

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Diploma in Electronics and Telecommunication Engineering

Semester-III

- A) Course Code : 2028C01BT028
B) Course Title : Analog Electronic Circuit - I
C) Pre-requisite Course Code and Title : Fundamentals of Electrical & Electronics Engineering

D) Rationale:

Analog Electronic circuits are the most important part of industrial equipment, automation and communication systems. Concept of analog circuit analysis and working helps in maintaining and troubleshooting different types of analog circuits. This course will help the students to maintain various electronic circuits consisting of analog components and will also develop the skills to troubleshoot the circuits frequently used in automation and communication Industries.

E) Course Outcomes:

CO-1 Use semiconductor diodes in various electronics circuits.

CO-2 Test the working of Bipolar Junction Transistor (BJT) and FET transistor.

CO-3 Analyze amplifier at low frequency.

CO-4 Analyze single stage and multistage transistor amplifiers at high frequency.

CO-5 Use of Feedback amplifier and power amplifier.

F) Scheme of Studies:

S.No.	Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)			
				L	P	T	Total Credit L+T+(P/2)
1	E&TC Engineering	2028C01BT028	Analog Electronic Circuit - I	2	-	1	3
2	E&TC Engineering	2028C01BL028	Analog Electronic Circuit - I (Lab)	-	2	-	1

Legend: L-Lecture, P- Practical, T- Tutorial

G) Scheme of Assessment:

S.No.	Board of Study	Course Code	Course Title	Scheme of Examination					
				Theory			Practical		Total Marks
				ES E	C T	TA	ES E	TA	
1	E&TC Engineering	2028C01BT028	Analog Electronic Circuit - I	100	20	20	-	-	140

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S.No	Board of Study	Course Code	Course Title	Scheme of Examination					
				Theory			Practical		Total Marks
				ESE	CT	TA	ESE	TA	
2	E&TC Engineering	2028C01BL028	Analog Electronic Circuit - I (Lab)	-	-	-	40	20	60

Legend: ESE- End semester Exam, CT- Class test, TA- Teacher Assessment

H) Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self-Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

CO-1 Analyze the transistor amplifier at low frequency.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO1.1: Explain the formation of depletion layer, barrier potential, and V-I characteristics of a PN junction diode. SO1.2: Analyze the performance parameters (PIV, ripple factor, efficiency) of full-wave rectifiers. SO1.3: Design Zener diode-based voltage regulators for given specifications. SO1.4: Demonstrate the operation of clipper and clamper circuits for waveform shaping.	LE1.1: Plot V-I characteristics of a PN junction diode and determine static/dynamic resistance. LE1.2: Assemble and test center-tapped and bridge rectifiers; measure ripple factor and efficiency. LE1.3: Design a Zener voltage regulator and observe load regulation. LE1.4: Construct positive/negative clipper and clamper circuits; analyze output waveforms.	Unit-1.0 Diode and it's application 1.1 PN Junction Diode: Depletion layer formation, barrier potential, forward/reverse bias. Diode current equation, static/dynamic resistance, equivalent circuits. 1.2 Rectifiers & Filters: Full-wave rectifiers (center-tapped, bridge), rectifier parameters (PIV, TUF, ripple factor). Filter circuits (L, C, LC, CLC) and ripple reduction analysis. 1.3 Diode Applications Zener breakdown mechanisms, voltage regulator design. Clippers (series/parallel), clampers (positive/negative).	- Compare half-wave vs. full-wave rectifiers using PIV and efficiency. - Research real-world applications of Zener diodes in power supplies. - Simulate clipper/clamper circuits using tools like Multisim/Proteus.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

- Calculate ripple factor for a bridge rectifier with/without an LC filter. Submit derivations + simulated waveforms (using Proteus/Multisim).
- Design a Zener shunt regulator for 9V output with 10mA load current. Justify component choices.
- Compare V-I characteristics of Si vs. Ge diodes using a breadboard experiment. Record observations.

b. Mini Project:

- "Solar-Powered Battery Charger": Use diodes, rectifiers, and filters to charge a 6V battery.
- "Audio Clipper Circuit": Build a clipper to limit microphone signal amplitude ($\pm 2V$).
- "Variable DC Supply": Design a 0-12V supply using rectifiers + Zener regulation.

Other Activities (Specify):

- Demonstrate a negative clamper circuit on breadboard. Capture input/output waveforms.
- Troubleshoot a faulty full-wave rectifier (e.g., open diode) in lab. Document steps.

CO-2 Analyze single stage and multistage transistor amplifiers at high frequency.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO2.1 Analyze the DC biasing conditions (Q-point) of BJT in CE, CB, CC configurations. SO2.2 Compare input/output characteristics of CE, CB, CC configurations. SO2.3 Explain thermal runaway and stability criteria in biasing circuits. SO2.4 Compare JFET and MOSFET characteristics..	LE2.1: Determine Q-point and load line for CE configuration. LE2.2: Measure input/output impedance and gain of CB/CC configurations. LE2.3: Test voltage divider bias circuit and observe thermal stability. LE2.4: Plot drain characteristics of JFET and identify pinch-off voltage.	Unit-2.0 BJT & FET 2.1 BJT Analysis Construction, modes of operation (active/saturation/cut off), base-width modulation. Biasing techniques (base resistor, voltage divider), thermal runaway. 2.2 Transistor Configurations CE, CB, CC: Input/output characteristics, current gain (α , β), power gain. 2.3 FET Basics JFET: Construction, pinch-off voltage, drain characteristics. MOSFET:	- Investigate BJT applications in amplifiers vs. switches. - Compare JFET and BJT based on input impedance and noise. - Study datasheets of commercial transistors (e.g., BC547, 2N7000).

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		Enhancement vs. depletion modes	
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SW-2 Suggested Sessional Work (SW):

a. Assignments:

- Derive Q-point for a voltage divider bias circuit. Simulate in software and validate calculations.
- Analyze thermal runaway in a BJT by varying ambient temperature (using a heat gun). Plot β vs. Temperature.

b. Mini Project:

- Class-A Audio Amplifier**: Build a 1W amplifier using BJT in CE configuration. Test frequency response.
- FET-Based Touch Switch**: Construct a touch-activated LED using MOSFET.

c. Other Activities (Specify):

- Measure and plot drain characteristics of JFET. Identify pinch-off voltage.

CO-3 Analyze transistor amplifier at low frequency.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO3.1: Explain the need for h-parameters to analyze performance of a transistor. SO3.2: Explain the steps to determine the h- parameters of the given type of transistor configuration. SO3.3: Compare the h- parameter of CE, CB, and CC configurations.	LE3.1 Determine the operating point, load line, input impedance, output impedance, voltage gain and forward current gain of CE configuration. LE3.2 Determine the operating point, load line, input impedance, output impedance, voltage gain and forward current gain of CB configuration. LE3.3 Determine the operating point, load line, input impedance, output impedance, voltage gain and	Unit 3.0 Transistor at Low Frequency 3.1 DC and AC Equivalent circuit of Transistor 3.2 Need for h-parameter model of transistor, calculation of input impedance, output impedance, current gain and voltage gain 3.3 Comparison of CE, CB, CC h- amplifier circuit based on h-parameter concept, voltage gain, current gain, input impedance, output impedance and load line analysis. 3.4 Simplified model of CE configuration of transistor.	Comparison between CE, CB, and CC on the basics of h-parameter. Differentiate between the circuits in which transistor is used as a switch and as an amplifier.

	forward current gain of CC configuration		
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(Approx. Hrs: CI+ LI+SW+SL =)

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

i. Calculate the performance parameters of CE, CB and CC amplifier for $R_L = 2K$, $R_s = 2K$.

ii. Describe the effect of R_e on voltage gain of CE configuration.

Mini Project:

i. Obtain the 3 dB cut off frequency and gain of a CE amplifier with $R_c = 2K$ and biasing resistors $R_1 = 100K$, $R_2 = 100K$.

c. Other Activities (Specify):

i. Organized a Seminar on importance of h- parameters for transistor analysis.

CO-4 .Analyze single stage and multistage transistor amplifiers at high frequency.

(Approx. Hrs: CI+SW+SL =)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self-Learning (SL)
SO4.1 Describe hybrid π model for CE configuration. SO4.2 Compare hybrid π model with h-parameter model for CE and CC configuration. SO4.3 Describe the working of RC coupled transistor amplifier. SO4.4 Differentiate various types of coupled amplifier. SO4.5 Identify the amplifier configuration in multistage amplifier designs. SO4.6 Suggest the coupling for the given application. SO4.7 Explain Various types of Distortions in amplifier.	LE4.1 Determine voltage gain and 3 dB frequency of CE transistor amplifier by plotting the frequency response. LE4.2 Determine voltage gain and 3 dB frequency of CB transistor amplifier by plotting the frequency response. LE4.3 Determine voltage gain and 3 dB frequency of CB transistor amplifier by plotting the frequency response. LE4.4 Determine voltage gain and 3 dB frequency of RC coupled transistor amplifier by plotting the frequency response.	Unit 4.0 Transistor at High Frequency and Multistage Amplifier 4.1 Hybrid π model in CE and CC configuration 4.2 Relation between hybrid π and h-parameter model. 4.3 Need of multistage amplifier, Selection of amplifier configuration for multistage amplifiers. 4.4 direct coupled, RC coupled and transformer coupled amplifier. 4.5 Distortions (Amplitude, Frequency & Phase shift Distortion) in amplifier.	Comparison of all Multistage amplifiers. Summarize advantages and disadvantages of multistage amplifiers.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

- i. Obtain hybrid π parameters in terms of h- parameters.
- ii. Explain the selection criteria amplifier configurations used for multistage amplifier.

b. Mini Project:

- i. Realize two stage (CB-CE) and two stage (CE-CE) amplifier and compare the output response of both.

C. Other Activities (Specify):

- i. Identify the low frequency and high frequency amplifiers amplifier used in AM and FM radio and describe its working.

CO-5. Feedback amplifier and power amplifier

(Approx. Hrs: CI+SW+SL =)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Explain the basic concept of feedback amplifier. SO5.2 Explain characteristics of the given type of power amplifiers.	LE5.1 Determine voltage gain and 3 dB frequency of Voltage series feedback transistor amplifier by plotting the frequency response. LE5.2 Determine voltage gain and 3 dB frequency of Voltage shunt feedback transistor amplifier by plotting the frequency response. LE5.3 Determine voltage gain and 3 dB frequency of current series feedback transistor amplifier by plotting the frequency response. LE5.4 Observe the waveform and find the efficiency of the given class A amplifier. LE5.5 Observe the waveform and find the efficiency of the given class B amplifier. LE5.6 Observe the waveform and find the efficiency of the given class C amplifier.	Unit 5. Feedback amplifier and power amplifier 5.1 Types of feedback, Feedback topologies : Voltage series, voltage shunt, Current series, Current shunt. Effect of negative feedback on gain, stability, distortion, noise, bandwidth . 5.2 Difference between voltage and power amplifiers, Characteristics and applications of Class A, Class B, Class C and Class AB amplifier.	Advantages and disadvantages of positive and negative feedback in the amplifiers. Summarize Frequency range of Various oscillators Compare the various types of power amplifiers.

SW-5 Suggested Sessional Work (SW) :

a. Assignments:

- i. Discuss various types of Noise in an amplifier circuit.
- ii. Compare input and output impedance of various feedback topologies.

iii. What are the performance parameters of a power amplifier?

b. Mini Project:

- Make a voltage series feedback amplifier on bread board and observe the change in gain of amplifier by changing the amount of feedback.
- Prepare a list of power ratings of power amplifiers used for different domestic applications.

C. Other Activities (Specify):

- Organize Seminar on application of amplifiers in all domestic electronic equipment.
- Demonstrate the difference between power amplifier and voltage amplifier in the lab.

Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

B) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):

Unit Number	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
I	Use semiconductor diodes in various electronics circuits.	6	6	8	20
II	Test the working of Bipolar Junction Transistor (BJT) and FET transistor .	4	7	9	20
III	CO-3 Analyze amplifier at low frequency..	6	7	7	20
IV	Analyze single stage and multistage transistor amplifiers at high frequency.	4	7	9	20
V	Use of Feedback amplifier and power amplifier.	3	8	9	20
Total		23	35	42	100

Legend: R: Remember, U: Understand, A: Apply and above

C) Suggested Specification Table (For ESA of Laboratory Instruction*):

S. No.	List of Practical's	Assessment of Laboratory Work
		(Marks)

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		Performance		Viva-Voce
		PRA	PDA	
LE1.1	Plot V-I characteristics of a PN junction diode and determine static/dynamic resistance.	20	15	05
LE1.2	Assemble and test center-tapped and bridge rectifiers; measure ripple factor and efficiency.	20	15	05
LE1.3	Design a Zener voltage regulator and observe load regulation.	20	15	05
LE1.4	Construct positive/negative clipper and clamper circuits; analyze output waveforms.	20	15	05
LE2.1	Determine Q-point and load line for CE configuration.	20	15	05
LE2.2	Measure input/output impedance and gain of CB/CC configurations.	20	15	05
LE2.3	Test voltage divider bias circuit and observe thermal stability.	20	15	05
LE2.4	Plot drain characteristics of JFET and identify pinchoff voltage.	20	15	05
LE3.1	Determine the operating point, load line, input impedance, output impedance, voltage gain and forward current gain of CE configuration.	20	15	05
LE3.2	Determine the operating point, load line, input impedance, output impedance, voltage gain and forward current gain of CB configuration.	20	15	05
LE3.3	Determine the operating point, load line, input impedance, output impedance, voltage gain and forward current gain of CC configuration	20	15	05
LE4.1	Determine voltage gain and 3 dB frequency of CE transistor amplifier by plotting the frequency response.	20	15	05
LE4.2	Determine voltage gain and 3 dB frequency of CB transistor amplifier by plotting the frequency response.	20	15	05

LE4.3	Determine voltage gain and 3 dB frequency of CB transistor amplifier by plotting the frequency response.	20	15	05
LE4.4	Determine voltage gain and 3 dB frequency of RC coupled transistor amplifier by plotting the frequency response.	20	15	05
LE5.1	Determine voltage gain and 3 dB frequency of Voltage series feedback transistor amplifier by plotting the frequency response.	15	15	05
LE5.2	Determine voltage gain and 3 dB frequency of Voltage shunt feedback transistor amplifier by plotting the frequency response.	20	15	05
LE5.3	Determine voltage gain and 3 dB frequency of current series feedback transistor amplifier by plotting the frequency response.	20	15	05
LE5.4	Observe the waveform and find the efficiency of the given class A amplifier.	20	15	05
LE5.5	Observe the waveform and find the efficiency of the given class B amplifier.	20	15	05
LE5.6	Observe the waveform and find the efficiency of the given class C amplifier.	20	15	05

* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments /practical

Legend: PRA: Process Assessment, PDA: Product Assessment

Note: Only one experiment has to perform at the end semester examination of **30** Marks as per assessment scheme

D) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration

11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

E) Suggested Learning Resources:

(a) Books :

S. No.	Titles	Author	Publisher	Edition & Year
1.	Electronic devices and circuit	Godse and Bakshi	Technical publications, Pune	1 st Edition ,2009 Or latest edition
2.	Integrated Electronics: analog and digital	Jacob Millman, Christos C. Halkias	Tata McGraw-Hill, New Delhi	3 rd Edition ,2010 Or latest edition
3.	Basic Electronics and Linear circuits	N.N. Bhargava, D.C. Kulshreshtha, S.C. Gupta	Technical education series, New Delhi	2 nd Edition ,2013 Or latest edition
4.	Principles of Electronics	V.K. Mehta	S. Chand and Company ltd., New Delhi	3 rd Edition ,2005 Or latest edition
5	Microelectronic circuits	Sedra and smith	Oxford University Press, New Delhi	6 th Edition,2009 Or latest edition
6	एनालॉग इलेक्ट्रॉनिक सर्किट-I	Satish Kumar Thakur and Jayant Kumar Rai	University Book house (Pvt.) Ltd. Jaipur	1 st Edition, 2022 ISBN No: 978-93-90672-38- 7

(b) Open source software and website address:

1. CEconfigurations:-<http://studentboxoffice.in/jntuh/notes/electronic-devices-and-circuits-lab/input-and-output-characteristics-of-ce-configuration-and-h-parameter-calculations/7>
2. Class A amplifier-http://www.electronics-tutorials.ws/amplifier/amp_5.html
3. Power amplifier- <http://www.learnabout-electronics.org/Amplifiers/amplifiers50.php>
4. Tuned amplifier-<http://ecetutorials.com/question-answers/amplifier-question-and-answers-2/tuned-ampli>

5. Book-<https://www.amazon.in/Basic-Electronics-Linear-Circuits-Bhargava/dp/1259006468>

(c) Others:

1. Learning Packages.
2. Lab Manuals.
3. Manufacturers' Manual
4. Users' Guide

F) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Multimeter	Analog and Digital AC voltage:0-400 V,DC Voltage:0-24V AC Current:0-20A,DC Current:0-20 A	All
2	CRO	60 MHz, Dual Channel, Dual Trace With Component Tester	All
4	Function generator	0 -2 MHz with Sine, Square, Triangular wave output With Variable Frequency and output	LE4.1 to LE4.4 LE5.1 to LE5.5
5	Variable DC supply	0 to 30 V DC dual power supply	All
6	Digital Multimeter	3 and ½ digit with component Tester	All

N) Mapping of POs & PSOs with COs:

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)	
	PO-1 Engineering knowledge	PO-2 Problem Analysis	PO-3 Solution Design	PO-4 Modern Tools Usage	PO-5 Ethics & Sustainability	PO-6 Project & Team Management	PO-7 Lifelong Learning	PSO-1	PSO-2
CO-1 Use semiconductor diodes in various electronics circuits.	2	3	2	2	1	1	1	3	3
CO-2 Test the working of Bipolar Junction Transistor (BJT) and FET transistor.	2	3	2	2	1	1	1	3	3
CO-3 Analyze amplifier at low frequency.	2	3	2	2	1	1	1	3	3
CO-4 Analyze single stage and multistage transistor amplifiers at high frequency.	2	3	2	2	1	1	1	3	3
CO-5 Use of Feedback amplifier and power amplifier.	2	3	2	2	1	1	1	3	3

Legend: 1 – Low, 2 – Medium, 3 – High

O) Course Curriculum Map:

POs & PSOs No.	COs No. & Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO-1,2,3,4,5,6,7 PSO-1,2	CO-1 Use semiconductor diodes in various electronics circuits.	SO1.1, SO1.2, SO1.3, SO1.4	LE1.1, LE1.2, LE1.3, LE1.4	Unit 1.0 Diode and its application 1.1, 1.2, 1.3	As mentioned in relevant page numbers
PO-1,2,3,4,5,6,7 PSO-1,2	CO-2 Test the working of Bipolar Junction Transistor (BJT) and FET transistor.	SO2.1, SO2.2, SO2.3, SO2.4	LE2.1, LE2.2, LE2.3, LE2.4	Unit 2.0 BJT & FET 2.1, 2.2, 2.3	
PO-1,2,3,4,5,6,7 PSO-1,2	CO-3 Analyze amplifier at low frequency.	SO3.1, SO3.2, SO3.3	LE3.1, LE3.2, LE3.3	Unit 3.0 Transistor at Low Frequency 3.1, 3.2, 3.3, 3.4	
PO-1,2,3,4,5,6,7 PSO-1,2	CO-4 Analyze single stage and multistage transistor amplifiers at high frequency.	SO4.1, SO4.2, SO4.3, SO4.4, SO4.5, SO4.6, SO4.7	LE4.1, LE4.2, LE4.3, LE4.4	Unit 4.0 Transistor at High Frequency and Multistage Amplifier 4.1, 4.2, 4.3, 4.4, 4.5	
PO-1,2,3,4,5,6,7 PSO-1,2	CO-5 Use of Feedback amplifier and power amplifier.	SO5.1, SO5.2	LE5.1, LE5.2, LE5.3, LE5.4, LE5.5, LE5.6	Unit 5.0 Feedback Amplifier & Power Amplifier 5.1, 5.2	

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others), LI: Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

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Diploma in Electronics and Telecommunication Engineering

Semester-III

- A) Course Code : 2028C02BT028
B) Course Title : Network Analysis
C) Pre- requisite Course Code and Title : Fundamental of Electrical & Electronics.
D) Rationale

Analysis and measurement of various parameters of electric circuit is the one of the primary works of diploma pass out. Voltage and current of any electrical and electronics circuits are required to check at various points in the circuit to maintain the working of that circuit. Network analysis course is indented to develop skills to calculating and measuring voltages and currents at various points of the given circuits. In this way students can develop the skills to test and maintain various electronics instruments/gadgets used in the domestic appliances and Industrial setups.

E) Course Outcomes

CO-1 Analyze electrical circuit using basic law.

CO-2 Apply basic circuit theorems to simplify complicated circuits.

CO-3 Analyze series and parallel resonance condition in the given circuit.

CO-4 Analyze the circuit using two port network theorems.

CO-5 Analyze basic switching conditions and transient response

F) Scheme of Studies:

S. No	Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)			
				L	P	T	Total Credit (L+T+P/2)
1	E&TC Engineering	2028C02BT028	Network Analysis	2	-	1	3
2	E&TC Engineering	2028C02BL028	Network Analysis (Lab)	-	2	-	1

Legend: L-Lecture,

P- Practical,

T- Tutorial

G) Scheme of Assessment:

S.		Course code	Course Title	Schemes of Examination
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Diploma in Electrical Engineering/Electrical & Electronics Engineering (NEP)

Semester III

No	Board of Study			Theory			Practical		Total Marks
				ESE	CT	TA	ESE	TA	
1	E&TC Engineering	2028C02BT 028	Network Analysis	100	20	20	-	-	140
2	E&TC Engineering	2028C02BL 028	Network Analysis (Lab)	-	-	-	40	20	60

Legend: ESE- End semester Exam, CT- Class test, TA- Teacher Assessment

H) Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

CO-1 Analyze electrical circuit using basic law.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Apply Ohm's law and Kirchhoff's law to calculate voltage and current in the given circuit. SO1.2 Apply source transformation and voltage division and current division techniques to measure various parameters of the given circuits. SO1.3 Analyse the given resistive circuits to calculate voltage and current using Mesh and nodal analysis method.	LE1.1 Measure voltage and current at various points in the given circuit and verify it by Kirchhoff's law. LE1.2 Measure voltage and current at various point in the given circuit and verify it by voltage division and current division.	Unit-1.0 Basic Concepts of Networks 1. Ohms law 2. Kirchhoff's current and voltage law 3. Sources: Controlled and Independent sources, source transformation: voltage to current and current to voltage 4. Voltage division and current division techniques 5. Star-Delta transformation 6. Nodal Analysis, Super Node, Mesh Analysis, Super	7. Identify the active circuit, passive circuit, linear circuit bilateral circuit 8. Star-delta transformation for circuit simplification

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Diploma in Electrical Engineering/Electrical & Electronics Engineering (NEP)

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SO1.4 Use star delta transformation technique to simplify circuit.		Mesh(Limited upto two node /mesh)	
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SW-1 Suggested Sessional Work (SW):

a. Assignments:

- Find an equivalent voltage source for two series connected voltage source ' V_1 '
- and ' V_2 ' having internal resistance ' R_1 ' and ' R_2 '.
- Find an equivalent current source for two parallel connected current sources ' I_1 ' and ' I_2 ' having internal resistance ' R_1 ' and ' R_2 '.
- Prepare a list of active and passive components and give the reason that, why it is called active or passive component.

I) Mini Project:

- Develop a voltage divider circuit using resistors.
- Built a circuit to demonstrate the use of Maximum power transfer theorem.

J) Other Activities (Specify):

- List various type of voltage source available in your institution and home.

CO-2 Apply basic circuit theorems to simplify complicated circuits.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Apply the superposition theorem to calculate voltages and currents of the given multi source circuit. SO2.2 Calculate load voltage and current using Thevenin's and Norton's theorem. SO2.3 Calculate the internal resistance of the given circuit, to deliver maximum power to the load. SO2.4 Apply the given network theorem to simplify the given circuit.	LE2.1 Apply Superposition theorem to determine output voltage and current of the given multisource circuit. LE2.2 Apply the Thevenin theorem to determine output voltage and current of the given circuit. LE2.3 Apply the Norton's theorem to determine output voltage and current of the given circuit. LE2.4 Apply the maximum power transfer theorem to determine maximum power transferred to the load.	Unit- 2.0 Network Theorems - Linearity and Superposition theorem (Only for Two Source network) - Thevenin's and Norton's theorem - Maximum Power transfer theorem - Milliman and Dual of Milliman theorem (No Numerical)	- Differentiate between Thevenin's and Norton's theorem - Calculate the value of unknown resistance when the circuit deliver maximum power to the load.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

- i. Calculate the voltage and current for the given circuit using Thevenin's theorem and verify it by Norton's theorem.
- ii. Show the Application of Thevenin's theorem in Maximum power transfer theorem.
- iii. Determine the current and voltage of the various electrical circuits using different theorem.
- iv. Explain why superposition theorem is not used for power calculation with suitable example.

b. Mini Project:

- i. Demonstrate the superposition theorem for resistive network containing 3 sources.

c. Other Activities (Specify):

- i. Seminar on various network theorems

CO-3 Analyze series and parallel resonance condition in the given circuit.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Calculate the resonance frequency, Quality factor and Bandwidth of the given series circuits. SO3.2 Calculate the resonance frequency, Quality factor and Bandwidth of the given parallel circuits. SO3.3 Describe the characteristic parameter of the given filter circuit. SO3.4 Analyze the frequency response of the following filters: LPF, HPF, BPF, BSF, Notch filter	LE3.1 For the given series resonance circuit, determine the frequency response curve to obtain the resonant frequency, resonant impedance, Bandwidth (BW) and Quality factor for series resonance circuit. LE3.2 For a parallel resonance circuit, determine the frequency response curve to obtain the resonant frequency, resonant impedance. LE3.3 Locate half power frequency on the characteristic curve of the following: LPF, HPF, BPF.	Unit 3: Resonance and Filters Circuits - Series Resonance: circuit diagram, resonant frequency, resonant impedance, Quality factor, Bandwidth, selectivity of series resonance circuit - Parallel Resonance: circuit diagram, resonant frequency, resonant impedance, Quality factor, Bandwidth, selectivity of parallel resonance circuit - Basics of filter: cutoff frequency, bandwidth, pass band, stop band,	Describe application of series and parallel resonance circuit

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		pass band attenuation, stop band attenuation, types of filter: LPF, HPF, BPF, BSF, Notch filter	
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SW-3 Suggested Sessional Work (SW) :

a. Assignments:

- Explain the application of RLC circuit in the oscillator
- Obtain bandwidth and Quality factor of the given parallel and series RLC circuit.
- State application of various types of filter.

b. Mini Project:

- Demonstrate the deviation between theoretical values of resonance frequency of a series RLC with its practical value in the lab.
- Realize LPF and HPF for the given cutoff frequency.

c. Other Activities (Specify):

- List various types of filters which used in various domestic and industrial application.

CO-4 Analyze the circuit using two port network theorems.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
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SO4.1 Describe the steps to calculate Z - parameter, Y-parameter, Transmission parameter, Hybrid parameter. SO4.2 Explain condition For Reciprocity and Symmetry for two port networks. SO4.3 Explain Interconnection of Two-port Network, Series connection, Parallel connection, Cascade connection. (For resistive, RL and RC circuits only).	LE4.1 Determine the Y and Z parameter of the given two port network. LE4.2 Determine the transmission and hybrid parameter of a two-port network. LE4.3 Measure voltages and currents for the given circuit to calculate equivalent parameter of series/parallel connection of two port network.	Unit-4 Two Port Network 1. Z-Parameter 2. Y-parameter 3. Transmission parameter 4. Hybrid parameter 5. Condition for Reciprocity and Symmetry for two port networks 6. Interconnection of Two- port Network: Series connection, Parallel connection, Cascade connection. (For resistive circuits only)	7. Determine the circuit parameter for the given two port network
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SW-4 Suggested Sessional Work (SW) :

a. Assignments:

- Convert the Z parameter into Y parameter for the given two port network
- Establish relation between Y parameter and h-parameter, transmission parameter.
- Compute equivalent hybrid parameter of two different two port network connected in cascaded.

b. Mini project

- Verify resultant Z-parameter of two series connected two port networks.
- Verify resultant Y-parameter of two parallel connected two port networks

CO-5 Analyze basic switching conditions and transient response.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
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SO5.1 Determine response across of L and C element at initial and final condition for the given circuit. SO5.2 Analyze transient and steady state response of RL and RC circuit.	LE5.1 Determine the transient and steady state response series RC circuit. LE5.2 Determine the transient and steady state response for series RL circuit and also find out the time constant of the given circuit.	Unit-5.0 Transient and Steady State Analysis - Transient and steady state analysis - Behavior of L and C element at initial and final condition - Procedures to evaluate initial & Final conditions.	- Problem solving on Laplace transformation to analyze the circuit. - Determine the transient response of the RLC circuit.
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Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others), LI: Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

SW-5 Suggested Sessional Work (SW):

a. Assignments:

- Derive an expression for current in RC circuit and plot the curve between current and time.
- Derive an expression for current in RL circuit and plot the curve between voltage and time
- State the significance of time constant of RL and RC circuit.

I. Mini Project:

- Build a RL circuit on bread board and observe the transient in current on CRO and prepare report on it.
- Build a RC circuit on bread board and observe the transient in current on CRO and prepare report on it.

c. Other Activities:

- Power point presentation on the initial and final value of current and voltage of inductor and capacitor

Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.
K) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):

Unit Number	Unit Titles	Marks Distribution			Total
		R	U	A	

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					Marks
I	Basic Concepts of Networks	6	6	8	20
II	Network Theorems	4	7	9	20
III	Resonance and Filters Circuits	6	7	7	20
IV	Two Port Network	4	7	9	20
V	Transient and Steady State Analysis	2	9	9	20
Total		22	36	42	100

Legend: R: Remember, U: Understand, A: Apply and above

L) Suggested Specification Table (For ESA of Laboratory Instruction*):

Laboratory Instruction Number	Short Laboratory Experiment Titles	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voice
		PRA	PDA	
LE1.1	Measure voltage and current at various points in the given circuit and verify it by Kirchhoff's law	20	15	5
LE1.2	Measure voltage and current at various point in the given circuit and verify it by voltage division and current division.	20	15	5
LE2.1	Apply Superposition theorem to determine output voltage and current of the given multisource circuit.	20	15	5
LE2.2	Apply the Thevenin theorem to determine output voltage and current of the given circuit.	20	15	5
LE2.3	Apply the Norton's theorem to determine output voltage and current of the given circuit.	20	15	5
LE2.4	Apply the maximum power transfer theorem to determine maximum power transferred to the load.	20	15	5
LE3.1	For series resonance circuit, determine the frequency response curve to obtain the resonant frequency, resonant impedance, and Bandwidth (BW) and Quality factor for series resonance circuit.	20	15	5
LE2.2	For a parallel resonance circuit, determine the frequency response curve to obtain the resonant frequency, resonant impedance.	20	15	5
LE3.3	Locate half power frequency on the characteristic	20	15	5

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	curve of the following: LPF, HPF, BPF.			
LE4.1	Determine the Y and Z parameter of a two-port network.	20	15	5
LE4.2	Determine the transmission and hybrid parameter of a two-port network.	20	15	5
LE4.3	Measure voltages and currents for the given circuit to calculate equivalent parameter of series/parallel connection of two port network.	20	15	5
LE5.1	Determine the transient and steady state response series RC circuit.	20	15	5

Laboratory Instruction Number	Short Laboratory Experiment Titles	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
LE5.2	Determine the transient and steady state response for series RL circuit and also find out the time constant of the given circuit.	20	15	5

* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise

teachers for each experiment for conduction and assessment of laboratory experiments /practicals

Legend: Note:

PRA: Process Assessment, PDA: Product Assessment

Only one experiment has to performed at the end semester examination of **30 Marks** as per assessment scheme

M) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming

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13. Others

N) Suggested Learning Resources:

(a) Books:

S. No.	Titles	Author	Publisher	Edition & Year
1	Network Analysis & Synthesis	Chakraborty, A. K.; Ghosh, S.P.	Tata McGraw-Hill, New Delhi	1 st edition, 2009 ISBN: 9780070144781
2	Network Analysis	Valkenburg, V.	Prentice Hall of India, N. Delhi	3 rd edition, 2014 ISBN: 9788120301566
3	Engineering Circuit Analysis	Hayt, W.H.	Tata McGraw-Hill, New Delhi	8 th edition, 2013 ISBN: 9781259098635
4	Network, Lines and Fields	Ryder, John D.	Prentice Hall of India, N. Delhi	2 nd edition, 2015 ISBN: 9789332559516
5	Introduction to network, Filters and Transmission Lines	Chakraborty, A. K.	Dhanpat Rai & Sons, New Delhi	ISBN: 1234567149104

S. No.	Titles	Author	Publisher	Edition & Year
6	Circuit and network	Sudhakar; Shyammo han, S.P.	Tata McGraw-Hill, New Delhi	5 th edition, 2015 ISBN: 9789339219604
7	Electrical circuit analysis	Babu, Ramesh	Sci tech publisher, New Delhi	2 nd edition, 2010 ISBN: 9788183710787
8	Network Analysis & Synthesis	Singh, Ravish	Tata McGraw-Hill, New Delhi	1 st edition, 2013, ISBN: 9781259062957
9.	नेटवर्क फ़िल्टर एंड ट्रांसमिशन लाइन	आशीष साहू	Krishan Prakashan;	2nd edition (1 January 2014) 978-8182836181

(b) Open source software and website address:

1. nptel.ac.in/video.php?subjectId=108102042
2. www.slideserve.com/melodie-mckay/network-analysis
3. ext02.fh-kaernten.at/auer/intern/Subj/AEE/pdf/EE_01.pdf
4. www.eolss.net/Sample-Chapters/C05/E6-39A-01-04.pdf
5. elect.mrt.ac.lk/EE101_2_Network_Theorems.pdf

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6. [nptel.ac.in/courses/108105053/pdf/L-10\(GDR\)\(ET\) \(\(EE\)NPTEL\).pdf](http://nptel.ac.in/courses/108105053/pdf/L-10(GDR)(ET) ((EE)NPTEL).pdf)
7. www.cemtool.com/.../pages/trex/upfiles/file/file_20120629105152.pdf
8. www.ece.ubc.ca/~grecuc/253/spring14/253-P2-4-two-ports.pdf
9. www.swarthmore.edu/NatSci/echeeve1/Ref/DataSheet/IntroToFilters.pdf
10. www.ti.com/lit/an/snoa224a/snoa224a.pdf
11. Software for circuit simulation:-SimulIDE
12. Software for circuit simulation:- Supersim

(c) Others:

1. Multisim software for circuit simulation
2. Tina pro for circuit simulation (www.tina.com)
3. ADS(Advance Design Software) software
4. SimulIDE
5. SUPERSIM

O) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	CRO	Dual trace, 20MHz with component testing	All
2	Multimeter	Analog and Digital AC Voltage :0-400V, DC Voltage :0-24V AC current:0-10A, Dc current : 0-20A Resistance: 0-1K ohm	All
3	LCR meter	Digital display, separate range for L,R and C	LE3.1, LE3.2, LE3.3
4	Basic regulated variable power supply	0-24V, 1A	ALL
5	Signal Generator	Up to 2MHz	LE3.1, LE3.2, LE3.3 LE4.1, LE4.2

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Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)	
	PO-1 Engineering knowledge	PO-2 Problem Analysis	PO-3 Solution Design	PO-4 Modern Tools Usage	PO-5 Ethics & Sustainability	PO-6 Project & Team Management	PO-7 Lifelong Learning	PSO-1	PSO-2
CO-1 Analyze electrical circuit using basic law.	2	3	2	2	1	1	1	2	2
CO-2 Apply basic circuit theorems to simplify complicated circuits	2	3	2	2	1	1	1	2	2
CO-3 Analyze series and parallel resonance condition in the given circuit.	2	3	2	2	1	1	1	2	2
CO-4 Analyze the circuit using two port network theorem	2	3	2	2	1	1	1	2	2
CO-5 Analyze basic switching conditions and transient response	2	3	2	2	1	1	1	2	2

Legend: 1 – Low, 2 – Medium, 3 – High

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POs & PSO No.	COs No. & Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO - 1, 2, 3, 4, 5, 6, 7 PSO – 1, 2	CO-1 Analyze electrical circuit using basic law.	SO1.1 SO1.2 SO1.3 SO1.4	LE1.1 LE1.2	Unit-1.0 Basic concepts of networks	As mentioned in relevant page numbers
PO - 1, 2, 3, 4, 5, 6, 7 PSO – 1, 2	CO-2 Apply basic circuit theorems to simplify complicated circuits.	SO2.1 SO2.2 SO2.3 SO2.4	LE2.1 LE2.2 LE2.3 LE2.4	Unit-2.0 Network Theorems	
PO - 1, 2, 3, 4, 5, 6, 7 PSO – 1, 2	CO-3 Analyze series and parallel resonance condition in the given circuit.	SO3.1 SO3.2 SO3.3 SO3.4	LE3.1 LE 3.2 LE3.3	Unit-3.0 Filters and Resonance circuits	
PO - 1, 2, 3, 4, 5, 6, 7 PSO – 1, 2	CO-4 Analyze the circuit using two port network theorems.	SO4.1 SO4.2 SO4.3	LE4.1 LE4.2 LE4.3	Unit-4.0 Two port network	
PO - 1, 2, 3, 4, 5, 6, 7 PSO – 1, 2	CO-5 Analyze basic switching conditions and transient response.	SO5.1 SO5.2	LE5.1 LE5.2	Unit-5.0 Transient and Steady state analysis	

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others), LI: Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

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Semester-III

- A) Course Code : 2028C03BT028
B) Course Title : Digital Electronics
C) Pre-requisite Course Code and Title : Fundamentals of Electrical & Electronics Engineering
D) Rationale :

Digitization of automation industries and communication systems has changed the complete Industrial scenario and human lifestyle across the globe. The advancement in microelectronics integrated circuits, manufacturing of VLSI and ULSI chips, computer technology and information systems have caused the rapid increase in the use of digital circuits. Hence this subject is intended to learn facts, concepts, principles and procedures of digital techniques and their application used in digital circuits and systems. Concepts of this course will help the students to develop skills to analysis and built applications based on digital Integrated circuits.

E) Course Outcomes:

CO-1 Use number systems and codes for various applications.

CO-2 Test the functionality of various types of logic gates.

CO-3 Build and test various types of combinational circuits.

CO-4 Build and test various types of sequential circuits.

CO-5 Maintain various types of A/D converters, D/A converters.

F) Scheme of Studies:

S. No.	Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)			
				L	P	T	Total Credit L+T+(P/2)
1	E&TC Engineering	2028C03BT028	Digital Electronics	2	-	1	3

Legend: L-Lecture, P-Practical, T-Tutorial

G) Scheme of Assessment:

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S. No.	Board of Study	Course Code	Course Title	Scheme of Examination					
				Theory			Practical		Total Marks
				ESE	CT	TA	ESE	TA	
1	E&TC Engineering	2028C03B T028	Digital Electronics	100	20	20	-	-	140

Legend: ESE-End semester Exam, CT-Class test, TA-Teacher Assessment

H) Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

CO-1 Use number systems and codes for various applications.

Session Outcomes(SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO1.1 Convert the given number into the given type of number system. SO1.2 Identify the Various types of binary codes. SO1.3 Differentiate Between weighted and non-weighted code with example. SO1.4 Apply the arithmetic operation on the given binary numbers.		Unit-1.0 NUMBERSYSTEM And CODES - Number systems and codes for various applications, base conversion of Number systems - Conversion between different number systems - r's and (r-1)'s complement of number - Binary Arithmetic operations: Addition, Subtraction, Multiplication and Division - Binary Codes Weighted and Un-weighted codes, Excess-3 code, Graycode, Error Detection and Correction Code, Hamming code, BCD Code, ASCII code	- Describe application of various types of codes. - Practice to convert base of number systems as specified.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

- i. Generate a hamming code for the data word 11000100.
- ii. Perform the conversion and arithmetic operation between the different types of number system.
- iii. Determiner' and(r-1)' complement for different types of number system.

b. Mini Project:

- i. Prepare a report on the applications of binary codes.
- ii. Describe properties of weighted and non-weighted codes.

c. Other Activities(Specify):

- i. Quiz on number system conversion.

CO-2 Test the functionality of various types of logic gates.

Session Outcomes(SOs)	Laboratory Instruction(LI)	Classroom Interaction (CI)	Self-Learning (SL)
SO2.1 Explain Functions of the given type of Logic gate with the help of truth table. SO2.2 Apply Boolean Algebra rules to Minimize the Given logic expression. SO2.3 Design simple Logic circuits Using logic gates. SO2.4 Apply the De-Morgan's theorem to Simplify the given logic expression. SO2.5 Minimize given Logic expression Using K-map method.		Unit-2 Logic gates and Boolean algebra 2.1 Logic Gates: basic gates, AND, OR, NOT, EX-OR, EX-NOR, Universal Gates: NAND, NOR, 2.2 truth table ,symbol, implement Basic Gate using universal gate 2.3 Boolean Algebra: Boolean theorems, De Morgan's Theorems, duality Max - term, Min - term, Sum of product (SOP) and Product of Sum (POS) expressions, Simplify the Boolean functions,, Simplify the Boolean functions using K-map method (up to 4 variables)	3 Simplify the given Boolean function up to 5 variables using K-map method. 4 Obtain standard SOP and POS form for the given expression.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

- i. Show that both NAND and NOR gate are universal gate.
- ii. Draw the logic symbols, construct the truth table, and with the help of circuit diagram explain the working of following gate
i) AND ii) OR iii) NOT iv) NAND v) NOR
- iii. Explain the procedure to expand an SOP and POS expression in to standard SOP form and standard POS form with suitable example.

b. Mini Project:

- i. Prepare an application (like series parallel control circuit) based on logic gates.

c. Other Activities (Specify):

- i. Seminar on applications of different types of logic Gates.

CO-3 Build and test various type combinational circuits.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Write step by step Procedure to realize any combinational circuit. SO3.2 Design a full adder Using half adder. SO3.3 Describe with Sketches working of 4 bit parallel adder. SO3.4 List applications of Encoder and decoders. SO3.5 Design 4X1 Multiplexer using 2X1 multiplexer. SO3.6 Design a 3 bit magnitude comparator.		Unit-3.0 Combinational Circuits 3.1 Half Adder, Full Adder, Half subtractor, Full Subtractor, parallel adder, 4 bit binary adder, 4 bit binary Subtractor, BCD adder 3.2 Magnitude comparator (2, 3 and 4 bit) 3.3 Encoder and Decoder: 4I/P and 2O/P encoder, 8I/P and 3O/P encoder, Octal to Binary and Decimal to BCD Encoder Decoders: 3-Line to 8-Line Decoder, 8-4-2-1 BCD to Decimal Decoder, BCD to Seven Segment Decoder	● Explain priority encoder circuit with justification. ● Realize 4 bit binary adder circuit using Mux and Demux.

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		3.4 Multiplexer (Mux) and Demultiplexer (Demux): 2X1, 4X1 and 8X1 multiplexer, 1X2, 1X4 and 1X8 demultiplexer, Applications of Multiplexers and Demultiplexers	
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SW-3 Suggested Sessional Work (SW):

a. Assignments:

- Realize a full adder using
i) Only NAND gate ii) Only NOR gate
- Discuss applications (any two) of multiplexer.
- Show an arrangement to obtain a 16 input mux from two 8 input mux.

b. Mini Project:

- Design BCD to 7 segment decoder using IC 7447.
- Design 4 bit binary adder/subtractor using IC 7483.

c. Other Activities (Specify):

- Prepare a PPT on all the combinational circuits.
- Prepare a chart to show the applications of Combinational circuits.

CO-4 Build and test various sequential circuits.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)

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SO4.1 Explain working of the given F/F with the help of excitation table.		Unit-4 SEQUENTIAL CIRCUITS	5	Develop modulo-10 counter using D Flip-Flop and T-flip flop.
SO4.2 Describe design procedure of Mod-10 up and down counter.		4.1 Flip Flop(F/F) -basic flip flop and latch, Clock, Set and Reset inputs to F/F, clock triggering-Positive and Negative clock Edge triggering, level triggering, difference between latch and flip flop, RS, JK, D and TF/F, truth table, characteristic table or excitation table	6	Differentiate between latch and flip flop.
SO4.3 Differentiate characteristic of synchronous and asynchronous counter.		4.2 Race around condition, Master Slave F/F	7	Test the functionality of the given F/F using simulation software.
SO4.4 Sketch the timing diagram of the output of each F/F of 4-bit serial in serial out shift register for the given input.		4.3 Counters:-Modules of a counter, synchronous and asynchronous counter, Ripple Counter, Up – down binary counter, Decade counter, BCD counter, Designing of counters		
		4.4 Register-Shift register, Serial in parallel out(SIPO), Serial in Serial out(SISO), Parallel in Serial out(PIPO), Parallel in Parallel out register(PISO), designing of register		

SW-4 Suggested Sessional Work (SW):

a. Assignments:

- Distinguish between combinational and sequential logic circuit.
- Explain the procedure to convert one flip flop to another flip flop (Like:JKF/F to SRF/F.)

b. Mini Project:

- Design 4-bit synchronous counter using IC 7476.
- Design decade counter using IC 7492/93. Prepare a PPT on all the applications of sequential circuit in the digital systems.
- Prepare a chart to show the difference between sequential and combinational circuits.

CO-5 Maintain various types of A/D converters, D/A converters.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO5.1 With the help of circuit diagram describe the working of following i) R-2R DAC ii) Weighted resistor DAC.		Unit-5 CONVERTERS and LOGIC FAMILIES • Digital to Analog converter(DAC): R-2R DAC,	vi) Compare Various logic families. vii) Develop R-2R Ladder Network for

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SO5.2 With the help of circuit diagram describe the working of following: iii) Counter type ADC iv) Flash ADC v) Successive Approximation ADC Compare technical specifications of different logic families.		Weighted resistor DAC - Analog to Digital converter (ADC) Counter type, ramp, Successive approximation, Flash type - Logic Families— Digital IC specifications (threshold voltage, propagation delay, power dissipation, Fan in, Fan out, transition width, logic levels, noise margin, speed power product and figure of merit), TTL, RTL, DTL, ECL, I²L and CMOS logic family characteristics.	The specified Analog output. viii) Describe the Function of the Given type of ADC.
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Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others), LI: Laboratory

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Semester-III

Instruction (includes Practical performances in using different instructional strategies) SL: Self Laboratory, Workshop, field or other locations Learning

SW-5 Suggested Sessional Work (SW):

a. Assignments:

- With the help of neat diagram explain the working of following DAC and ADC
i) R-2R ii) weighted resist or type DAC iii) Counter type ADC
iv) Flash type ADC Successive Approximation type ADC

b. Mini Project:

- On the basis of Internet search prepare a report to summarize technical specifications of ADC and DAC ICs.

c. Other Activities(Specify):

- Prepare a PPT on logic family
- Prepare PPT on DAC and ADC

Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

I) Suggested Specification Table(For ESA of Classroom Instruction CI+SW+SL):

Unit Number	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
I	Number System and Codes	6	6	8	20
II	Logic Gates and Boolean Algebra	5	7	8	20
III	Combinational Circuits	6	6	8	20
IV	Sequential Circuits	5	7	8	20
V	Converters And Logic Families	4	8	8	20
Total		26	34	40	100

Legend: R: Remember, U: Understand, A: Apply and above

J) Suggested Specification Table(For ESA of Laboratory Instruction*):

Laboratory Instruction Number	Short Laboratory Experiment Titles	Assessment of Laboratory Work(Marks)		
		Performance		Viva - Voce
		PRA	PDA	

*Assessment rubric, process and product checklist with rating scale need to be prepared by the course wise

Teachers for each experiment for conduction and assessment of laboratory experiments/ practicals

Legend: PRA: Process Assessment, PDA: Product Assessment

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Note: Only one experiment has to be performed at the end semester examination of **40** Marks as per assessment scheme

K) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Facebook, Mobile)
12. Brainstorming
13. Others

L) Suggested Learning Resources:

(a) Books:

S.No	Titles	Author	Publisher	Edition & Year
1.	Digital Logic and Computer Design	Mano M. Morris	Pearson India pvt. Limited, New Delhi	1 st edition, 2016, ISBN:9789332542525
2.	Digital Electronics: Principle Devices and Applications	Maini, Anil K.	John Wiley & Sons Ltd., New Delhi	1 st edition, 2007 ISBN:9788126514663
3.	Digital Principles and Applications	Malvino and Leach	Tata Mc Graw-Hill, New Delhi	8 th edition, 2014 ISBN:9789339203405
4.	Fundamental Digital Circuits	KUMAR, A. ANAND	Prentice Hall of India, New Delhi	4 th edition ISBN:9788120352681
5.	Modern Digital Electronics	R.P. Jain	Tata McGraw-Hill	4 th edition, 2009 ISBN:9780070669116
6.	Digital Circuits and Design	A. Arivazhgan	Vikash Publishing House, New Delhi	2 nd edition, 2003 ISBN:9788125914358

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7.	Digital Electronics and Logic Design	Sharma Sanjay	Kataria & Sons, New Delhi	2015 ISBN:9789350141991
8.	Digital Fundamentals	Thomas L. Floyd	Pearson India, New Delhi	10 th edition, 2011 ISBN:9788131734483
9	Digital Systems: Principles and Applications	Neal S. Widmer, Ronald J. Tocci, Gregory L. Moss	Pearson India, New Delh	10th Edition, 2009, ISBN: 9788131727249
10	Digital Electronics	Mamta Agrawal	Deepak Prakashan	2016, ISBN: 8177762249 / ISBN-13: 9788177762242

(b) Open source software and website address:

(c) Open source software and website address:

1. <http://logos.cs.uic.edu/366/notes/ErrorCorrectionAndDetectionSupplement.pdf>
2. <https://www.youtube.com/watch?v=N8Yy0-4YMS4>
3. Full Subtractor:-<http://www.flintgroups.com/2012/10/half-subtractor-and-full-subtractor.html>
4. Encoder and Decoder:-<http://www.edgefxkits.com/blog/encoders-and-decoders-truth-tables/>

M) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number

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Course Outcomes(COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)	
	PO-1 Engineering knowledge	PO-2 Problem Analysis	PO-3 Solution Design	PO-4 Modern Tools Usage	PO-5 Ethics & Sustainability	PO-6 Project & Team Management	PO-7 Life-long learning	PSO-1	PSO-2
CO-1 Use number systems and codes for various applications	3	2	2	2	2	1	1	2	2
CO-2 Test the functionality of various types of logic gates	3	3	3	3	2	1	2	2	2
CO-3 Build and test various types of combinational circuits.	2	3	3	2	1	1	2	3	3
CO-4 Build and test various types of sequential circuits	2	3	3	3	2	1	1	3	3
CO-5 Maintain various types of A/D converters, D/A converters	2	2	3	3	2	1	2	3	3

Legend: 1-Low, 2-Medium, 3-Hi

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POs & PSOs No.	COs No.& Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning(SL)
PO-1,2,3,4,5,6,7 PSO-1,2	CO-1 Use number systems and codes for various applications	SO1.1		Unit-1 NUMBER SYSTEM and CODES	
		SO1.2		1.1, 1.2	
		SO1.3		1.3,1.4,1.5	
		SO1.4			
PO-1,2,3,4,5,6, 7	CO-2 Test the functionality of various types of logic gates.	SO 2.1		Unit-2 Logic gates and Boolean algebra	
		SO 2.2			
		SO2.3		2.1	
		SO2.4		2.2	
PO-1,2,3,4,5,6, 7	CO-3 Build and test various types of combinational circuits	SO2.5		2.3	
		SO 3.1		Unit-3 Combinational Circuits 3.1 3.2 3.3 3.4	
		SO3.2			
		SO3.3			As mentioned in relevant page numbers
PO-1,2 PSO-1,2	CO-4 Build and test	SO3.4			
		SO3.5			
		SO3.6			
		SO4.1		Unit-4	

	various types			SEQUENTIAL CIRCUITS	
7	of sequential circuits	SO4.2		4.1	
		SO4.3		4.2	
PSO-1,2		SO4.4		4.3	
				4.4	
				Unit-5 CONVERTERS AND LOGIC	
PO-1,2,3,4,5,6,		SO5.1			
7		SO5.2		FAMILIES	
	CO-5 Maintain various types of A/D converters, D/A converters.	SO5.3		5.1	
PSO-1,2				5.2	
				5.3	

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others, LI: Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self-Learning.

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- A) Course Code : 2028C04CT028
 B) Course Title : Instrumentation and Measurement System
 C) Pre-requisite Course Code and Title: Fundamentals of Electrical & Electronics Engineering
 D) Rationale :

In all type of manufacturing and assembling industry test and measuring instruments are frequently used for the parameters measurement and monitoring. Sensors and transducers are the basic building blocks of electronic automation systems. This course enables the student to understand the basic concepts and principles of electronic Instrumentation and Measurement system and also empower them to apply the same to handle the test and measuring equipment for the process parameters measurement and instrumentation purpose. This course will also help the student to develop various skills required to maintain test and measuring equipment, sensors and transducers, display and recording systems. Students will also develop skills to select the appropriate transducer for the specified application.

E) Course Outcomes:

CO-1 Analyze functions of basic elements of Instrumentation and Measurement system.

CO-2 Measure unknown value of different circuit elements like R, L and C with the help of different types of bridge method.

CO-3 Use test and measuring instrument to measure various parameters.

CO-4 Test the performance of the given transducer used for the specified application.

CO-5 Use various transducers to sense the given physical quantity.

F) Scheme of Studies:

S. No.	Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)			
				L	P	T	Total Credit L+T+(P/2)
1	E&TC Engineering	2028C04CT028	Instrumentation and Measurement System	2		1	3
2	E&TC Engineering	2028C03CL028	Instrumentation and Measurement System (Lab)	-	2	-	1

Legend: L-Lecture, P-Practical, T-Tutorial

G) Scheme of Assessment:

S. No.	Board of Study	Course Code	Course Title	Scheme of Examination					
				Theory			Practical		Total Marks
				E S E	C T	TA	ES E	TA	

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1	E&TC Engineering	2028C04CT 028	Instrumentation and Measurement System	100	20	20	-	-	140
2.	E&TC Engineering	2028C03CL 028	Instrumentation and Measurement System (Lab)	-	-	-	40	20	60

Legend: ESE- End semester Exam, CT-Class test, TA-Teacher Assessment

Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

CO-1 Analyze functions of basic elements of Instrumentation and measurement and system.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO1.1 Differentiate between measurement and Instrumentation system. SO1.2 Describe the functions of the given block of basic measurement system. SO1.3 Define the given Parameter of the measurement system. SO1.4 Describe the given static characteristics of measurement system. SO1.5 Calculate types of error in the given sample measurement.		Unit-1.0 Introduction of Instrumentation and Measurement System - Basic building blocks of Instrumentation and measurement system, functions of instruments and measurement system - Basic parameters of measurement system: Static characteristics- Accuracy & Precision, Sensitivity, Linearity, Hysteresis, Resolution, Repeatability, Reliability, Maintainability, Span, Calibration - Dynamic characteristic- speed of response, fidelity, lag, dynamic error - Definition of error, types of errors, definition of primary and secondary standard used in Measurement system.	- Differentiate between accuracy and precision with example. - Explain the need for electrical standards used in measurement system. - Compare direct and indirect methods of measurement.

SW-1 Suggested Sessional Work (SW):

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a. Assignments:

- List different types of errors that occur during measurement and explain each type of error with example.
- Describe different types of electrical standards used in measurement system.
- Differentiate between Static and Dynamic characteristics of measurement system.

b. Other Activities(Specify):

- Prepare PPT on elements and functions of measurement system.
- Seminar on the latest test and measuring instrument used in the industry.

CO-2 Measure unknown value of different circuit elements like R, L and C with the help of different types of bridge method.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
SO2.1 Obtain the value of unknown resistance using Wheat stone bridge. SO2.2 Apply Maxwell bridge method to obtain the value of unknown inductance. SO2.3 Apply Schering Bridge method to obtain the value unknown inductance. SO2.4 Apply the Kelvin's double bridge to find the value unknown low resistance. SO2.5 State the importance of Wagner's earth connection in A.C. bridges SO2.6 Identify the need of instrument transformer.	LE2.1 Measure the Resistance value of the given resistor using Wheatstone Bridge. LE2.2 Measure inductance value of the given inductor with the help of Maxwell bridge. LE2.3 Measure Capacitance of the given capacitor using Wein bridge. LE2.4 Measure the Q of the given coil with the help of appropriate bridge. LE2.5 Determine the frequency of the given source using Wine bridge.	Unit-2.0 Bridges 2.1 Introduction of bridge method and bridge balance, AC and DC bridges 2.2 Wheatstone Bridge and Kelvin's bridge for measurement of unknown resistance 2.3 Maxwell Bridge and Hay's bridge method for measurement of unknown inductance 2.4 Schering Bridge and Wien bridge method for measurement of unknown capacitance, Wagner's earth (ground) connection	3 Compare DC and AC Bridges. 4 Measure frequency using the given Wine Bridge.

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SW-2 Suggested Sessional Work (SW):

a. Assignments:

- i. Explain the step to measure the Q of the given capacitor.
- ii. List the uses of different types of bridges.

b. Mini Project:

- i. Build a bridge circuit for measurement of R, L, C.

c. Other Activities (Specify):

- i. Presentation on application of Bridge method for the measurement of unknown circuit elements.
- ii. Presentation on application of different types of D.C. and A.C. bridges.
- iii. Demonstrate the use of RLC-Q meter to measure R, L, C and Q of the distributed components.

CO-3 Use test and measuring instrument to measure various parameters.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self Learning (SL)
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SO3.1 Describe the function of each block of CRO with the help of block diagram. SO3.2 Compare the Functions of DSO and CRO. SO3.3 Describe the Working function of signal generator with the help of suitable block diagram. SO3.4 Explain the steps to use spectrum analyzer for the radio signal analysis. SO3.5 State the important feature of LCDs and LEDs displays. SO3.6 Differentiate between indicator and recorder. SO3.7 List various types of recorders.	LE3.1 Measure Frequency & Phase of the given signal using Lissajous pattern on DSO/CRO. LE3.2 Test the various functions of DSO front panel. LE3.3 Measure the resultant amplitude, frequency and phase of the two given signal waveforms. LE3.4 Measure the frequency response, power and distortion and harmonics of the given radio signal. LE3.5 Trace the spectrum of the given signal on the graph paper using spectrum analyzer.	Unit-3.0 Test and Measuring Instruments 3.1 Cathode Ray Oscilloscope (CRO): Block diagram of CRO, CRT and principle of operation, Vertical Amplifier, Time Base Generator, Trace Synchronization, Triggering Modes, Front Panel Controls, Probe Characteristics, Features of dual trace and dual beam oscilloscopes, chopper beam switch, alternate beam switch. 3.2 Digital Storage Oscilloscope (DSO) Basic block diagram, front panel functions, Measurement of amplitude, frequency, time period, storage and retrieval of wave form 3.3 Signal generator: principle of signal generation, descriptions, types of signals used in communication system, Basic block diagram 3.4 Spectrum analyser: Basic block diagram and its functions, applications, specifications 3.5 Records and Display devices: Fundamental of recorders and LED and LCD display techniques, types of recorders, applications of recorders	4 Signal Generator applications. 5 Construction and features of LED and LCD display devices. 6 Need of Instrument Transformer and Advantages of Instrument Transformers 7
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SW-3 Suggested Sessional Work (SW):

a. Assignments:

- List the application of spectrum analyzer.
- Compare the LCD and LED display.
- List the major functions of DSO.

b. Mini Project:

- Collect technical specifications of DSO (of any five leading company) and prepare a report on it.

c. Other Activities(Specify):

- i. Presentation on functions of CRO, DSO.
- ii. Presentation on different types of display (LED, LCD).

CO-4 Test the performance of the given transducer used for the specified application.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Explain the principle of operation of analog transducer. SO4.2 Classify Transducer on the basis of different parameter. SO4.3 Identify the factors for selecting a transducer. SO4.4 Explain the Need for signal conditioning circuit.	LE4.1 Identify transducers and sensors available in the lab. LE4.2 Test the Performance of the specific signal condition circuit. LE4.3 Test the Performance of the given transducer.	Unit-4.0 Transducer fundamentals - Principle of operation of transducer and sensor - Classification of transducer: Electrical and Mechanical, Primary and Secondary, Active and Passive, Analog and Digital transducer - Factors for selecting a transducer - Parameter of electrical transducer: linearity, sensitivity, Dynamic range, repeatability, physical size - Signal conditioning: basic building blocks, need, functions and instrumentation amplifier	- Difference between sensors and transducers. - Advantage of electrical transducer over mechanical transducer.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

- i. Explain the difference between primary and secondary transducer with the help of example.
- ii. State the various parameter of electrical transducer.

Mini Project:

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iii. Build a simple signal conditioning circuit for the specified application.

b. Other Activities (Specify):

- Prepare presentation on classification of transducers.
- Seminar on the signal conditioning circuit.

CO-5 Use various transducers to sense the given physical quantity.

Session Outcomes(SOs)	Laboratory Instruction(LI)	Classroom Instruction(CI)	Self Learning (SL)
SO5.1 Select transducer for specific application. SO5.2 Describe strain Gauge and state the importance of gauge factor. SO5.3 Describe the Application of the given temperature transducer. SO5.4 Describe the principle of operation of the given type of capacitive transducer. SO5.5 Explain the steps To use LVDT for displacement measurement. SO5.6 Describe the use Of Photoelectric transducer in various application.	LE5.1 Measure the Weight of the given sample using strain gauge. LE5.2 Test the performance of the given load cell. LE5.3 Measure Temperature of the given sample using thermocouple. LE5.4 Measure Temperature of the given sample using Thermistor. LE5.5 Measure the thickness, length, electricity and liquid level of the given sample with the help of capacitive transducer. LE5.6 Measure the flow rate of the given liquid with the help of electromagnetic flow meter. LE5.7 Measure Displacement with the help of LVDT transducer.	Unit-5.0 Applications of Transducers 5.1 Measurement of physical quantity: pressure, displacement, temperature, level, flow, thickness 5.2 Strain gauge: - Resistance wires strain gauge and semiconductor strain gauge, piezo electric crystal, load cell 5.3 Temperature: RTD, Thermistor, Thermocouple, Pyrometer 5.4 Capacitive transducers 5.5 Linear variable differential transducer (LVDT) 5.6 Photo electric transducers: photo emissive, photo conductive, and photovoltaic transducer	6 Difference between piezo resistive and piezo electric materials. 7 Summarize the applications of the given type of transducer.

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	LE5.8 Test the performance of the given photovoltaic cell.		
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Legends: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others), LI: Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

SW-5 Suggested Sessional Work (SW):

a. Assignments:

- List the name of the five physical quantities that the given type of transducer sense.
- List the advantage and disadvantage of semiconductor strain gauge. Differentiate between Thermistor and thermocouple.
- Describe the principle of operation of pressure transducer employing each of the following principle (a) resistive transducer (b) capacitive transducer

b. Mini Project:

- Prepare a chart for different types of temperature transducer of different temperature range.
- Prepare a circuit using appropriate transducer to measure water level of the water tank.

c. Other Activities (Specify):

- Presentation on LVDT and RVDT
- Presentation on different types of temperature sensor.
- Presentation on the applications of Chemical transducer

Note: Performance under Laboratory and Sessional work may appear in more than one Cos/Sos.

H) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):

Unit Number	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
I	Introduction of Instrumentation and Measurement System	6	6	8	20
II	Bridges	5	7	8	20
III	Test and Measuring Instruments	6	7	7	20
IV	Transducer fundamentals	5	7	8	20
V	Applications of Transducers	4	8	8	20
Total		26	35	39	100

Legend: R: Remember, U: Understand, A: Apply and above

I) Suggested Specification Table (For ESA of Laboratory Instruction*):

Laboratory	Short Laboratory Experiment Titles	Assessment of Laboratory Work (Marks)
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Instruction Number		Performance		Viva-Voice
		PRA	PDA	
LE2.1	Measure the resistance value of the given resistor using Whetstone Bridge.	20	15	5
LE2.2	Measure inductance value of the given inductor using Maxwell bridge.	20	15	5
LE2.3	Measure capacitance of the given capacitor using Wein bridge.	20	15	5
LE2.4	Measure the Q of the given coil using the appropriate bridge.	20	15	5
LE2.5	Determine the frequency of the given source using Wine bridge.	20	15	5
LE3.1	Measure frequency & Phase of the given signal using Lissajous pattern on DSO/CRO.	20	15	5
LE3.2	Test the various functions of DSO front panel.	20	15	5

PRA: Process Assessment, PDA: Product Assessment
Only one experiment has to performed at the end semester examination of **40** Marks as per assessment scheme

Legend: Note:

J) Suggested Instructional / Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Facebook, Mobile)
12. Brainstorming
13. Others

K) Suggested Learning Resources:

(a) Books:

S.	Titles	Author	Publisher	Edition & Year
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N o.				
1.	Electrical and electronics Measurements and instrumentation	Sawhney, A. K.	Dhanpat Rai & Co. New Delhi	3 rd edition 2014 ISBN:-978-8177001006 Or latest edition
2.	Electronics instrumentation	Kalsi, H.S.	Mc Graw Hill education (India) Private limited, New Delhi	3 rd edition 2010 ISBN:-978-0-07-070206-6 Or latest edition
3.	Electrical and electronics measurements and instrumentation	Purkait, Prithwiraj; Biswas, Budhaditya; Das, Santanu; Koley, Chirajib	Mc Graw Hill education (India) private limited, New Delhi	2017 edition, ISBN:-978-1-25-902959-2 Or latest edition
4.	Electrical and electronics Measurements and instrumentation	Rajput, R.K.;	S.CHAND, New Delhi	4 th edition, 2016 ISBN:-978-9385676017 Or latest edition
5.	Electronic measurements and instrumentation	David A. Bell	OXFORD University Press India, New Delhi	3 rd edition, 2013 ISBN:-978-0195696141 Or latest edition

(b) Open source software and website address:

- https://en.wikipedia.org/wiki/Spectrum_analyzer
- http://www.hit.ac.il/upload/engineering/experiment_1_spectrum_analyzer.pdf
- <http://www.gatestudymaterial.com/study-material/emi/text%20books/A%20course%20in%20Electrical%20and%20Electronic%20Measurements%20and%20Instrumentation%20-%20A.K.Sawhney.pdf>

L) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	CRO	50 MHz, dual trace, dual beam, in built ± 5 v supply, component tester, in built function generator	LE3.1

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2	DSO	Bandwidth 50MHz to 100MHz,Real-time Sampling Rate500MSa/s,EquivalentSamplingRate50GSa/s. , Memory Depth: 32Kpts,Trigger types: Edge, Pulse width, Video, Slope, Alternative, e Digital Filter function and Waveform Recorder function, Support pass/fail function, Auto Measure function, Save/recall types: Setups, Waveforms, CSV file, Picture, Waveform Intensity and grid brightness can be adjusted, Standard configuration port: USB Host: Support USB flash driver save /recall function and	LE3.1,LE3.2,LE3.3
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S. No .	Name of Equipment	Broad Specificat ions	Relevant Experiment Number
		Update firmware, USB Device: Support PICT Bridge compatible printer and support PC remote control, RS232	
3	Digital multimeter	Digitalmultimeter3and½digitwithcomponent Tester	LE2.1toLE2.5 LE4.2toLE4.3
4	Function generator	0-2MHzwithsine,squareandtriangularwaveoutput With variable frequency and amplitude	LE2.3,LE2.4,LE3.1,LE3.2,
5	Spectrum analyzer	Frequency range: 10 Hz to 44 GHz ResolutionBandwidth:1Hzto8MHz Noise Floor/Dynamic range:-163dBmto+30dBm	LE3.4
6	Wheat stone bridge	Measuringrange:1Ohm-10MegaOhm Accuracy:Range,±0.1%ofreadingon100Ωto100kΩRange,±0.3%ofreadingon10Ωto1MΩRange, ±0.6%ofreading on1Ωto10MΩRange Temperature coe Of resistance element:±0.5×10 ⁻⁵ /°C at ambient temperature of 5 to 35°C (41 to 95°F), ±2 × 10 ⁻⁵ /°C at ambient temperature of 20 to 35°C (68 to 95°F)	LE2.1
7	Transducer trainer kit	4 different Temperature Transducers, Study of Transducer controlled switching / alarm systems, LVDT, Strain gauge, Burdon tube, hall effect transducer, Phizo electric transducer, photo voltaic transducer ,On board signal conditioning circuitry, Built-in DC Power Supply, Functional blocks indicated on-board Mimic	LE5.1toLE5.8

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Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)	
	PO-1 Engineering knowledge	PO-2 Problem Analysis	PO-3 Solution Design	PO-4 Modern Tools Usage	PO-5 & Sustainability	PO-6 Project & Team Management	PO-7 Lifelong Learning	PSO-1	PSO-2
CO-1 Analyze functions of basic elements of Instrumentation and Measurement system.	2	2	2	2	1	1	1	3	3
CO-2 Measure unknown value of different circuit elements like R, L and C with the help of different types of bridge method.	2	2	2	2	1	1	1	3	3
CO-3 Use test and measuring instrument to measure various parameters.	2	3	2	2	1	1	1	3	3
CO-4 Test the performance of the given transducer used for the specified application.	2	3	2	2	1	1	1	3	3

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CO-5 Use various transducers to sense the given physical quantity.	2	3	2	2	1	1	3	3
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Legend: 1–Low,2–Medium,3–High

POs & PSO No.	Cos No. & Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO-1,2,3,4,5,6,7 PSO-1,2	CO-1 Analyze functions of basic elements of Instrumentation and measurement and system.	SO1.1,SO1.2 SO1.3,SO1.4 SO1.5		Unit 1.0 Introduction Of Instrument & Measurement System 1.1,1.2,1.3,1.4	As mentioned in Relevant page numbers
PO-1,2,3,4,5,6,7 PSO-1,2	CO-2 Measure unknown value of different circuit elements like R, L and C with the help of Different types of bridge method.	SO2.1,SO2.2 SO2.3,SO2.4 SO2.5,SO2.6	LE2.1 LE2.2 LE2.3 LE2.4 LE2.5	Unit2.00 R,L,C Measurement & Instrument Transformer 2.1,2.2 2.3,2.4	
PO-1,2,3,4,5,6,7 PSO-1,2	CO-3 Use test and measuring instrument to measure various parameters.	SO3.1,SO3.2 SO3.3,SO3.4 SO3.5,SO3.6, SO3.7	LE3.1 LE3.2 L 3.3 LE3.4 LE3.5	Unit3.0 Test and Measuring instruments 3.1, 3.2 3.3,3.4 3.5	
PO-1,2,3,4,5,6,7 PSO-1,2	CO-4 Test the performance of the given transducer used for the specified application.	SO4.1,SO4.2 SO4.3,SO4.4	LE4.1 LE4.2 LE4.3	Unit4.0 Transducer fundamental 4.1,4.2,4.3 4.4,4.5	

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PO-1,2,3,4,5,6, 7 PSO-1,2	CO-5 Use various transducers to sense the given physical quantity.	SO5.1,SO5.2 SO5.3,SO5.4 SO5.5,SO5.6 SO5.7,SO5.8	LE5.1,LE5.2 LE5.3,LE5.4 LE5.5,LE5.6 LE5.7,LE5.8	Unit5.0Applications of transducer 5.1,5.2 5.3,5.4 5.5,5.6	
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Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others), LI: Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

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- A) Course Code : 2028C05CT022
B) Course Title : Basic Python Programming
C) Pre-requisite Course Code and Title : Fundamentals of computer and IT

D) Rationale :

This Course imparts problem solving skill in the students, using a general-purpose interpreted, interactive, object-oriented, and high-level programming language 'Python'. The course is crafted to help the students to develop logical ability to identify the best solution for a given problem. The programming skills thus acquired using 'Python' language can be used for acquiring necessary programming skill to work with advance level programming languages. This will be helpful in developing programs for the scientific, research and business purposes.

E) Course Outcomes: The students will be able to:

CO-1 Write a Python program using interactive and script mode.

CO-2 Develop program in Python using decision making and loop statements.

CO-3 Develop programs in Python using sequence and built in function.

CO-4 Develop programs in Python using modules, user-defined functions and exception handling.

CO-5 Develop programs in Python using Python libraries.

F) Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of studies(hours / week)			
			L	P	T	Total Credits(C) (L+T+P/2)
Electronics and Telecommunication Engineering	2028C05CT022	Basic Python Programming	2	-	1	2
Electronics and Telecommunication Engineering	2028C04CL022	Basic Python Programming (Lab)	-	2	-	1

Legend: Lecture (L) and Tutorial (T) and Practical (P)

G) Scheme of Assessment:

Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI),

Sessional Work (SW) and Self-Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Board of Study	Course Code	Course Title	Scheme of examination Total Marks					
			Theory			Practical		Total Marks
			ESE	CT	TA	ESE	TA	
Electronics and Telecommunicatio n Engineering	2028C05C T022	Basic Python Programmi ng	100	20	20	-	-	140
Electronics and Telecommunicatio n Engineering	2028C04C L022	Basic Python Programmi ng	-	-	-	40	20	60

CO-1: Write a Python program using interactive and script mode.
 (Approx.Hrs:6+6)

Session Out comes (SOs)	Laboratory Instruction (LI)	Classroom Instruction(CI)	Self-Learning(SL)
SO1.1 Describe the feature of Python SO1.2 Classify different data type, operator and input output of Python program	LE1.1 Write a Program to display your name using interactive mode function. LE1.2 Create variable which hold your name. LE1.3 Write a program for sum of two numbers using script mode	Unit1.0 Introduction to Python Programming 1.1 Basics of programming (Flow chart and architecture) 1.2 Features of Python 1.3 Working Mode 1.3.1 Interactive Mode 1.3.2 Script Mode 1.4 Variable and Data Types 1.4.1 Numbers 1.4.2 Sequences Keywords Operator Relational Logical Assignment Input and Output Functions 1.7.1 Input 1.7.2 Print	List company name which use Python in real product generation. Use of Arithmetic Operator Comments some code Use of type expression.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

- Write a note on how keywords different from variable names.
- Write a note on list of I/O methods in Python.

b. Mini Project:

1. Develop a program to convert a string to integer.
2. Write a program that asks the user to enter his/her name, stores the name in a variable called name and say hello to him/her.

c. Other Activities (Specify):

1. Presentation on 'working mode' of python.

CO-2: Develop program in Python using decision making and loop statements. (Approx. Hrs: 6+6)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO2.1 Describe decision making statement. SO2.2 Determine the need of correct loop statement.	LE2.1 Write a program to find max and min of two Numbers. LE2.2 Write a program to find greatest among three numbers LE2.3 Write a program to print table of '5'. LE2.4 Write a program to find the factorial of given number. LE2.5 Write a program to list prime number between 1 to 100.	Unit 2.0 Control Structure 2.1 Decision making 2.1.1 The <i>if-else</i> Statement 2.1.2 <i>if-elif-else</i> statement 2.2 Control flow 2.2.1 While loop and its nesting 2.2.2 For loop 2.2.3 break, continue statement	2.1 Conditional branching statement in Python. 2.2 Nested for loop in Python 2.3 Difference between break and continue

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Write short notes on decision making statement.
2. Write short notes on control flow statement.

b. Mini Project:

1. Write a program calculate grade from given percentage like
>85 'A' >70 to <=85 'B' >60 to <=70 'C' >45 to <=60 'D'
2. Write a program to find the Armstrong number.

c. Other Activities (Specify):

1. Present a Power point presentation on *control statements*.

CO-3:

Develop programs in Python using sequence and built-in function.

(Approx. Hrs: 8+8)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO3.1 Describe the need and use of sequence	LE3.1 Write program to print the list of your subject name using List. LE3.2 Write a program to compare two different list and print duplicate records LE3.3 Write a program to find the length of entered string using Tuple. LE3.4 Write a program to print students name using their roll number.	Unit 3.0 Sequence, Dictionary & Built-in Function - Sequence: - List: - create, access & update list - basic operation on list - built-in function of list 3.1.2 Tuples: - create, access &	3.1 Difference between list & Tuples 3.2 Built in function of Tuples. 3.3 Time zone and local time function. 3.4 min, max function

	LE3.5 Write a program to print calendar of your birth month.	update - basic operation - Dictionary: - Basic operation - Built in function & method - Calendar & Time function - Built in Function of Python - Cmp, Range, Round	
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SW-3 Suggested Sessional Work (SW):

a. Assignments:

1. Differentiate between List & Tuple in Python.
2. Merits and demerits of Dictionary.

b. Mini Project:

1. Develop a program in Python to sort the element of two different lists and store sorted elements in third list.
2. List the common method and built-in function of List, Tuple and Dictionary.

c. Other Activities (Specify):

1. Present a power point presentation on *sequence of Python*.

CO-4: Develop programs in Python using user defined function and exception handling.
(Approx.Hrs:8+8)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
SO4.1 Describe the use of inbuilt module. SO4.2 Describe the user defined function SO4.3 Describe handling of exception in Python	LE4.1 Write program to find ceil and floor of given floating number using math module. LE4.2 Write program to find sin(x) and cos(x). LE4.3 Write your own function 'si' to find the simple interest. LE4.4 Write program to handle exception 'Division by zero'. LE4.5 Write program to handle exception 'Accessing an out of Bound list element'	Unit 4.0 Function File Handling 4.1 Introduction to module 4.1.1 4.1.1 Import module 4.1.2 4.1.2 From module 4.1.3 4.1.3 math and random module 4.2 User defined function 4.2.1 Need of user defined function 4.2.2 Define and declare function 4.2.3 Function with return type and arguments 4.3 Exception handling 4.3.1 Need of exception handling 4.3.2 raise, try, catch and finally	4.1 Difference between import and from. 4.2 Explain log, pow, sqrt function in math module. 4.3 Function without argument and no return type.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

1. Write short note on different modules.
2. Write a short note on type of function.

b. Mini Project:

1. Develop a program in Python to find all prime factor of a given number.
2. Develop a program in Python to check whether the given number is Arm strong number or not.

c. Other Activities (Specify):

1. Seminar on need of functions and modules.

CO-5: Develop programs in Python using Python libraries.

(Approx.Hrs:8+8)

Session Outcome s (SOs)	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning(SL)
SO5.1 Define the key features of NumPy. SO5.2 Describe the different types of plots in Matplotlib and their applications in sensor data visualization. SO5.3 Discuss the concept of serial communication and its implementation using Python. SO5.4 Outline the steps for interfacing Python with Arduino and the necessary libraries for communication.	LE5.1 Perform mathematical operations using NumPy. LE5.2 Plot and analyse sensor data using Matplotlib. LE5.3 Establish serial communication between a microcontroller (Arduino) and a Python script.	Unit 5.0 Application of Python 5.1 Introduction of Python libraries: 5.1.1 NumPy 5.1.2 Pandas 5.1.3 Matplotlib 5.2 Basic data visualization for sensor data using Matplotlib 5.3 Serial communication using Python 5.4 Interfacing Python with Arduino	5.1 Use Pandas to group, aggregate, and visualize sensor data. 5.2 Learn how to clean and preprocess sensor data for accurate analysis. 5.3 Explore additional Python libraries like Seaborn for advanced data visualization.

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) And Tutorial (T) and others), LI: Laboratory Instruction (Includes Practical Performances in Laboratory, Workshop, field or other locations using different Instructional strategies) SL: Self learning
SW-5 Suggested Sessional Work (SW):

a. Assignments:

1. Explain key features of NumPy, Pandas and Matplotlib.
2. Writes notes on interfacing Python with Arduino.

b. Mini Project:

1. Develop a real-time temperature and humidity monitoring system using an Arduino and Python.
2. Develop a system to analyze and visualize stored sensor data using Python libraries.

c. Other Activities(Specify):

1. Present a power point presentation on Python libraries.

Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

H) Suggested Specification Table (For ESA of Classroom Instruction CI+SW+SL):

Unit Number	Unit Title	Marks Distribution			Total Marks
		R	U	A	
I	Introduction to Python Programming	6	8	6	20
II	Control Structure	6	8	6	20
III	Sequence, Dictionary & built-in Function	4	8	8	20
IV	Function & File Handling	4	8	8	20
V	Application of Python	4	8	8	20
Total		24	40	36	100

Legend: R: Remember, U: Understand, A: Apply and above

I) Suggested Specification Table (For ESA of Laboratory Instruction*):

S.No	List of Practicals	Assessment of Laboratory Work (Marks)		
		Performance		Viva- Voce
		PRA	PD A	
LE1.1	Write a Program to display your name using interactive mode function.	15	15	10
LE1.2	Create variable which hold your name.	15	15	10
LE1.3	Write a program for sum of two numbers using script mode	15	15	10
LE2.1	Write a program to find max and min of two Numbers.	15	15	10
LE2.2	Write a program to find greatest among three numbers	15	15	10
LE2.3	Write a program to print table of '5'.	15	15	10
LE2.4	Write a program to find the factorial of given number.	15	15	10
LE2.5	Write a program to list prime number between 1 to 100.	15	15	10

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LE3.1	Write program to print the list of your subject name using List.	15	15	10
LE3.2	Write a program to compare two different list and print duplicate records	15	15	10
LE3.3	Write a program to find the length of entered string using Tuple.	15	15	10
LE3.4	Write a program to print students name using their roll number.	15	15	10
LE3.5	Write a program to print calendar of your birth month.	15	15	10
LE4.1	Write program to find ceil and floor of given floating number using math module.	15	15	10
LE4.2	Write program to find sin(x) and cos(x).	15	15	10
LE4.3	Write your own function 'si' to find the simple interested.	15	15	10
LE4.4	Write program to handle exception 'Division by zero'.	15	15	10
LE4.5	Write program to handle exception 'Accessing an out of Bound list element'	15	15	10
LE5.1	Perform mathematical operations using NumPy.	15	15	10
LE5.2	Plot and analyse sensor data using Matplotlib.	15	15	10
LE5.3	Establish serial communication between a microcontroller (Arduino) and a Python script.	15	15	10

*Assessment rubric, process, and product checklist with a rating scale need to be prepared by the course-wise teachers for each experiment to ensure proper conduction and assessment of laboratory experiments/practicals.

Legend: PRA: Process Assessment, PDA: Product Assessment

Note: Only one experiment is to be performed during the end-semester examination, carrying 40 marks as per the assessment scheme.**Suggested Instructional/Implementation Strategies:**

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration

11. ICTBasedTeachingLearning(VideoDemonstration,CBT,Blog,Facebook,Mobile)
12. Brainstorming
13. Others

J) Suggested Learning Resources:

K) Books:

S. No.	Title	Author	Publisher	Edition & Year
1	Taming Python by Programming	Jeeva Jose	Khanna Publishing House	Latest Edition
2	Starting Out with Python	Tony Gaddis	Pearson publication,	Latest Edition
3	Python Programming: Using Problem Solving Approach	Reema Thareja	Oxford University Press	Latest Edition
4	Python: Basic to Advanced	Aamer Khan	Code Academy	Latest Edition

L) Open source software and website address:

- a. 'Python' :<https://www.python.org/downloads/>
- b. 'Python' Tutorial: <https://www.tutorialspoint.com/python/index.htm>
- c. 'Python' Tutorial: <https://wiki.python.org/moin/BeginnersGuide>
- d. Learn 'Python' online: <http://www.learnonline.com>

M) Others:

- a. Learning Packages
- b. Lab Manuals
- c. Users Guide

N) List of Major Laboratory Equipment and Tools:

Computer System with latest configuration and memory

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Computer System	i5 processor or higher , 4GB RAM or higher with linux or windows o.s.	LE1.1-LE1.4 LE2.1-LE2.3 LE3.1-LE3.4 LE4.1-LE4.3 LE5.1-LE5.3
2	'Python' IDE	version 3.7.7 or higher	LE1.1-LE1.4 LE2.1-LE2.3 LE3.1-LE3.4 LE4.1-LE4.3 LE5.1-LE5.3

Semester-III

Legend-0: No correlation, 1: Low, 2: Medium, 3: High

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O) Course Curriculum Map

Pos & PSOs No.	Cos No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self-Learning (SL)
PO1,2,3,4,7 PSO1	CO-1 Write a Python program using interactive and script mode.	SO1.1-SO1.4	LE1.1 LE1.2 LE1.3	Unit1.0 Introduction to Python Programming	As mentioned in relevant page numbers
PO1,2,3,4,7 PSO1	CO-2 Develop program in Python using decision making and loop statements.	SO2.1-SO2.6	LE2.1 LE2.2 LE2.3 LE2.4 LE2.5	Unit2.0 Control Structure	
PO1,2,3,4,7 PSO1	CO-3 Develop programs in Python using sequence and built in function.	SO3.1-SO3.3	LE3.1 LE3.2 LE3.3 LE3.4	Unit3.0 Sequence, Dictionary & built in Function	
PO1,2,3,4,7 PSO1	CO-4: Develop programs in Python using modules, user defined function And exception handling.	SO4.1-SO4.6	LE3.5 LE4.1 LE4.2 LE4.3 LE4.4 LE4.5	Unit4.0 Function & File Handling	
PO1,2,3,4,7 PSO1	CO-5: Develop programs in Python using Python libraries.	SO5.1-SO5.3	LE5.1 LE5.2 LE5.3	Unit5.0 Application of Python	

Legend:

CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) and others), LI: Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

- A) **Course Code** : 2028C06ET046
- B) **Course Title** : Indian Traditional Knowledge: Science and Practice
- C) **Pre- requisite Course Code and Title** : None
- D) **Rationale** :
- E) **Course Objectives:**
1. Creating awareness amongst the youths about the true history and rich culture of the country;
 2. Understanding the scientific value of the traditional knowledge of Bhārata;
 3. To familiarize learners with major sequential development in Indian science, engineering and technology.
 4. To review & strengthen the ancient discovery and research in physics, chemistry, maths, metallurgy, astronomy, architecture, textile, transport, agriculture and Ayurveda etc.
 5. To understand the importance of functional, aesthetic, psychological, culture and socio religious concepts of ancient India architecture.
- F) **Course Outcomes:**
1. Students understand the various traditional practices of ancient India.
 2. They have been introduced to some concepts of Ancient Indian Physics and Chemistry.
 3. They have been introduced to some concepts of Ancient Indian Science (Metallurgy, Astronomy & Astrology).
 4. They have been introduced to some fields of IKS like Ancient Architecture and Engineering.

Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)				
			L	P	T	Total Study Hours (L+T+P)	Total Credits (C) (L+T+P/2)
Humanities	2028C06ET046	Indian Traditional Knowledge: Science and Practice	1	0	0	1	1

Legend: Lecture (L) and Tutorial (T) and Practical(P)

G) Scheme of Assessment:

Board of Study	Course Code	Course Title	Scheme of examination					
			Total Marks					Total Marks
			Theory			Practical		
			ESE	CT	TA	ESE	TA	

Humanities	2028C06ET046	Indian Traditional Knowledge: Science and Practice	0	0	0	0	20	20
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UNIT I: Bhāratīya Civilization and Development of Knowledge System

(4

Hours)

Genesis of the land, Antiquity of civilization, On the Trail of the Lost River, Discovery of the Saraswatī River, the Saraswatī-Sindhu Civilization, Traditional Knowledge System, Introduction to Vedas, A synopsis of the four Vedas, Sub-classification of Vedas, Vedic Life: A Distinctive Features, Ancient Education System, the Takṣaśilā University, the Nālandā University, Knowledge Export from Bhārata.

UNIT II: ANCIENT INDIAN SCIENCE

(4 Hours)

Physics in India: Vaisheshika darshan Atomic theory & law of motion, theory of panchmahabhoota, Brihath Shathaka (divisions of the time, unit of distance), bhaskaracharya (Theory of gravity, surya siddhanta & sidhanta shriomani), Lilavati (gurutvakashan Shakti).

Chemistry in India: Vatsyayana, Nagarjuna, Khanda, Al-Biruni, Vagbhaṭa –building of the ras-shala (laboratory), working arrangements of ras-shala, material and equipment, Yaśodhara Bhaṭṭa-process of distillation, apparatus, saranasamskara, saranataila

UNIT III: ANCIENT INDIAN TECHNOLOGY

(4

Hours)

Metallurgy in India: Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Mining and ore extraction, Survarṇa (gold), Rajata (silver), Tamra (copper), Loha (iron), Vanga (tin), Naga / sisa (lead), Pittala (brass), and steel in ancient India, Apparatuses used for extraction of metallic components, Iron Pillar of Delhi.

Astronomy and Astrology: The Beginnings of Indian Astronomy - The Early Historical Period-The Siddhāntic Era., Ancient Indian Observational astronomy. Foundation concepts - nakṣatra, graha, time units, phenomena like meteors, eclipses., Brief notes on Astronomical instruments like sundials, water clock, time measurement. Aryabhata - Varahamihira- Bhaskara I – Brahamagupta- Bhaskara II

UNIT IV: ARCHITECTURE AND CIVIL ENGINEERING

(3 Hours)

Perspective of Arthaśāstra on town planning, Vāstu-śāstra – The science of architecture, Eight limbs of Vāstu, Town planning, Temple architecture in India, Iconography, Architecture in India: Nagara (northern style), Vesara (mixed style), and Dravida (southern style), Indian vernacular architecture,

Temple style, cave architecture, rock cut architecture, kalinga architecture, chandels architecture, rajput architecture, jain architecture, sikh architecture, Maratha architecture.

Text Books: (Hindi and English language as per availability)

1. Textbook on “The Knowledge System of Bhārata by Bhag Chand Chauhan.
2. वास्तविक आईना सनातन विज्ञान का, परम कुमार, वैभव प्रकाशन रायपुर
3. SCIENTIFIC BASIS OF INDIAN KNOWLEDGE SYSTEM Saroj Sharma, Bal Krishna Rai, Sunita Joshi Kathuria, SHIPRA PUBLICATIONS
4. R P Kulkarni, Glimpse of Indian Engineering and Technology (Ancient & Medieval period, Munshiram Manoharlal Publishers Pvt. Ltd. 2018.
5. Sen, S. N., and Shukla, K. S. (Ed.) (2000). History of Astronomy in India, 2nd Revised Edition. New Delhi: Indian National Science Academy.
6. D N Shukla Civil Architecture in Ancient India (Part-I) Meharchand lakshmidas publication, 2016.

Reference Books: (Hindi and English language both)

1. Iyengar, R. N. (2016) Astronomy in Vedic texts, History of Indian Astronomy, A Handbook - Volume brought out on the occasion of IX International Conference on Oriental Astronomy November 14–18.
2. Pride of India- A Glimpse of India’s Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).
3. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012). 3. India’s Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).
4. AK Pathak, Science and Technology in India, Anshika prakashan pratapgarh, 2016.
5. AR vasudev Murty, Science and Technology in Ancient India as Reflected in the Mahabharata, Sanskrit bharati, 2019.
6. B Dagens, Mayamata: An Indian Treatise on Housing Architecture and Iconography (An Updated Edition with revised Glossary), Motilal banrsidas, 2017.
7. Dr. V. Ganapati Sthapati, Building Architecture of Sthapatya Veda.

- A) **Course Code** : 2028C05FL022
B) **Course Title** : Idea and Innovation Lab
C) **Pre-requisite Course Code and Title** :

D) **Rationale** :

The Idea and Innovation Lab provides hands-on, experiential learning component in the Diploma Engineering program to nurture skills. The course aims to instill an innovation mindset among students by guiding them through the complete cycle of problem identification, idea generation, conceptual design, prototyping, testing, and pitching. It emphasizes design thinking, teamwork, and user-centric development, encouraging students to step beyond textbooks and apply their knowledge to practical, meaningful challenges.

E) **Course Outcome:**

- CO1: Develop creative thinking, innovation skills, and problem-solving mindset.
CO2: Learn the process of taking an idea from concept to working prototype
CO3: Apply design thinking in real-world scenarios
CO4: Understand and evaluate prototype
CO5: Prepare technical report and demonstrate awareness of IPR

F) **Scheme of Studies:**

Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)				
			L	P	T	Total Study Hours (L+T+P)	Total Credits(C) (L+T+P/2)
Computer Science	2028C05FL022	Idea and Innovation Lab	0	2	0	2	1

Legend: Lecture (L), Tutorial (T) and Practical(P)

G) **Scheme of Assessment:**

Board of Study	Course Code	Course Title	Scheme of examination					
			Total Marks					
			Theory			Practical		Total Marks
			ESE	CT	TA	ESE	TA	
Computer Science	2028C05FL022	Idea and Innovation Lab	0	0	0	0	30	30

H) **Course-Curriculum Detailing:**

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Laboratory Instruction (LI) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

CO-1 Develop creative thinking, innovation skills, and problem-solving mindset

(Approx. Hrs: LI +SL =5)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Self-Learning (SL)
SO1.1 List of real-world problems SO1.2 Shortlisted idea proposals	Unit-1.0 Ideation & Problem Identification iv. Introduction to Innovation & Design Thinking v. Empathizing with users and identifying real-life problems vi. Brainstorming, Mind Mapping, SCAMPER method vii. Creating clear problem statements	1.1 Different creative thinking techniques. 1.2 List of Real life problems

CO-2 Learn the process of taking an idea from concept to working prototype.

(Approx. Hrs: LI+ SL =6)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Self-Learning (SL)
SO2.1 Concept document SO2.2 Wireframes, flow diagrams	Unit-2.0 Concept Development 2.1 Concept sketching, use-case creation 2.2 Wireframes, user journey mapping 2.3 Technical feasibility study 2.4 Functional requirement gathering	iii. Basic blueprint making iv. Feasibility study

CO-3 Apply design thinking in real-world scenarios

(Approx. Hrs: LI+ SL =7)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Self-Learning (SL)
SO3.1 Selection of tools and technologies SO3.2 Prototype plan	Unit-3.0 Tools & Technologies for Prototyping 3.1 Web/Mobile app prototyping tools (like Figma, HTML/CSS basics) 3.2 Basics of hardware/software integration 3.3 Component selection, system design	3.1 Usage of different tools. 3.2 Hardware Software integration

CO-4 Understand and evaluate prototype

(Approx. Hrs: CI+LI+SW+SL =7)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Self-Learning (SL)
SO4.1 Working prototype (Minimum Viable Product)	Unit-4.0 Building the Prototype 4.1 Development of the Prototype 4.2 Interface design, module integration 4.3 Testing and Evaluation 4.4 Final refinement of prototype based on feedback	4.1 Prototype models 4.2 Interface design 4.3 Prototype evaluation methods 4.4 Debugging steps

CO-5 Prepare technical report and demonstrate awareness of IPR

(Approx. Hrs: LI+ SL =5)

Session Outcomes (SOs)	Laboratory Instruction (LI)	Self-Learning (SL)
SO5.1 Students will be able to prepare technical reports SO5.2 Students will be able to demonstrate prototypes SO5.3 Students will be able to understand IP basics.	Unit5. Reporting and IPR 6. Reporting of results/ demos: process of explaining the project idea, working and results. • Learning intellectual property basics: legal rights given to creations of the mind. Types of Intellectual Property i. Patent —Protects new inventions ii. Copyright – Protects written work, software iii. Trademark —Protects logos, brand names iv. Design Rights – Protects product appearance its Importance for Students	Identify the purpose of Form 1 and Form 2 in the patent application process. List the difference between Provisional Specification and a Complete specification while filing an IPR List the specific features as per Design act that constitutes a Design

I) Suggested Learning Resources:

S. No.	Titles	Author	Publisher	Edition & Year
1	Developing Thinking Skills (The way to Success)	E Balaguruswamy	Khanna Publication, 2022	1 st Edition 2022
2	Product Design and Manufacturing	A.K. Chitale and R.C. Gupta	Prentice Hall, India	7 th edition
3	Ideas to Innovation: Creativity, Design Thinking, IPR & the Innovation	Dr Gaurav Kumar	Atlantic Publishers and Distributors (P) Ltd.	1 st edition, 2025

	Ecosystem			
4	Startupology: Ideation to Execution for First-Time Founders	Vivek Chadha	Zebra Learn	1 st edition, 2025
5	8 Steps to Innovation	Vinay Dabholkar, Rishikesh T Krishnan	Collins	1 st edition, 2013

J) List of Suggestive Laboratory Equipment and Tools:

1.	Simulation Software	Necessary Licensed softwares with Desktop Computer with minimum processor of 3 GHz, 64 bit, Graphic Card, 16 GB RAM and SSD drive.
2.	3 D Printer	Print Technology Fused Deposition modelling, Material Supported PLA, ABS, PETG and flexible TPU, Build volume: Suitable for prototype and projects (200mmx200mmx200mm) to (300mmx300mmx300mm), Layer resolution 50-300 micron, Software: Open-source software compatibility e.g., Cura, Prusa Slicer that can import standard CAD formats like STL or OBJ
3.	Development Boards & Sensors	Example: Arduino UNO, Arduino MEGA, Arduino 8266, ESP 32 etc, RTC Module, Temperature sensors, Light sensors, Motion sensors, Pressure sensors, Humidity Sensors, Gas sensors
4.	Display Boards	Character LCDs, Graphic LCDs, OLED and TFT LCDs
5.	Tools & Measuring Instruments	Drilling Machines, Automated welding machines, CNC lathes, Soldering stations, Digital Multimeters, Waveform analyzers,

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Semester-III

- A) Course Code : 2028C07DT046
B) Course Title : Personality Development
C) Pre- requisite Course Code and Title : None

Course Objectives: This course aims to develop self-awareness, self-management, communication, interpersonal, and professional skills in students to enhance their personality and prepare them for career and workplace readiness.

D) Scheme of Studies:

Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)				
			L	P	T	Total Study Hours (L+T+P)	Total Credits(C) (L+T+P/ 2)
Humanities	2028C07DT046	Personality Development	1	0	0	1	1

Legend: Lecture (L) and Tutorial (T) and Practical (P)

E) Scheme of Assessment:

Board of Study	Course Code	Course Title	Scheme of examination					
			Total Marks					
			Theory			Practical		Total Marks
			ESE	CT	TA	ESE	TA	
Humanities	2028C07DT046	Personality Development	0	0	0	0	10	10

Course Contents:

Unit I: Personality & Self-Awareness – Concept and determinants of personality, Self-awareness and SWOT analysis, Attitude and confidence building.(3 Hrs)

Unit II: Self-Management– Stress management techniques, Time management and goal setting, Body language.(3 Hrs)

Unit III: Interpersonal Skills – Interpersonal transactions and Transactional Analysis (TA) basics; Conflict – Types and resolution, Digital communication etiquette: email writing, netiquette, and professional social media presence.(3 Hrs)

Unit IV: Teamwork – Group dynamics and team building, Leadership skills, Collaboration and coordination, Problem-solving in teams.(3 Hrs)

Unit V: Professional Skills – Public speaking and presentation skills: overcoming stage fear, structuring a talk, use of visuals; Workplace etiquette: professional appearance, meeting conduct, and workplace relationship.(3 Hrs)

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Semester-III

Course Outcomes:

CO No.	Course Outcome	Bloom's Level
CO1	Identify personality traits and perform self-assessment analysis.	Remember (L1) / Understand (L2)
CO2	Apply self-management techniques for personal and career goals.	Apply (L3)
CO3	Demonstrate effective interpersonal skills in various contexts.	Apply (L3)
CO4	Analyze group dynamics and exhibit teamwork abilities.	Analyze (L4)
CO5	Develop professional competencies and workplace etiquettes.	Create (L6)

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Personality Development and Soft Skills	Barun K. Mitra	-	Oxford University Press
2	Communication Skills and Personality Development	J.R. Kadam et al.	-	Scientific Publishers

Reference Books:

S.No.	Title	Authors	Edition	Publisher
1	Communication Skills and Personality Development	M. Jegadeesan et al.	-	-
2	How to Win Friends and Influence People	Dale Carnegie	-	-