statements a. if.....else statement b. if...elseif...else statement c. Nested if statement (any two programs for all conditions)	2	02
8	Write Python program to demonstrate use of looping statements a. while loop b. while .... Break c. while....continue d. Nested loops (any two programs for all conditions)	2	02
9	Write Python program to demonstrate use of for loop and nested loops	2	02
10	Write Python program which takes two digits m (row) and n (column) as input and generates a two-dimensional array. The element value in the i-th row and j-th column of the array should be i*j.	3	02
11	Write Python program to perform operations on list such as create, access, delete, update etc.	3	02
12	Write Python program to perform operations on Tuples such as create, access, delete, update etc.	3	02
13	Write Python program to perform operations on Dictionaries such as create, access, delete, update etc.	3	02
14	Write a Python script to concatenate following dictionaries to create a new one. Sample Dictionary: dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60} Expected Result: {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}	3	02

15	a) Write Python program to demonstrate math built- in functions (Any 2 programs) b) Write Python program to demonstrate string built – in functions (Any 2 programs)	3	02
16	Write a program to perform the below operations on files: <ul style="list-style-type: none"> <li>• Create a text file and write a string to it.</li> <li>• Read an entire text file.</li> <li>• Read a text file line by line.</li> <li>• Write a string to a file.</li> <li>• Write a list of strings to a file.</li> <li>• Count the number of lines, words in a file.</li> </ul>	4	02
17	Write a program that reads a text file and calculates the average word length and sentence length in that file	4	02
18	Write Python program to demonstrate use of: a) built-in packages (e.g. NumPy, Pandas) b) user defined packages	5	02
19	Write a program to automate the organization of files by their extensions.	6	02
20	Write a python automation program to check disk usage.	6	02
21	Write a python automation program to process and clean a CSV file. .	6	02
22	Write a python automation program to automatically convert PDF file to image using PyMuPDF library.	6	02
23	Complete a Micro- project based on guidelines provided in sr.no. 11.	All	--
			<b>38</b>

**Note: Note: Any 12 practical from sr. no. 1 –18 , any two practical from 20 to 24 can be performed and 23 is compulsory**

#### V. 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 that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs (Affective Domain Outcomes). Each student will have to maintain an activity chart consisting of individual contributions to the project work and give a seminar presentation of it before submission. The student ought to submit a micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Employee Management System using Python
- File Sharing App using Python
- Student Management System



- GUI based microproject using
  - Tkinter Projects
  - Turtle Projects
  - Python Django Projects

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

Sr.No	Equipment Name with Broad Specifications
1	Computer with latest configuration with Windows/Linux/Unix Operating System.
2	Python IDE
3	Anaconda, Jupyter
4	Text Editor (VS Code, Sublime Text, Atom, Vim or any other editor) or Python IDE (IDLE, PyCharm, PyDev, Spyder or any other IDE)

**VII. 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	Fundamentals of Python	CO1	06	2	4	4	10
2	II	Control Flow Statements	CO2	10	4	4	4	12
3	III	Data Structures in Python	CO3	07	2	4	8	14
4	IV	File I/O Handling	CO4	06	2	4	6	12
5	V	Functions and Packages	CO5	10	2	2	8	12
6	VI	Automation in Python	CO6	06	2	4	4	10
Grand Total				45	14	22	34	70



**VIII. ASSESSMENT METHODOLOGIES / TOOLS**

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

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


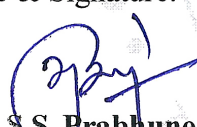

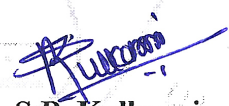
Course Outcomes (COs)	Programme Outcomes(POs)							Programme Specific Outcomes *(PSOs)		
	PO-1 Basic and Discipline-Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	1	2	-	-	1	2	2	3
CO2	3	2	2	2	-	2	2	3	2	3
CO3	2	1	2	2	-	2	2	3	2	3
CO4	2	2	3	2	-	3	3	3	2	3
CO5	2	2	3	2	-	2	2	3	2	3
CO6	1	3	3	3	-	2	1	2	3	3
<b>Legends:- High:03, Medium:02, Low:01, No Mapping: -</b> *PSOs are to be formulated at the institute level										

**X. SUGGESTED LEARNING MATERIALS / BOOKS**

Sr.No	Author	Title	Publisher
1	Fundamentals of Python – First Programs	Kenneth A. Lambert	CENGAGE Publication, 2015
2	Let Us Python	Yashwant KAnetkar	BPB publications
3	Core Python Programming	R. Nageswara Rao	Dreamtech
4	Introduction to Computation and Programming Using Python	John V Guttag	Prentice Hall of India
5	Introduction to Computing and Problem Solving with PYTHON	Jeeva Jose &.SojanLal	Khanna Publishers, New Delhi, 2016
6	Python Programming	R. Nageswara Rao	Scitech Publications (India) Pvt. Ltd.
7	Python Essential Reference	David Beazley	Addison-Wesley Professional

## XI. LEARNING WEBSITES &amp; PORTALS

Sr.No	Link/Portal	Description
1.	<a href="https://www.learnpython.org/">https://www.learnpython.org/</a>	Basics of Python Programming
2.	<a href="https://www.programiz.com/python-programming">https://www.programiz.com/python-programming</a>	Python Programming
3.	<a href="https://pynative.com/python-control-flow-statements/">https://pynative.com/python-control-flow-statements/</a>	Control Flow Statements
4.	<a href="https://www.youtube.com/watch?v=W8KRzm-HUcc">https://www.youtube.com/watch?v=W8KRzm-HUcc</a>	Tuples
5.	<a href="https://www.youtube.com/watch?v=daefaLgNkw0">https://www.youtube.com/watch?v=daefaLgNkw0</a>	Dictionaries
6.	<a href="https://www.geeksforgeeks.org/python-modules/">https://www.geeksforgeeks.org/python-modules/</a>	Modules
7.	<a href="https://medium.com/@er.26yashiagarwal/modules-and-functions-in-python-423a0b6c4f49">https://medium.com/@er.26yashiagarwal/modules-and-functions-in-python-423a0b6c4f49</a>	Functions
8.	<a href="https://www.geeksforgeeks.org/python-packages/">https://www.geeksforgeeks.org/python-packages/</a>	Packages

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