

**Scheme and Syllabus**  
**of**  
**D.Voc (2 Years)/Diploma (3 Years)**  
**Industrial Electronics**  
by  
Skill Department of Industry 4.0  
under  
Skill Faculty of Engineering and Technology



**Shri Vishwakarma Skill University**

Dudhola, Palwal-121102, Haryana

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**Shri Vishwakarma Skill University, Palwal**

## Skill Faculty of Engineering and Technology

### Skill Department of Industry 4.0

#### D.Voc Industrial Electronics


Effective from batch 2024 Onwards

#### Semester-I

Subject Code	Subject Name	Credits				Marks							Hrs		
						Theory			Practical			Total	T	P	TO
		Th	T	P	TO	I	E	TO	I	E	TO	(T+P)			
24DEVS01	Environmental Science	2	0	0	2	30	70	100	-	-	-	100	30	-	30
24DECE24	Electrical Engineering Drawing Lab	0	0	3	3	-	-	-	70	30	100	100	-	90	90
24DECE25	Basics of Electronics and Electrical Engineering	2	0	2	4	15	35	50	35	15	50	100	30	60	90
24DECE26	Basics of Electronics and Electrical Engineering Lab														
24DECE27	Digital Electronics	2	0	2	4	15	35	50	35	15	50	100	30	60	90
24DECE28	Digital Electronics Lab														
24DECE29	Electronics Instruments and Measurements	3	0	1	4	15	35	50	35	15	50	100	45	30	75
24DECE30	Electronics Instruments and Measurements Lab														
24DECE31	Python Programming	2	0	1	3	15	35	50	35	15	50	100	30	30	60
24DECE32	Python Programming Lab														
Total		11	0	9	20	90	210	300	210	90	300	600	165	270	435

The above scheme is approved in Certificate/Diploma Programs BoS held on July 23, 2024.

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## D.Voc Industrial Electronics

Effective from batch 2024 Onwards

### Semester-II

Subject Code	Subject Name	Credits				Marks							Hrs		
						Theory			Practical			Total	T	P	TO
		Th	T	P	TO	I	E	TO	I	E	TO	(T+P)			
24DENG01	English Language and Communication Skills	1	0	1	2	15	35	50	35	15	50	100	15	30	45
24DENG02	English Language and Communication Skills Practical														
24DCSE01	Basics of Computer with Programming in C	2	0	1	3	15	35	50	35	15	50	100	30	30	60
24DCSE02	Basics of Computer with Programming in C Lab														
24DPHY01	Applied Physics	2	0	1	3	15	35	50	35	15	50	100	30	30	60
24DPHY02	Applied Physics Lab														
24DECE33	Electronic Device Circuits	3	0	1	4	15	35	50	35	15	50	100	45	30	75
24DECE34	Electronic Device Circuits Lab														
24DYHS01	Yoga and Health Skills-I	2	0	0	2	30	70	100	-	-	-	100	30		30
24DECE35	Fundamentals of Wiring Harness	4	0	0	4	15	35	50	35	15	50	100	60	30	90
24DECE36	Wiring Harness Assembly Lab	0	0	2	2										
<b>Total</b>		<b>14</b>	<b>0</b>	<b>6</b>	<b>20</b>	<b>105</b>	<b>245</b>	<b>350</b>	<b>175</b>	<b>75</b>	<b>250</b>	<b>600</b>	<b>210</b>	<b>150</b>	<b>360</b>

**Note:** For the Award of Certification after 1 year, Student have to complete Min. 2 Month OJT from the Industry partner

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**D.Voc Industrial Electronics**  
**Scheme of The Third Semester**

Effective from batch 2024 Onwards

**Semester-III**

Subject Code	Subject Name	Credits				Marks							Hrs		
						Theory			Practical			Total			
		Th	T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
24UENG03	Employability Skills	1	0	1	2	15	35	50	35	15	50	100	15	30	45
24UENG04	Employability Skills Practical														
24DCSE03	Spreadsheet Modelling Lab	0	0	2	2	-	-	-	30	70	100	100		60	60
24DECE37	Analog Electronics	3	0	1	4	15	35	50	35	15	50	100	45	30	75
24DECE38	Analog Electronics Lab														
24DECE39	Microprocessors and Peripheral Devices	4	0	0	4	30	70	100	-	-	-	100	60		60
24DECE40	PCB Assembly	2	0	2	4	15	35	50	35	15	50	100	30	60	90
24DECE41	PCB Assembly Lab														
24DECE42	Major Project	0	0	4	4	-	-	-	140	60	200	200	-	120	120
24DECE43	Internship	-	-	-	-	-	-	-	-	-	-	-	-	60	60
<b>Total</b>		10	0	10	20	75	175	250	275	175	450	700	150	360	510

**Scheme of The Fourth Semester**

Effective from batch 2024 Onwards

**Semester-IV**

Subject Code	Subject Name	Credits				Marks							Hrs		
						Theory			Practical			Total			
		Th	T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
24DECE44	NSQF aligned On Job Training	-	-	20	20	-	-	-	420	180	600	600	-	600	600
<b>Total</b>		-	-	20	20	-	-	-	420	180	600	600	-	600	600

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## D.Voc/\*Diploma Industrial Electronics

### Scheme of The Fifth Semester

Effective from batch 2024 Onwards

#### Semester-V

Subject Code	Subject Name	Credits				Marks							Hrs		
						Theory			Practical			Total			
		Th	T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
24DECE45	NSQF aligned On Job Training	-	-	20	20	-	-	-	420	180	600	600	-	600	600
	<b>Total</b>	-	-	20	20	-	-	-	420	180	600	600	-	600	600

### Scheme of The Sixth Semester

Effective from batch 2024 Onwards

#### Semester-VI

Subject Code	Subject Name	Credits				Marks							Hrs		
						Theory			Practical			Total			
		Th	T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
24DECE46	Linear Control System	4	0	0	4	30	70	100	-	-	-	100	60		60
24DECE47	Programmable Logic Controller	3	0	1	4	15	35	50	35	15	50	100	45	30	75
24DECE48	Programmable Logic Controller Lab														
24DECE49	Transducers and Signal Conditioning	4	0	0	4	30	70	100	-	-	-	100	60		60
24DECE50	Linear Integrated Circuits	3	0	1	4	15	35	50	35	15	50	100	45	30	75
24DECE51	Linear Integrated Circuits Lab														
24DECE52	Principles of Quality Management	4	0	0	4	-	-	-	140	60	200	200	60		60
	<b>Total</b>	17	0	3	20	90	210	300	210	90	300	600	270	60	330

\*3<sup>rd</sup> Year Optional (if student opts to continue for 3<sup>rd</sup> year for Diploma Program after completing 2 years in D.Voc. Industrial Electronics Program)

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**Job Role: Wiring Harness Assembly Operator**

**Brief Job Description**

The individual makes a wire harness assembly by cutting, stripping and crimping wires and then soldering, connecting, taping and labeling them on a laying board as per the design specifications. This is followed by testing the components of the assembly.

QP Mapping Level-3			
Job role	NOS Code	NOS Hrs	Alignment
Wiring Harness Assembly Operator ELE/Q6306 (Ver 2.0)	ELE/N6306: Perform pre-assembly operations	(112 Hours)	1. Fundamentals of Wiring Harness 2. Wire Harness Assembly Lab
	ELE/N6307: Assemble the components of wire harness	(108 Hours)	1. Fundamentals of Wiring Harness 2. Wire Harness Assembly Lab
	ELE/N9972: Communicate and coordinate effectively with others	(40 Hours)	NSQF aligned On Job Training
	ELE/N1003: Work effectively, sustainably and safely	(40 Hours)	NSQF aligned On Job Training
	DGT/VSQ/N0101: Employability Skills	(30 Hours)	1. Employability Skills 2. Expert lectures conducted by IDC Cell

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**Job Role: PCB Assembly Operator**

**Brief Job Description**

PCB assembly operator is responsible for manually placing different types of components on the PCB as per the design requirements and then soldering them.

QP Mapping Level-4			
Job role	NOS Code	NOS Hrs	Alignment
PCB Assembly Operator ELE/Q7804 (Ver 3.0)	ELE/N7812: Assemble Printed Circuit Board (PCB)	(160 Hours)	1. PCB Assembly 2. PCB Assembly Lab 3. On the Job Training
	ELE/N9905: Work effectively at the workplace	(40 Hours)	1. PCB Assembly 2. PCB Assembly Lab 3. On the Job Training
	ELE/N1002: Apply health and safety practices at the workplace	(40 Hours)	NSQF aligned On Job Training
	DGT/VSQ/N0102: Employability Skills (60 Hours)	(60 Hours)	1. Employability Skills 2. Expert lectures conducted by IDC Cell

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### Job Role: Incoming QC Technician

#### Brief Job Description

The individual at work is responsible for checking quality check on the components and modules procured from suppliers for production of hardware equipment. The individual performs physical and functional quality check processes on the components and modules and ensure QC passed components is used for hardware assembling.

QP Mapping Level-5			
Job role	NOS Code	NOS Hrs	Alignment
Incoming QC Technician ELE/Q4401 (Ver 2.0)	ELE/N4401: Perform Incoming Quality Check	(112 Hours)	1. Wire Harness Assembly Lab 2. PCB Assembly Lab 3. Principles of Quality Management 4. NSQF aligned On Job Training
	ELE/N9905: Work effectively at the workplace	(40 Hours)	NSQF aligned On Job Training
	ELE/N1002: Apply health and safety practices at the workplace	(40 Hours)	NSQF aligned On Job Training

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**Syllabus  
of  
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Industrial Electronics**

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**D.Voc Industrial Electronics**  
**Syllabus of The First Semester**

**SUBJECT: Environmental Science**  
**CODE: 24DEVS01**

Credit	Hours	Marks		
		I	E	To
2	30	30	70	100

**Objectives**

- To create awareness among the students about our ecosystem, related problems and our role in that.

**Course Outcomes**

After the completion of this course, students will be able to:

- CO1: Understand our environment.
- CO2: Comprehend ecosystems and biodiversity.
- CO3: Analyze atmospheric and climate dynamics.
- CO4: Evaluate urbanization and agricultural practices.
- CO5: Develop strategies for environmental pollution control.

**Unit 1: Indian Knowledge System- Indigenous Practices, Understanding our Environment**

Environment: Definition, Scope and Importance, Natural Resources management: Forest Resources, Water Resources, Mineral Resources, Energy Resources, Food Resources, Land Resources., Traditional agricultural practices - Organic farming, Crop rotation, Intercropping), Water management techniques - Stepwells, Tankas, Baolis, Forest management and conservation methods - Sacred groves, Agroforestry

**Unit 2: Ecosystem**

Ecosystem: Introduction, structure, functions & Kinds of ecosystem. Energy flow in ecosystem, Biogeochemical cycles, Habitat and Ecological Niche, Species Interactions, Bio-geographic zones of India.

**Unit 3: Atmosphere and Environmental Pollution**

Atmosphere: Introduction, layers of the atmosphere, Climate Change: Greenhouse effect, Global warming, Ozone layer depletion, Deforestation, Air pollution: major air pollutants, classification of air pollutants, impact of air Pollution, controlling measures. Acid Rain.  
Water Pollution: Introduction, causes, impacts & waste water treatment.

**Unit 4: Urbanization**

Urbanization: Introduction, Manifestations of Urbanization, social economic and environmental problems in urbanization, Agriculture: Introduction, unsustainable patterns of modern industrialized agriculture, Green revolution, Soil erosion.

**Field Work**

- Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural
- Participation in plantation drive and nature camps.

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- Campus environmental management activities such as solid waste disposal, water Management and sanitation, and sewage treatment.

### Text Books

1. Singh, J.S., Singh, S.P. & Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications.
2. Odum, E.P., Odum, H.T. & Andrews, J. (1971). Fundamentals of Ecology. Philadelphia: Saunders.
3. Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson).

### References

1. Deevedi M. (2021). Environment and ecology in the Indian knowledge system. Vidyanidhi prakashan.
2. Melissa K. Nelson and Daniel Shilling. (2018). Traditional Ecological Knowledge: Learning from Indigenous Practices for Environmental Sustainability. Cambridge University Press.
3. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK.
4. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press.
5. Central Pollution Control Board Web page for various pollution standards. <https://cpcb.nic.in/standards/>
6. Ahluwalia, V. K. (2015). *Environmental Pollution, and Health*. The Energy and Resources Institute (TERI)

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**SUBJECT: Electrical Engineering Drawing (Lab)**  
**CODE: 23DECE24**

Credit	Hours	Marks		
		I	E	To
3	90	70	30	100

### Objectives

- The course inculcates the students the importance and basic principles of Technical/Engineering Drawing and different steps in producing drawings according to BIS conventions.

### Course Outcomes

After the completion of this course, the student will be able to

- CO1: Read, understand and interpret engineering drawings.  
CO2: Communicate and co-relate through sketches and drawings.  
CO3: Prepare working drawings of panels, transmission and distribution.  
CO4: Effectively design various engineering components.  
CO5: Understand and apply the concepts of projection of planes and solids.

### CONTENTS (TO MAKE 12 SHEETS)

#### 1. Symbols and Signs Conventions: (2 Sheets)

- Various Electrical Symbols used in Domestic and Industrial Installation and Power System as per BIS.

#### 2. Panels/Distribution Boards: (3 Sheets)

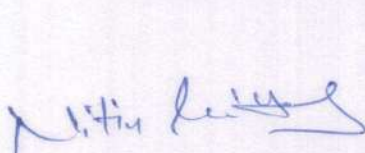
- Design and Drawing of panels/Distribution board using MCBs, ELCB, main switches and change over switches for domestic installation, industrial and commercial installation.

#### 3. Contactor Control Circuits: Schematic and wiring diagram: (3 Sheets)

- DOL Starter of 3-phase induction Motor.
- Forwarding/reversing of 3-phase induction motor
- Limit switch control of a 3-phase induction motor
- Sequence operation of two motors using T.D.R.
- Two speed motor control.
- Automatic star-delta starter for 3-phase induction motor

#### 4. Projection of Planes and Solids: (2 Sheets)

- Projections of Planes: Projection of regular planes, Plane inclined to both reference planes (No conditional problems).
- Projections of Solids: Projections of regular solids prism and pyramid inclined to both planes (No conditional problems).



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## 5. Isometric projection (2 Sheets)

- Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions – Plane Figures, Simple and Compound Solids.

### Suggested Readings:

- Engineering Drawing Plane and Solid Geometry: N.D. Bhatt and V.M. Panchal, Forty- Fourth Edition 2002, Charotar Publishing House.
- Electrical Engineering Design and Drawings by Surjeet Singh, Dhanpat Rai and Co, New Delhi
- Electrical Engineering Design and Drawings by SK Bhattacharya, SK Kataria and Sons, New Delhi
- Electrical Engineering Design and Drawings by Ubhi & Marwaha, IPH, New Delhi
- Electrical Design and Drawing by SK Sahdev, Uneek Publications, Jalandhar
- Electrical Engineering Drawing by Surjit Singh, SK Kataria and Sons, New Delhi

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**SUBJECT: Basics of Electrical and Electronics Engineering**  
**CODE: 23DECE25**

Credit	Hours	Marks		
		I	E	To
2	30	15	35	50

**Objectives**

- To provide quality electrical and electronics engineering knowledge with extensive hands-on and laboratory experience.

**Course Outcomes**

After the completion of this course, the student will be able to

CO1: Understand and remember various electrical quantities and their units.

CO2: Understand and apply the electromagnetic effects and its laws.

CO3: Derive Ohm's Law, Kirchhoff's Laws and make use of its applications by performing experiments on breadboard circuit.

CO4: Design and analyse the capacitors & resistance based circuits and use them in series and parallel connection.

CO5: Understand the construction and working of PN Junction diode, Zener diode, and analyse its performance using half wave, full wave rectifier and other applications.

Unit	Topic	Key Learning
I	<b>Basic Electrical Quantities Overview of Atom and Sub-Atomic Particles</b>	<ul style="list-style-type: none"> <li>Basic concept of charge, current, voltage, resistance, power, energy and their units, Conversion of units of work, power and energy from one form to another</li> <li>Atom and its elements,</li> <li>Electron,</li> <li>Force,</li> <li>Field intensity,</li> <li>Potential,</li> <li>Energy,</li> <li>Kinetic energy</li> </ul>
II	<b>Electromagnetic Effects</b>	<ul style="list-style-type: none"> <li>Permanent magnets and Electromagnets,</li> <li>Faraday's Laws of Electromagnetic Induction,</li> <li>dynamically induced e.m.f., its magnitude and induction, inductance and its unit.</li> <li>Mutually induced e.m.f., its magnitude and direction.</li> <li>Force acting on a current carrying conductor in magnetic field,</li> <li>its magnitude and direction.</li> </ul>
III	<b>DC Circuits and Capacitors</b>	<ul style="list-style-type: none"> <li>Ohm's Law, Series – parallel resistance circuits,</li> <li>calculation of equivalent resistance,</li> <li>Kirchhoff's Laws and their applications</li> </ul>

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		<ul style="list-style-type: none"> <li>• Electronic components, Active and Passive components, Concept of Current and Voltage sources, Constant voltage and current sources</li> <li>• Capacitor and its capacity, Concept of charging and Discharging of capacitors, Types of Capacitors and their use in circuits, Series and parallel connection of capacitors,</li> <li>• Energy stored in a capacitor</li> </ul>
IV	<b>AC Circuits and Power Supply</b>	<ul style="list-style-type: none"> <li>• Concept of AC Generation,</li> <li>• Difference between AC and DC,</li> <li>• Concept of alternating current and voltage,</li> <li>• equation of instantaneous values,</li> <li>• average value, r.m.s value, form factor, power factor etc.,</li> <li>• A.C. Series Circuits with (i) resistance and inductance (ii) resistance and capacitance and (iii) resistance inductance and capacitance</li> <li>• Introduction and Working of Switched Mode Power Supply (SMPS),</li> <li>• Voltage Regulator,</li> <li>• Introduction to Inverters and UPS.</li> </ul>
V	<b>Introduction to electronic components</b>	<ul style="list-style-type: none"> <li>• PN junction diode, Zener Diode</li> <li>• Types and applications of diode.</li> <li>• Diode as a rectifier,</li> <li>• Half wave and full wave rectifier (Bridge rectifier)</li> <li>• Introduction to SCR, DIAC and TRIAC</li> <li>• Introduction to Filters.</li> </ul>

#### Suggested Readings:

- Electrical Technology by BL Theraja, S Chand and Co, New Delhi.
- Basic Electrical and Electronics Engineering by SK Sahdev; Dhanpat Rai and Sons, New Delhi.
- Experiments in Basic Electrical Engineering by SK Bhattacharya, KM Rastogi; New Age International(P) Ltd.; Publishers New Delhi.

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**SUBJECT: Basics of Electrical and Electronics  
Lab**

**CODE: 23DECE26**

Credit	Hours	Marks		
		I	E	To
2	60	35	15	50

### Objectives

- To provide quality electrical and electronics engineering knowledge with extensive hands-on and laboratory experience.

### Course Outcomes

After the completion of this course, the student will be able to

CO1: Understand and remember various electrical quantities and their units.

CO2: Understand and apply the electromagnetic effects and its laws.

CO3: Derive Ohm's Law, Kirchhoff's Laws and make use of its applications by performing experiments on breadboard circuit.

CO4: Design and analyse the capacitors & resistance based circuits and use them in series and parallel connection.

CO5: Understand the construction and working of PN Junction diode, Zener diode, and analyse its performance using half wave, full wave rectifier and other applications.

### List of Practical's

1. Identification and testing of electronic components such as resistor, inductor, capacitor, diode, transistor and different types of switches used in Electronic circuits.
2. Verify that resistance of conductor is directly proportional to resistivity and length and inversely proportional to cross-sectional area of the conductor.
3. Verification of Ohm's Law.
4. Study of series resistive circuits.
5. Study of parallel resistive circuits.
6. Verification of Kirchhoff's current and voltage laws applied to DC circuits
7. Charging and Discharging of a capacitor
8. Verification of Faraday's Laws of electromagnetic induction.
9. Plot V-I characteristics for PN junction diode and calculate its Static and dynamic resistance
10. Plot V-I characteristics of Zener diode.
11. Observe the wave shape of Bridge rectifier.
12. Construction & Working of DOL starter.
13. Construction & Working of Star-Delta starter.
14. Construction & Working of Distribution Board and Extension Board.
15. To perform open circuit test and short circuit test of a single-phase transformer.
16. Study of SMPS Circuit.

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**Suggested Readings:**

- Electrical Technology by BL Theraja, S Chand and Co, New Delhi.
- Basic Electrical and Electronics Engineering by SK Sahdev; Dhanpat Rai and Sons, New Delhi.
- Experiments in Basic Electrical Engineering by SK Bhattacharya, KM Rastogi; New Age International (P) Ltd.; Publishers New Delhi.

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**SUBJECT: Digital Electronics**  
**CODE: 24DECE27**

Credit	Hours	Marks		
		I	E	To
2	30	15	35	50

**Objectives**

To enable learners to understand common forms of number representation in digital electronic circuits and to be able to convert between different representations along with the understanding of digital design and digital system.

**Course Outcomes**

After the completion of this course, the student will be able to

CO1: Analyze the structure of number systems and proficiently convert between different number systems.

CO2: Apply logic simplification rules effectively for the design of digital logic.

CO3: Illustrate the reduction of logical expressions using boolean algebra, k-map, and tabulation method, and implement functions using logic gates.

CO4: Realize combinational circuits for specific applications, demonstrating entrepreneurial skills.

CO5: Design and analyze synchronous and asynchronous sequential circuits and counters using flip-flops, enhancing entrepreneurial skills.

Unit	Topic	Key Learning
I	<b>Introduction &amp; Number System</b>	<ul style="list-style-type: none"> <li>• Distinction between analog and digital signals,</li> <li>• Applications and advantages of digital signals</li> <li>• Binary, octal and hexadecimal number system</li> <li>• Conversion from decimal and hexadecimal to binary and vice-versa.</li> <li>• Binary addition, subtraction, 1's and 2's complement method of addition/subtraction</li> </ul>
II	<b>Logic gates and Families</b>	<ul style="list-style-type: none"> <li>• Concept of negative and positive logic,</li> <li>• Definition, symbols and truth tables of NOT, AND, OR, NAND, NOR, EXOR Gates,</li> <li>• NAND and NOR as universal gates.</li> <li>• Introduction to TTL and CMOS logic families</li> </ul>
III	<b>Logic Simplification</b>	<ul style="list-style-type: none"> <li>• Boolean algebra,</li> <li>• Implementation of Boolean (logic) equation with gates,</li> <li>• Karnaugh map (up to 4 variables) and simple application in developing combinational logic circuits</li> <li>• Half adder and Full adder circuit,</li> <li>• design and implementation,</li> <li>• Half and Full subtractor circuit,</li> <li>• design and implementation.</li> </ul>

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IV	<b>Multiplexers and De-Multiplexers</b>	<ul style="list-style-type: none"> <li>• Multiplexers and De-Multiplexers,</li> <li>• Basic functions and block diagram of MUX and DEMUX, Different types and ICs</li> </ul>
V	<b>Latches, flip flops and Counters</b>	<ul style="list-style-type: none"> <li>• Concept and types of latch with their working and applications,</li> <li>• Operation using waveforms and truth tables of RS, T, D, and Master/Slave JK flip flops,</li> <li>• Difference between a latch and a flip flop</li> <li>• Introduction to Asynchronous and Synchronous Counters</li> <li>• Binary counters</li> <li>• Divide by N ripple counters, Decade counter, counter</li> </ul>

**Suggested Readings:**

- Digital Electronics by Soumitra Kumar Mandal, Tata McGraw Hill Education Pvt. Ltd.
- Fundamentals of Digital Electronics by Naresh Gupta, Jain Brothers, New Delhi
- Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi
- books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.
- **Websites for Reference:** <http://swayam.gov.in>

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**SUBJECT: Digital Electronics Lab**  
**CODE: 24DECE28**

Credit	Hours	Marks		
		I	E	To
2	60	35	15	50

**Objectives:**

To enable learners to understand common forms of number representation in digital electronic circuits and to be able to convert between different representations along with the understanding of digital design and digital system.

**Course Outcomes**

After the completion of this course, the student will be able to

CO1: Analyze the structure of number systems and proficiently convert between different number systems.

CO2: Apply logic simplification rules effectively for the design of digital logic.

CO3: Illustrate the reduction of logical expressions using boolean algebra, k-map, and tabulation method, and implement functions using logic gates.

CO4: Realize combinational circuits for specific applications, demonstrating entrepreneurial skills.

CO5: Design and analyze synchronous and asynchronous sequential circuits and counters using flip-flops, enhancing entrepreneurial skills.

**List of Practicals**

1. Verification of truth tables for AND, OR, NOT and NAND logic gates.
2. Verification of truth tables for NOR, XOR and XNOR logic gates.
3. Construction and verification of operations of half adder and full adder circuits using basic gates.
4. Construction and verification of operations of half Subtractor circuit using basic gates.
5. Construction and verification of operations of full Subtractor circuit using basic gates.
6. Study and verification of truth tables for 4:1 MUX using gates.
7. Study and verification of truth tables for 1:4 DEMUX using gates.
8. Construction and verification of truth tables for S-R flip flops.
9. Construction and verification of truth tables for D flip flops.
10. Construction and verification of truth tables for J-K flip flops.
11. Configuring NAND and NOR logic gates as universal gates.
12. Implementation of Boolean Logic Functions using logic gates and combinational circuits.
13. To design and construct of Synchronous Counter.
14. To design and construct Asynchronous counter.

**Suggested Readings:**

- Digital Electronics and Applications by Malvino Leach, Tata Mcgral Hill, New Delhi.
- Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi.
- Digital Fundamentals by Thomas Floyds, Universal Book Stall.
- Digital Electronics by RP Jain, Tata McGraw Hill, New Delhi.

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**SUBJECT: Electronic Instruments and Measurement**  
**CODE: 24DECE29**

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

**Objectives**

The study of this subject will help students to gain the knowledge of working principles and operation of different instruments.

**Course Outcomes**

After the completion of this course, the student will be able to

CO1: Describe and demonstrate the specifications (accuracy, precision, sensitivity, resolution, range, errors, loading effects) of measuring instruments.

CO2: Demonstrate the working principle of measuring instruments like multi-meter, CRO, DSO and measure the frequency, voltage, time period and phase

CO3: Measure the loading effect of a multi-meter and describe the limitation of multi-meter for high frequency measurement.

CO4: Learn the functioning, specification, and applications of signal analysing instruments such as logic pulser, logic analyzer and signature analyser.

CO5: Measure various parameters using proper instruments without errors using CRO and DSO.

Unit	Topic	Key Learning
I	<b>Basics of Measurements</b>	Measurement, method of measurement, types of instruments Specifications of instruments: Accuracy, precision, sensitivity, resolution, range, errors in measurement, sources of errors, limiting errors, loading effect, importance and applications of standards and calibration
II	<b>Voltage, Current and Resistance Measurement</b>	<ul style="list-style-type: none"> <li>Principles of measurement of DC voltage, DC current, AC voltage, AC current</li> <li>Principles of operation and construction of permanent magnet moving coil (PMMC) instruments and Moving iron type instruments</li> </ul>
III	<b>Cathode Ray Oscilloscope</b>	<ul style="list-style-type: none"> <li>Construction and working of Cathode Ray Tube (CRT)</li> <li>Block diagram description of a basic CRO and triggered sweep oscilloscope, front panel controls, Specifications of CRO and their explanation</li> <li>Measurement of current, voltage, frequency, time period and phase using CRO</li> <li>Digital storage oscilloscope (DSO): block diagram and working principle</li> </ul>
IV	<b>Impedance Bridge Q Meters</b>	<ul style="list-style-type: none"> <li>Wheat stone bridge</li> <li>AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and Anderson bridge</li> </ul>

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		<ul style="list-style-type: none"> <li>Block diagram description of laboratory type RLC bridge, specifications of RLC bridge, Block diagram and working principle of Q meter</li> </ul>
V	<b>Digital Instruments</b>	<ul style="list-style-type: none"> <li>Comparison of analog and digital instruments</li> <li>Working principle of ramp, dual slope and integration type digital voltmeter, Block diagram and working of a digital multi-meter</li> <li>Specifications of digital multi-meter and their application.</li> </ul>

**Suggested Readings:**

- Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Sons, New Delhi
- Electronics Measurement and Instrumentation by Oliver, Tata McGraw Hill Education Pvt Ltd, New Delhi
- Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi
- Electronics Test and Instrumentation by Sanjeev Kumar and Yash Pal; North Publications
- Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi
- e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

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**SUBJECT: Electronic Instruments and  
Measurement Lab  
CODE: 24DECE30**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

### Objectives

The study of this subject will help students to gain the knowledge of working principles and operation of different instruments.

### Course Outcomes

After the completion of this course, the student will be able to

CO1: Describe and demonstrate the specifications (accuracy, precision, sensitivity, resolution, range, errors, loading effects) of measuring instruments.

CO2: Demonstrate the working principle of measuring instruments like multi-meter, CRO, DSO and measure the frequency, voltage, time period and phase

CO3: Measure the loading effect of a multi-meter and describe the limitation of multi-meter for high frequency measurement.

CO4: Learn the functioning, specification, and applications of signal analysing instruments such as logic pulser, logic analyzer and signature analyser.

CO5: Measure various parameters using proper instruments without errors using CRO and DSO.

### List of practical

1. Measurement of voltage, resistance, frequency using digital multimeter.
2. Measurement of voltage, frequency, time period and phase using CRO.
3. Measurement of voltage, frequency, time and phase using DSO.
4. Measurement of Q of a coil.
5. Measurement of resistance and inductance of coil using RLC Bridge.
6. Measurement of impedance using Maxwell Induction Bridge.
7. To find the value of unknown resistance using Wheat Stone Bridge.
8. Use of logic pulser and logic probe.

### Suggested Readings

- Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Sons, New Delhi
- Electronics Measurement and Instrumentation by Oliver, Tata McGraw Hill Education Pvt Ltd, New Delhi
- Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi
- Electronics Test and Instrumentation by Sanjeev Kumar and Yash Pal; North Publications
- Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi
- e-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/ NITTTR.



**SUBJECT: Python Programming**  
**CODE: 23DECE31**

Credit	Hours	Marks		
		I	E	To
2	30	15	35	50

**Objectives**

- The course inculcates the students the importance and basic principles of Python Programming and to develop Python programs with conditionals and loops.

**Course Outcomes**

After the completion of the course, the student will be able to

CO1: Read, write, execute by hand simple Python programs.

CO2: Structure simple Python programs for solving problems.

CO3: Decompose a Python program into functions.

CO4: Represent compound data using Python lists, tuples, and dictionaries.

CO5: Read and write data from/to files in Python Programs

Unit	Topic	Key Learning
I	Introduction to Python Programming Language	<ul style="list-style-type: none"> <li>Introduction to Python Language and installation</li> <li>overview on python interpreters</li> <li>working with python</li> <li>Numeric Data Types: int, float, Boolean, complex and string and its operations</li> <li>Standard Data Types: List, tuples, set and Dictionaries</li> <li>Data Type conversions, commenting in python.</li> </ul>
II	Variables and Operators	<ul style="list-style-type: none"> <li>Understanding Python variables,</li> <li>Multiple variable declarations,</li> <li>Python basic statements,</li> <li>Python basic operators: Arithmetic operators, Assignment operators,</li> <li>Comparison operators, Logical operators, Identity operators, Membership operators,</li> <li>Bitwise operators, Precedence of operators, Expressions.</li> </ul>
III	Control Flow And Loops	<ul style="list-style-type: none"> <li>Conditional (if), alternative (if-else),</li> <li>chained conditional (if- elif -else),</li> <li>Loops: For loop using ranges, string,</li> <li>Use of while loops in python,</li> <li>Loop manipulation using pass, continue and break</li> </ul>
IV	Functions	<ul style="list-style-type: none"> <li>Defining Your Own Functions,</li> <li>Calling Functions, passing parameters and arguments,</li> <li>Python Function arguments: Keyword Arguments, Default Arguments, Variable-length arguments,</li> <li>Anonymous Functions, Fruitful Functions (Function Returning Values),</li> </ul>

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		<ul style="list-style-type: none"> <li>• Scope of the Variables in a Function - Global and Local Variables.</li> <li>• Powerful Lambda functions in python.</li> </ul>
V	I/O and Error Handling in Python	<ul style="list-style-type: none"> <li>• Introduction, Access Modes, Writing Data to a File,</li> <li>• Reading Data from a File, Additional File Methods introduction to Errors and Exceptions,</li> <li>• Handling IO Exceptions, Run Time Errors,</li> <li>• Handling Multiple Exceptions.</li> <li>• Introduction to Data Structures, Types of Data structures, Introduction to Stacks and Queues.</li> </ul>

**Suggested Readings:**

1. R. Nageswara Rao, "Core Python Programming", Dream Tech
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015, ISBN: 978-9352134755.
3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
4. Data Structures and Algorithmic Thinking with Python by Narasimha Karumanchi
5. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1<sup>st</sup> Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.
6. Charles Dierbach, "Introduction to Computer Science Using Python", 1<sup>st</sup> Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
7. Wesley J Chun, "Core Python Applications Programming", 3<sup>rd</sup> Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.
8. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1<sup>st</sup> Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176.
9. Reema Thareja, "Python Programming using problem solving approach", Oxford University press, 2017. ISBN-13: 978-0199480173

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**SUBJECT: Python Programming Lab**  
**CODE: 23DECE32**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

### Objectives

- The course inculcates the students the importance and basic principles of Python Programming and to develop Python programs with conditionals and loops.

### Course Outcomes

After the completion of the course, the student will be able to

CO1: Read, write, execute by hand simple Python programs.

CO2: Structure simple Python programs for solving problems.

CO3: Decompose a Python program into functions.

CO4: Represent compound data using Python lists, tuples, and dictionaries.

CO5: Read and write data from/to files in Python Programs

### List of Practicals

- Create a list and perform the following methods  
1. insert() 2. remove() 3. append() 4. len() 5. pop() 6. clear()
- Create a dictionary and apply the following methods  
1. Print the dictionary items 2. access items 3. use get() 4. change values 5. use len()
- Create a tuple and perform the following methods  
1. Add items 2. len() 3. check for item in tuple 4. Access items
- (a) Write a python program to add two numbers.  
(b) Write a python program to print a number is positive/negative using if-else.  
(c) Write a python program to find largest number among three numbers.  
(d) Write a python Program to read a number and display corresponding day using if\_elif\_else?
- Write a python program to check whether the given string is palindrome or not.
- Write a python program to find factorial of a given number using functions
- Write a Python function that takes two lists and returns True if they are equal otherwise false
- (a) Write a program to double a given number and add two numbers using lambda()?  
(b) Write a program for filter() to filter only even numbers from a given list.  
(c) Write a program for map() function to double all the items in the list?  
(d) Write a program to find sum of the numbers for the elements of the list by using reduce()?
- (a) Demonstrate a python code to implement abnormal termination?  
(b) Demonstrate a python code to print try, except and finally block statements  
(c) Write a python program to open and write "hello world" into a file?

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- (d) Write a python program to write the content "hi python programming" for the existing file.
11. Write a python program which accepts the radius of a circle from user and computes the area (use math module).
12. (a) Using a numpy module create an array and check the following:  
1. Type of array 2. Axes of array 3. Shape of array 4. Type of elements in array  
(b) Using a numpy module create array and check the following:  
1. List with type float 2. 3\*4 array with all zeros 3. From tuple 4. Random values

### Suggested Readings:

1. R. Nageswara Rao, "Core Python Programming", Dream Tech
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015, ISBN: 978-9352134755.
3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
4. Data Structures and Algorithmic Thinking with Python by Narasimha Karumanchi
5. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1<sup>st</sup> Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.
6. Charles Dierbach, "Introduction to Computer Science Using Python", 1<sup>st</sup> Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
7. Wesley J Chun, "Core Python Applications Programming", 3<sup>rd</sup> Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.
8. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1<sup>st</sup> Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176.
9. Reema Thareja, "Python Programming using problem solving approach", Oxford University press, 2017. ISBN-13: 978-0199480173

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## SEMESTER-2

**SUBJECT: English Language and  
Communication Skills**  
**CODE: 24DENG01**

Credit	Hours	Marks		
		I	E	To
1	15	15	35	50

### Objectives

To enhance the language and communication competence of learners with an emphasis on English for Specific Purposes (ESP) through communication skills related activities.

### Course Outcomes

After the completion of the course, the student will be able to

CO1: Communicate effectively in diverse situations.

CO2: Frame sentences for their professional and personal communication needs.

CO3: Draft meticulous resumes, letters, minutes and presentations.

CO4: Comprehend and understand intermediate level of passages and audios.

Unit	Topic	Key Learning
I	Communication Skills	<ul style="list-style-type: none"><li>• Meaning, Process and Types of Communication;</li><li>• Principles of Effective Communication</li></ul>
II	Grammar and Vocabulary	<ul style="list-style-type: none"><li>• Use of Tenses, Articles, Prepositions, Conjunctions, Subject-verb concord,</li><li>• Word formation: Base, Prefixes, Suffixes</li><li>• Synonyms, Antonyms, One-word substitutes</li></ul>
III	Listening Skills	<ul style="list-style-type: none"><li>• Process and types of listening,</li><li>• deterrents to listening process,</li><li>• Essentials of good listening.</li><li>• Listening Comprehension and Note-Taking</li></ul>
IV	Writing Skills	<ul style="list-style-type: none"><li>• Report writing, Agenda and Minutes;</li><li>• Letter Writing: Business letters,</li><li>• Cover letters, Electronic mail;</li><li>• Resume Writing</li></ul>
V	Speaking Skills	<ul style="list-style-type: none"><li>• Preparing for interviews- Types of interviews,</li><li>• Group discussion;</li><li>• Effective ways of performing well in interviews;</li><li>• Public Speaking</li></ul>

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### Suggested Readings:

- Joseph, C. J., Myall, E. G., and A. Biswas, eds. A Comprehensive Grammar of Current English. New Delhi: Inter University P, 2014.
- Lata, Pushp, and Sanjay Kumar. Communication Skills. 2nd ed. New Delhi: OUP, 2019.
- Monippally, Matthukutty, M. Business Communication: From Principles to Practice. New Delhi: McGraw Hill Pub., 2018.
- Mukerjee, H. S. Business Communication: Connecting at Workplace. New-Delhi: Oxford University Press, 2012.
- Murphy, H. A., Hildebrandt, H.W., and Thomas, J.P. Effective Business Communication. Boston: McGraw-Hill Companies, 1997.
- Ramesh, Gopaldaswamy, and Mahadevan Ramesh. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success. Noida: Pearson, 2019.
- Sandra, M. O. Handbook of Corporate Communication and Strategic Public Relations: Pure and Applied. New Delhi: Routledge, 2004.
- Sinha, K. K. Taxmann's Business Communication. 4th Revised ed. New Delhi: Taxmann's Pub., 2018.
- Sinha, R. P. Current English and Usage with Composition. New Delhi: OUP, 2013.
- Taylor, Grant. English Conversation Practice. Indian ed. Chennai: McGraw Hill Education Pvt. Ltd., 2017.

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**SUBJECT: English Language and  
Communication Skills Practical  
CODE: 24DENG02**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

**Objectives**

This course is designed to strengthen the communication abilities of the learners by providing them hands-on practice.

**Course Outcomes**

After completing this course, the learners will be able to

CO1: Demonstrate knowledge and understanding of a range of professional or public communication situations.

CO2: Perform effectively in diverse professional and public communication situations like interviews and negotiations, drafting emails and resume etc.

**Details:**

1. Situational Conversations
2. Listening Skills
3. Resume Writing
4. Mock Interviews
5. Group Discussion
6. Presentation Skills
7. Negotiation Skills
8. Email Writing
9. Public Speaking

**Note:** The teacher should play the role of the facilitator and allow the learners maximum time to practice these activities. The focus should be primarily on helping the learners overcome the LSWR barrier and gradually move towards honing these skills to enable the learners use them in professional communication situations.

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**SUBJECT: Basics of Computer with  
Programming in C  
CODE: 24DCSE01**

Credit	Hours	Marks		
		I	E	To
2	30	15	35	50

### Objectives

Build basic technical skills and develop any kind of computer application.

### Course Outcomes

After the completion of the course, the student will be able to

CO1: Differentiate among various data types and variables, demonstrating understanding of their respective applicability.

CO2: Evaluate programming skills through proficient debugging techniques, ensuring the correctness of the program.

CO3: Apply algorithmic principles effectively to solve simple problems and implement them in a functional program.

CO4: Analyze program logic with reasoning abilities to demonstrate effective problem-solving skills.

CO5: Create complex programming applications by utilizing decision statements, looping structures, and functions.

Unit	Topic	Key Learning
I	<b>Introduction to Computer system</b>	<ul style="list-style-type: none"> <li>• Basic Applications of Computer;</li> <li>• Block Diagram of Computer System, Input / Output Devices,</li> <li>• Computer Memory,</li> <li>• Concepts of Hardware and Software;</li> <li>• Computer Virus: Definition,</li> <li>• Types of viruses, Characteristics of viruses, Anti-virus software.</li> </ul>
II	<b>Operating System</b>	<ul style="list-style-type: none"> <li>• Overview of operating system: Definition,</li> <li>• Functions of operating system, Need and its services,</li> <li>• Types of operating system,</li> <li>• Batch Processing,</li> <li>• Spooling, Multiprocessing, Multiprogramming, Time-Sharing,</li> <li>• Comparison between DOS and windows,</li> <li>• Comparison between Unix and Windows.</li> <li>• Introduction to Linux commands and Linux Text Editors</li> </ul>
III	<b>Algorithm and Programming, Program</b>	<ul style="list-style-type: none"> <li>• Problem solving techniques – algorithms and flowcharts, basics of programming language, steps in development of a program, program compilation and debugging.</li> </ul>

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	<b>Structure and Control Structures</b>	<ul style="list-style-type: none"> <li>• Input/output statements, assignment statements, constants, variables and data types, operators and expressions, use of header files and library functions</li> <li>• Introduction, decision making with if – statement, if – else and Nested if, while and do-while, until, for loop, switch and break statements</li> </ul>
IV	<b>Functions, Arrays and Pointers</b>	<ul style="list-style-type: none"> <li>• Introduction to functions, global and local variables, function definition, declaration and function call, parameters and parameter passing techniques – call by value/ reference</li> <li>• Introduction to arrays, array declaration and initialization, single and multidimensional array, arrays of characters</li> <li>• Introduction to pointers, address operator and pointers, declaring and initializing pointers, assignment through pointers, pointers and functions, pointers and arrays.</li> <li>• Bitwise Programming</li> </ul>
V	<b>Structures and Unions, Strings and Files</b>	<ul style="list-style-type: none"> <li>• Declaration of structures, accessing structure members, structure initialization, arrays of structure, unions, differences between structure and union</li> <li>• Introduction, declaring and initializing string variables, reading and writing strings, string handling functions, array of strings</li> <li>• Introduction, file reading/writing in different modes, file manipulation using standard function types.</li> </ul>

**Suggested Readings:**

- Computers and Beginners by Jain, V.K., Pustak Mahal Publications, Delhi.
- Computer Fundamentals by Anita Goel, Pearson Publications, Delhi.
- Programming in C by Schaum Series, McGraw Hills Publishers, New Delhi.
- Let Us C by Yashwant Kanetkar, BPB Publications, New Delhi.

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**SUBJECT: Basics of Computer with  
Programming in C (Lab)  
CODE: 24DCSE02**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

### Objectives

Build basic technical skills and develop any kind of computer application.

### Course Outcomes

After the completion of the course, the student will be able to

CO1: Differentiate among various data types and variables, demonstrating understanding of their respective applicability.

CO2: Evaluate programming skills through proficient debugging techniques, ensuring the correctness of the program.

CO3: Apply algorithmic principles effectively to solve simple problems and implement them in a functional program.

CO4: Analyze program logic with reasoning abilities to demonstrate effective problem-solving skills.

CO5: Create complex programming applications by utilizing decision statements, looping structures, and functions.

### List of Practical's

1. Practical based on to be exposed/shown various components and supposed how to switch on a computer.
2. Handling Boot Setup, Installation of Operating System.
3. Programming exercises on executing and editing a C program.
4. Programming exercises on defining variables and assigning values to variables.
5. Programming exercises on arithmetic and relational operators.
6. Programming exercises on formatting input/output using printf and scanf.
7. Programming exercises using if- statements.
8. Programming exercises using if- Else.
9. Simple program using pointers and structures.
10. Simple program for reading from a file and writing into a file.

### Suggested Readings:

- Computers and Beginners by Jain, V.K.
- Computer Fundamentals by Anita Goel, Pearson.
- Programming in C by Schaum Series, McGraw Hills Publishers, New Delhi.
- Let Us C by Yashwant Kanetkar, BPB Publications, New Delhi.

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**SUBJECT: Applied Physics**  
**CODE: 24DPHY01**

Credit	Hours	Marks		
		I	E	To
2	30	15	35	50

### Objectives

The course aims to inculcate skills among students with following objectives:

- Identify and measure physical quantities with accuracy.
- Represent physical quantities, understand the concepts of energy conservation and its applications.
- Acquire scientific skills to solve problems.
- Comprehend matter and environmental effects on it.
- Apply physical principles in different fields.

### Course Outcomes

After completing this subject, student should be able to:

- CO1. Learn about Indian knowledge system.
- CO2. Understand the physical quantities and their units along with measurements with accuracy.
- CO3. Solve scientific problems related to force, motion, work and energy.
- CO4. Demonstrate competency in phenomena of electrostatics and electricity.
- CO5. Apply the use of physical principles and analysis in various technical fields.

### UNIT I: Indian Knowledge System

Physics in Vedas, Atomic theory from Bhagavad-Gita, Indian invention of atomic theory, History of Electricity: From Ancient times to the Modern times, Maharishi Augustaya, History of light, Sound in Vedic Science, Indian Scientist in Physics: Acharya Kanada (Laws of motion), Aryabhata, Sir C. V. Raman, Satyendra Nath Bose, Homi Jahangir Bhabha, Subrahmanyam Chandrasekhar, Vikram Ambalal Sarabhai.

### UNIT II. Unit and Dimensions

Physical quantities and units- fundamental and derived System of units: CGS, FPS, MKS, SI Dimension, dimensional formulae and SI units of physical quantities-distance, displacement, area, volume, density, velocity, acceleration, linear momentum, force, impulse, work, power, energy, pressure, surface tension, stress, strain) Dimensional equations, principle of homogeneity of dimensional equation, Application of dimensional analysis: checking the correctness of physical equation, conversion of system of unit (force, work, acceleration).

### UNIT III: Force, Motion, Work and Energy

Scalar and vector quantities- definition and examples, representation of vector, types of vector (unit vector, position vector, co-initial vector, collinear vector, co-planar vector) Force and its units, resolution of force Newton's laws of motion, Linear momentum, Law of conservation of linear momentum, Impulse Circular motion: definition of angular displacement, angular velocity, angular acceleration, frequency, time period; Relation between linear and angular velocity, centripetal and centrifugal forces, Torque, angular momentum, moment of inertia and its physical significance, Definition, formula and SI unit: Work, Friction, Power- definition, Energy (Kinetic Energy and Potential Energy)

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### UNIT VI: Electrostatics and Electricity

Electric charge, unit of charge, conservation of charge, Coulomb's law of electrostatics, Electric field, electric lines of force, electric field intensity due to a point charge, Definition of electric flux, Gauss law, Capacitor and capacitance, Electric current and its SI Unit, direct and alternating current, Resistance, conductance, Series and parallel combination of resistances, Ohm's law.

#### Text Books:

1. "Text Book of Physics for Class XI (Part-I, Part-II)", N.C.E.R.T., Delhi.
2. "Text Book of Physics for Class XI (Part-I, Part-II)", N.C.E.R.T., Delhi.

#### Recommended Books:

1. Dr. HH Lal, "Applied Physics, Vol. I and Vol. II", TTTI Publications, Tata McGraw Hill, Delhi.
2. AS Vasudeva, "Applied Physics – I", Modern Publishers, Jalandhar.
3. R A Banwait, "Applied Physics – I", Eagle Prakashan, Jalandhar.
4. E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/ NITTTR.
5. C. L. Arora, "Practical Physics", S Chand Publication.

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**SUBJECT: Applied Physics Lab**  
**CODE: 24DPHY02**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

### Objectives

The course aims to inculcate skills among students with following objectives:

- to be familiarized with the physical property measuring tools.
- reading values and understanding their parts.
- to read values from the measuring tools.
- to compute physical properties of objects.
- to verify the laws of force.
- to compute atmospheric properties
- to compute force constant, Elastic constant, moment of inertia.
- to apply physical principles in different fields.

### Course Outcomes

After completing this subject, student should be able to:

CO1: Recognize the tool to measure the physical properties of the objects.

CO2: Use tools such as Vernier calliper, screw gauge, spherometer, etc. to measure physical properties of objects.

CO3: Investigate moment of inertia, resistance and resistivity.

CO4: Verify Ohm's and laws of resistance, room temperature, etc.

CO5: Solve problems to convert temperature into different scales.

### PRACTICAL EXERCISES

1. Familiarization of measurement instruments and their parts (for example - Vernier calliper, screw gauge, spherometer, travelling microscope etc.), and taking a reading. (compulsory to all students)
2. To find diameter of solid cylinder using a vernier caliper
3. To find internal diameter and depth of a beaker using a vernier calliper and hence find its volume.
4. To find the diameter of wire using screw gauge
5. To find thickness of paper using screw gauge.
6. To determine the thickness of glass strip using a spherometer
7. To determine radius of curvature of a given spherical surface by a spherometer.
8. To determine force constant of spring using Hooke's law
9. Measuring room temperature with the help of thermometer and its conversion in different scale.
10. Determine the moment of inertia of a flywheel.
11. To verify Ohm's laws by plotting a graph between voltage and current.
12. To verify laws of resistances in series combination.
13. To verify laws of resistance in parallel combination.
14. Measurement of random errors of different objects.

**Note:** Experiment may be added as per the curriculum and ability.

**Note:** Minimum 8 Experiments to be performed.

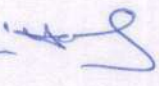
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**Reference Books**

1. B.Sc. Practical Physics, Geeta Sanon
2. B.Sc. Practical Physics, C. L. Arora
3. NCERT Class XI Practical Physics.
4. NCERT Class XII Practical Physics.

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**SUBJECT: Electronic Device Circuits**  
**CODE: 24DECE33**

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

**Objectives**

Familiarize the students with different electronic devices such as diodes, BJTs, FETs and MOSFETs.

**Course Outcomes**

After the completion of the course, the student will be able to

CO1: Demonstrate understanding of the foundational aspects of constructing semiconducting materials, fabricating elements, and the working principles and operation of semiconductors.

CO2: Analyze the concept with the working principles of forward and reverse bias characteristics of semiconductor diodes.

CO3: Design and analyze simple rectifiers and voltage regulators using diodes to enhance the entrepreneur skills.

CO4: Discriminate the principle, construction and operation of BJTs, FETs and MOSFETs.

CO5: Describe the behavior of special purpose diodes and power devices, enhancing entrepreneurial skills.

Unit	Topic	Key Learning
I	<b>Semi-Conductor Physics</b>	<ul style="list-style-type: none"> <li>Review of basic atomic structure and energy levels, concept of insulators, conductors and semiconductors</li> <li>Atomic Structure of Ge and Si</li> <li>Concept of intrinsic and extrinsic semiconductors, P and N impurities and doping of impurity</li> <li>P and N type semiconductors and their conductivity, Effect of temperature on conductivity of intrinsic semiconductor.</li> <li>Energy Level diagram of conductors, insulators and conductors and minority and majority carriers.</li> </ul>
II	<b>Semi-Conductor Diode</b>	<ul style="list-style-type: none"> <li>PN junction Diode, mechanism of current flow in PN junction, Drift and diffusion current, Depletion layer, forward and reverse biased PN junction, potential barrier.</li> <li>Concept of junction capacitance in forward and reverse bias characteristics.</li> <li>Ideal vs Practical PN junction diode, Diode Equivalent Circuits</li> <li>Types of diode characteristics and applications of Zener Diode, Zener and avalanche break down</li> <li>LED, Photo Diode, PIN Diode</li> </ul>
III	<b>Introduction to Bipolar transistor</b>	<ul style="list-style-type: none"> <li>Concept of bipolar transistor, structure, PNP and NPN transistor, their symbols and mechanism of current flow, current relations in transistor,</li> </ul>

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		<ul style="list-style-type: none"> <li>• CB, CC, CE configuration of the transistor,</li> <li>• Input and Output characteristic in CB and CE configurations and current amplification factor</li> </ul>
IV	<b>Field Effect Transistor (FET)</b>	<ul style="list-style-type: none"> <li>• Construction, operation and characteristics of FET.</li> <li>• Transfer Characteristics of FET</li> <li>• Comparison of BJT and JFET</li> </ul>
V	<b>Metal Oxide Semiconductor Field Effect Transistor (MOSFET)</b>	<ul style="list-style-type: none"> <li>• Construction, operation and characteristics of MOSFET in depletion and enhancement modes and its applications.</li> <li>• Comparison of JFET and MOSFET</li> </ul>

**Suggested Readings:**

- A text book of Basic Electronics and Linear Circuits by NN Bhargava and others, Tata McGraw Hill, New Delhi.
- Electronic devices and circuit theory by Robert L. Boylestad, Louis Nashelsky, Pearson, 11th ed.
- Electronics Principles by SK Sahdev, Dhanpat Rai and Co., New Delhi.
- Electronics Principles by Albert Paul Malina, Tata McGraw Hill, New Delhi.
- Electronic Devices Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi.

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**SUBJECT: Electronic Device Circuits (Lab)**  
**CODE: 24DECE34**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

### Objectives

Familiarize the students with different electronic devices such as diodes, BJTs, FETs and MOSFETs.

### Course Outcomes

After the completion of the course, the student will be able to

CO1: Demonstrate understanding of the foundational aspects of constructing semiconducting materials, fabricating elements, and the working principles and operation of semiconductors.

CO2: Analyze the concept with the working principles of forward and reverse bias characteristics of semiconductor diodes.

CO3: Design and analyze simple rectifiers and voltage regulators using diodes to enhance the entrepreneur skills.

CO4: Discriminate the principle, construction and operation of BJTs, FETs and MOSFETs.

CO5: Describe the behavior of special purpose diodes and power devices, enhancing entrepreneurial skills.

### List of Practicals

1. Familiarization with operation of following instruments: Multi-meter, CRO/DSO, Signal generator, Regulated Power Supply by taking readings of relevant quantities with their help.
2. Plot V-I characteristics for PN junction diode and calculate its Static and dynamic characteristics.
3. Plot V-I characteristics for Zener diode and draw its characteristics.
4. Experiment on Zener diode as voltage regulator.
5. Draw the characteristics of LED.
6. Draw the characteristics of photo diode.
7. Application of BJT as an amplifier and switch.
8. Plot input and output characteristics and calculate parameters of transistors in CE configuration
9. Plot input and output characteristics and calculate parameters of transistors in CB configuration.
10. Plot V-I Characteristics of FET amplifier.
11. To study and draw the characteristics of FET in common drain configuration.
12. Measure the Q-Point and note the variation of Q-Point by increasing the base resistance in fixed bias circuit.
13. Measure the Q-Point and note the variation of Q-Point by changing out of bias resistance in potential divider circuit electronics.

### Suggested Readings:

- A text book of Basic Electronics and Linear Circuits by NN Bhargava and others, Tata McGraw Hill, New Delhi.
- Electronic devices and circuit theory by Robert L. Boylestad, Louis Nashelsky, Pearson, 11th ed.
- Electronics Principles by SK Sahdev, Dhanpat Rai and Co., New Delhi.
- Electronics Principles by Albert Paul Malina, Tata McGraw Hill, New Delhi.
- Electronic Devices Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi.

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**SUBJECT: Yoga and Health Skills- I**  
**CODE: 24DYHS01**

Credit	Hours	Marks		
		I	E	To
2	30	30	70	100

**Objectives**

To enable the student to have knowledge of Yoga.

- To possess emotional stability.
- To attain higher level of consciousness.

**Course Outcomes**

After the completion of the course, the student will be able to

CO1: Know and understand about basic Yoga.

CO2: Apply the knowledge of about different school of yoga to practice it traditionally.

CO3: Explaining the importance of health.

CO4: Apply knowledge of yoga asana for mental, physical and social well- being.

CO5: Understand the need of mediation techniques to practice it on daily basis.

Unit	Topic	Key Learning
I	Introduction to Yoga	<ul style="list-style-type: none"> <li>• Yogic Prayer Mantra,</li> <li>• Meaning and Definition of Yoga,</li> <li>• Aim and objectives of Yoga,</li> <li>• Misconceptions of Yoga,</li> <li>• Importance of Yoga in modern era.</li> </ul>
II	Yoga Practices	<ul style="list-style-type: none"> <li>• Raja Yoga (AshtangaYoga),</li> <li>• Bhakti Yoga,</li> <li>• Karma Yoga,</li> <li>• Hatha Yoga.</li> </ul>
III	Health	<ul style="list-style-type: none"> <li>• Meaning,</li> <li>• definition,</li> <li>• yogic lifestyle,</li> <li>• importance of yoga in health protection,</li> <li>• measures to increase immunity.</li> </ul>
IV	Yogic Management in Health Problems	<ul style="list-style-type: none"> <li>• Cervical,</li> <li>• Back Pain,</li> <li>• Diabetes and Stress.</li> </ul>
V	Meditation	<ul style="list-style-type: none"> <li>• Meaning,</li> <li>• Types,</li> <li>• Importance,</li> <li>• General Instructions and Suggestions for Meditation,</li> <li>• Physical, Mental and Spiritual effects of Meditation.</li> </ul>

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### TEXT BOOKS

1. Yoga & yogic chikitsa - Singh Prof. Ramharsh , Chaukhamba Sanskrit pratishthan, Edition 2011
2. Swami Vivekananda: Jnana Yoga, Bhakti Yoga, Karma Yoga, Raja Yoga, Advaita Ashrama, Calcutta, 2002.
3. Prof. Ramharsh Singh -SwasthavrittaVigyan, Chaukhambha Sanskrit Prakashan, Varanasi, 1998.
4. Sriram Sharma Acharya- JivemSharadahShatam, AkhandJyoti Mathura 1998.
5. Prof. Ramharsh Singh-Yogewam Yogic Chitksha, Chaukhambha Sanskrit Prakashan, Varanasi, 1998.
6. SwasthaVrittaVigyanewam Yogic Chiktsha- Dr. RakeshGiri, SikhshaBharti, Utrakhand.

### REFERENCE BOOKS

1. Swami Kuvalyananda: Asana, Kaivalyadhama, Lonavla, 1993
2. Swami Satyananda Saraswati: Asana, Pranayama, Bandha, Mudra, Bihar School of Yoga, Munger, 2006
3. Basavaraddi, I.V. & others: YOGASANA: A Comprehensive description about Yogasana, MDNIY, New Delhi, 2011.
4. Basavaraddi, I.V. & others: Yogic Sukshma Evam Sthula Vyayama, MDNIY, New Delhi, 2011.

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**SUBJECT: Fundamentals of Wiring Harness**  
**CODE: 24DECE35**

Credit	Hours	Marks		
		I	E	To
4	60	15	35	50

**Objectives**

The fundamentals of Wire Harness and its Assembly for Operators course will give each participant the ability to identify and use the key tools, materials, and processes that wire harness operators need to reliably and repeatably assemble quality harnesses.

**Course Outcomes**

- After the completion of the course, the student will be able to
- CO1: Describe the role and responsibilities of a Wiring Harness Assembly Operator and demonstrate the step-by-step process of assembling a wire harness.
  - CO2: Employ various techniques for performing pre-assembly operations of the harness.
  - CO3: Perform the crimping, taping and soldering operations on wires.
  - CO4: Demonstrate the process of assembling wire harness components and apply proper techniques for recording assembly testing results in prescribed formats.
  - CO5: Perform wire harness operations, inspect the assembled wire harness and demonstrate basic diagnosis to enhance the entrepreneur skills.

**Unit 1 Electrical Subsystem**

Introduction, Benefits of Wiring Harness & Perform pre assembly operations, Assemble the components of Wiring Harness & Wiring Harness in Automotive Industry, Understanding Printed Wiring Board, Assembly instruction, Hand Tools Maintenance. Resistors and its types, Capacitor and its types, Inspection Resistors and Capacitor, Basics of Integrated Circuit.

**Unit 2 Wire Control Panel**

Control Panel and Electrical Codes and Standards, Electrical Control Panel Wiring, Electrical Wiring Problems, Equipment used in Electrical Control Panel Wiring, Safety & Quality Standards.

**Unit 3 Wire Cutting, Striping and Crimping**

Cutting of Wire, Quality Crimped Joint, crimp an Electrical Connector, Electro-mechanical Equipments, Wire Bonding, Wire Bonding Process, Lead Frame, Harness Inspection, harness terms Viz; Cut length, strip length, crimp height, pull force, understanding of cutting chart, strip length Chart, splice chart, tubes/sleeves/tapes, Laying board, Labels.

**Unit 4 Connector assembly and Wire Bonding**

Connectors, Various types of connectors, Cutting of Wire, Quality Crimped Joint, crimp an Electrical Connector, Electro-mechanical Equipments, Wire Bonding, Wire Bonding Process, Lead Frame, Harness Inspection, harness terms Viz; Cut length, strip length, crimp height, pull force, understanding of cutting chart, strip length Chart, splice chart, tubes/sleeves/tapes, Laying board, Labels.

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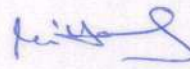
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## Unit 5 Effective communication, Sustainability and Safety

Hazards at workplace, 5-S, importance of Housekeeping, Workplace electrical injuries, Waste and their disposal, waste disposal process, effective utilisation of water, electricity and other resources.

### Suggested Readings:

- Qualification Handbook: Wiring Harness Assembly Operator
- Wiring Harness Assembly Operator - ELE\_Q6306\_v2.0
- Automotive harness Assembly, 3G e-learning

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**SUBJECT: Wiring Harness Assembly Lab**  
**CODE: 24DECE36**

Credit	Hours	Marks		
		I	E	To
2	60	35	15	50

### Objectives

The Wire Harness Assembly for Operators course will give each participant the ability to identify and use the key tools, materials, and processes that wire harness operators need to reliably and repeatably assemble quality harnesses.

### Course Outcomes

After the completion of the course, the student will be able to

CO1: Describe the role and responsibilities of a Wiring Harness Assembly Operator and demonstrate the step-by-step process of assembling a wire harness.

CO2: Employ various techniques for performing pre-assembly operations of the harness.

CO3: Perform the crimping, taping and soldering operations on wires.

CO4: Demonstrate the process of assembling wire harness components and apply proper techniques for recording assembly testing results in prescribed formats.

CO5: Perform wire harness operations, inspect the assembled wire harness and demonstrate basic diagnosis to enhance the entrepreneur skills.

### List of Practicals

1. To study the different types of meters for measuring AC & DC parameters.
2. Identify the different tools & machines used in wire harness assembly.
3. To Study harness drawing and laying board.
4. To Study various connector housing and Thimbles/Lugs/Terminal/Crimp.
5. To understand & identify the various labels used in harness assembly.
6. To Perform the cutting & stripping operations on different size of wires.
7. Familiarizations of soldering technology, use of materials like solder, flux and cleaning solvents, Usage of correct tools, Component mounting, Solderability testing.
8. Demonstrate soldering and de soldering using soldering and de-soldering stations.
9. Demonstrate the crimping of various terminals using different crimping methods.
10. Demonstrate the fixing of terminals/crimp into connector housing.
11. Demonstrate to use the various types of sleeves/tubes used in harness assembly.
12. Perform visual inspection for correct wire gauge, proper terminal and connectors, Accurate labelling, free from moisture and corrosion.
13. To test & identify defect in assembled wire through continuity test.
14. To test & identify defect in assembled wire through functional test and short test.
15. To test the crimp and connectors through pull test.
16. Design, Assemble and testing of a two or more nodes wire harness.

### Suggested Readings:

- Qualification Handbook: Wiring Harness Assembly Operator
- Automotive harness Assembly, 3G e-learning
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### Semester-3

**SUBJECT: Employability Skills**  
**CODE: 24UENG03**

Credit	Hours	Marks		
		I	E	To
1	15	15	35	50

#### **Objectives**

- This course will introduce students to Basics of Employability Skills with a focus on Attitude, Communication, Etiquettes etc. to enable them practice or showcase professional behavior in formal context.

#### **Course Outcomes**

CO1: Learners will be able to use soft skills effectively.

CO2: Learners will demonstrate a professional behaviour at workplace.

CO3: Learners will learn Interview skills with ability to prepare for interviews and perform well in the same.

CO4: Learners will be able to deal with various types of customers in an effective manner.

Unit	Topic	Key Learning
I	Soft Skills	<ul style="list-style-type: none"><li>• Soft Skills- Introduction to soft skills,</li><li>• Aspects and importance of soft skills.</li><li>• Personality Development: Types of personality;</li><li>• SWOT Analysis, Goal Setting</li></ul>
II	Organizational Behavior	<ul style="list-style-type: none"><li>• Types of Behavior,</li><li>• Emotional Intelligence,</li><li>• Time Management,</li><li>• Decision Making</li><li>• Critical Thinking</li><li>• Team Intelligence and Leadership</li></ul>
III	Interview Skills	<ul style="list-style-type: none"><li>• Interview- Types, a n d Process,</li><li>• Resume Writing</li><li>• Job Application;</li><li>• Research about Industry and</li><li>• Mapping of Job Competencies with PersonalSkills</li></ul>
IV	InterpersonalSkills	<ul style="list-style-type: none"><li>• Workplace communication</li><li>• Active listening,</li><li>• Positive Attitude</li><li>• Negotiation Skills</li></ul>

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**Suggested Readings:**

- Bovee, C., & Thill, J.V., and Raina, R.L. *Business Communication Today*. New York: Pearson, 2016.
- Lata, Pushp, and Sanjay Kumar. *Communication Skills*. 2<sup>nd</sup> ed. New Delhi: OUP, 2019.
- Lehman, C. M., Dufrene D. D., and Sinha, M. *BCOM: The South Asian Perspective on Business Communication*. New Delhi: Cengage Learning, 2016.
- Monippally, Matthukutty, M. *Business Communication: From Principles to Practice*. New Delhi: McGraw Hill Pub., 2018.
- Mukerjee, H. S. *Business Communication: Connecting at Workplace*. New-Delhi: Oxford University Press, 2012.
- Murphy, H. A., Hildebrandt, H.W., and Thomas, J.P. *Effective Business Communication*. Boston: McGraw-Hill Companies, 1997.
- Post, Emily. *The Etiquette Advantage in Business*. New York: Collins, 2005.
- Ramesh, Gopaldaswamy, and Mahadevan Ramesh. *The Ace of Soft Skills: Attitude, Communication and Etiquette for Success*. Noida: Pearson, 2019.
- Sandra, M. O. *Handbook of Corporate Communication and Strategic Public Relations: Pure and Applied*. New Delhi: Routledge, 2004.
- Sinha, K. K. *Taxmann's Business Communication*. 4<sup>th</sup> Revised ed. New Delhi: Taxmann's Pub., 2018.
- Taylor, Grant. *English Conversation Practice*. Indian ed. Chennai: McGraw Hill Education Pvt. Ltd., 2017.

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**SUBJECT: Employability Skills**

**Practical**

**CODE: 24UENG04**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

**Objectives**

This course is designed to strengthen the communication abilities of the learners by providing them hands-on practice.

**Course Outcomes**

After the completion of the course, the student will be able to

CO1: Demonstrate knowledge and understanding of a range of professional or public communication situations.

CO2: Perform effectively in diverse professional and public communication situations like interviews and negotiations, drafting emails and resume etc.

**Details:**

1. Role Play in Business Affairs
2. Group Discussion
3. Resume writing
4. Listening Skills
5. Telephone etiquettes
6. Team building
7. Presentation skills
8. SWOT
9. Goal Setting

**Note:** The teacher should play the role of the facilitator and allow the learners maximum time to practice these activities. The focus should be primarily on helping the learners overcome the LSWR barrier and gradually move towards honing these skills to enable the learners use them in professional communication situations.

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**SUBJECT: Spreadsheet Modeling Lab**  
**CODE: 24DCSE03**

Credit	Hours	Marks		
		I	E	To
2	60	30	70	100

### Objectives

Master advanced functions of Spreadsheet Applications that enable to produce reports, and to perform complex statistical calculations

### Course Outcomes

After the completion of the course, the student will be able to

CO1: Work with spreadsheets and save them in different formats for developing proper formats.

CO2: Create mathematical and logical formulas using standard spreadsheet functions.

CO3: Choose, create and format charts to communicate information meaningfully.

CO4: Work with tables and lists to analyze, filter and sort data to analyze the results for different data sets.

CO5: Enhance productivity by working with named cell ranges, macros and templates.

### List of Practicals

1. Familiarize students with the interface and basic functions of spreadsheet software (e.g., Microsoft Excel, Google Sheets).
2. Practice basic spreadsheet operations, including data entry, formatting, and performing simple calculations.
3. Explore the concepts of relative and absolute cell referencing, and apply various formulas, such as SUM, AVERAGE, and COUNT.
4. Create different types of charts (bar graphs, line charts, and pie charts) using sample data.
5. Work with advanced formulas, including IF statements, VLOOKUP, HLOOKUP, INDEX, and MATCH.
6. Implement data validation rules and techniques for cleaning and organizing data effectively.
7. Explore the creation of PivotTables for data analysis and generate PivotCharts for visual representation.
8. Learn advanced charting techniques, including combination charts and dynamic charts with dynamic data ranges.
9. Utilize the Scenario Manager to set up and manage scenarios for sensitivity analysis.
10. Apply spreadsheet modeling techniques to a real-world scenario, integrating various concepts learned throughout the course.

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**SUBJECT: Analog Electronics**  
**CODE: 24DECE37**

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

**Objectives**

- The goal of this course is to introduce basic principles, operation and applications of the various analog electronic devices like: BJT and MOSFET for various functions.
- To make students understand and analyze the working of amplifiers and oscillators and their configurations.

**Course Outcomes**

After the completion of the course, the student will be able to

CO1: Design and analyze simple rectifiers and voltage regulators using diodes to enhance the entrepreneur skills.

CO2: Design and analyze simple BJT and MOSFET circuits to enhance the entrepreneur skills.

CO3: Analyze oscillator designs, perform frequency response calculations using mathematical expressions.

CO4: Comprehend fundamental concepts in feedback amplifier circuits.

CO5: Create circuit design, conduct testing, and apply the circuits at various levels.

Unit	Topic	Key Learning
I	<b>Semi-Conductor Diode Applications</b>	<ul style="list-style-type: none"> <li>• Load Line Analysis, Series Diodes Configurations, parallel, and series-parallel diode networks.</li> <li>• Diode as half wave, full wave and bridge rectifier.</li> <li>• Clippers, Clampers</li> <li>• Voltage multiplier circuits</li> <li>• Voltage Regulators</li> </ul>
II	<b>Transistor Biasing Circuits and Single stage transistor amplifier</b>	<ul style="list-style-type: none"> <li>• Concept of transistor biasing and selection of operating point. Need for stabilization of operating point. Different types of biasing circuits.</li> <li>• Single stage transistor amplifier circuit, a.c load line and its use in calculation of current and voltage gain of a single stage amplifier circuit.</li> <li>• Explanation of phase reversal of output voltage with respect to input voltage.</li> <li>• H-parameters and their significance and calculation of current and voltage gain.</li> </ul>
III	<b>FET Biasing</b>	<ul style="list-style-type: none"> <li>• FET amplifier circuit and its working principle.</li> <li>• FET Biasing</li> <li>• fixed-bias configuration</li> <li>• self-bias configuration</li> <li>• voltage-divider bias configuration</li> <li>• Biasing of MOSFETS</li> </ul>

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IV	<b>Feedback Amplifier</b>	<ul style="list-style-type: none"> <li>• The general feedback structure,</li> <li>• properties of negative feedback,</li> <li>• the four basic feedback topologies,</li> <li>• the series-shunt feedback amplifier,</li> <li>• the series-series feedback amplifier,</li> <li>• the shunt-shunt and shunt series feedback amplifier.</li> </ul>
V	<b>Sinusoidal Oscillators</b>	<ul style="list-style-type: none"> <li>• Sinusoidal Oscillators – positive feedback in amplifiers</li> <li>• Introduction Non-Sinusoidal Oscillators</li> <li>• Difference between an oscillator and an alternator</li> <li>• Essentials of an oscillator</li> <li>• Circuit details and working of LC oscillators viz. Tuned Collector, Hartley and Colpitt's oscillators</li> <li>• R-C oscillator circuits, phase shift and Wein bridge oscillator circuits. Introduction to piezoelectric crystal and crystal oscillator circuit</li> </ul>

**Suggested Readings:**

- Basic Electronics and Linear Circuits by NN Bhargava, Tata McGraw Hills, New Delhi.
- Electronic devices and circuit theory by Robert L. Boylestad, Louis Nashelsky, Pearson, 11th ed.
- Electronics Principles by Malvino, Tata McGraw Hills, New Delhi.
- Electronic Devices and Circuits by Millman and Halkias, McGraw Hills, New Delhi.

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**SUBJECT: Analog Electronics (Lab)**  
**CODE: 24DECE38**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

### Objectives

- The goal of this course is to introduce basic principles, operation and applications of the various analog electronic devices like: BJT and MOSFET for various functions.
- To make students understand and analyze the working of amplifiers and oscillators and their configurations.

### Course Outcomes

After the completion of the course, the student will be able to

CO1: Design and analyze simple rectifiers and voltage regulators using diodes to enhance the entrepreneur skills.

CO2: Design and analyze simple BJT and MOSFET circuits to enhance the entrepreneur skills.

CO3: Analyze oscillator designs, perform frequency response calculations using mathematical expressions.

CO4: Comprehend fundamental concepts in feedback amplifier circuits.

CO5: Create circuit design, conduct testing, and apply the circuits at various levels.

### List of Practical's

1. Experiment on Zener diode as voltage regulator.
2. Observe the wave shape of following rectifier circuit (i) Half wave rectifier (ii) Full wave rectifier.
3. Observe the wave shape of Full wave bridge rectifier.
4. Implement clippers circuits using diodes.
5. Implement clampers circuits using diodes.
6. Implement voltage multiplier circuits using diodes.
7. Implement Voltage Regulators using diodes.
8. Measure the Q-Point and note the variation of Q-Point by increasing the base resistance in fixed bias circuit.
9. Measure the Q-Point and note the variation of Q-Point by changing out of bias resistance in potential divider circuit electronics.
10. Implement R-C oscillator circuits.
11. Implement phase shift oscillator circuits
12. Implement Wein bridge oscillator circuits.

### Suggested Readings:

- Basic Electronics and Linear Circuits by NN Bhargava, Tata McGraw Hills, New Delhi
- Electronics Principles by Malvino, Tata McGraw Hills, New Delhi
- Electronic Devices and Circuits by Millman and Halkias, McGraw Hills, New Delhi

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**SUBJECT: Microprocessors and Peripheral Devices**  
**CODE: 24DECE39**

Credit	Hours	Marks		
		I	E	To
4	60	30	70	100

**Objectives**

Build basic understanding about interfacing memory and peripheral devices to a microprocessor.

**Course Outcomes**

After the completion of the course, the student will be able to

CO1: Understand the organization of microcomputer system and compare the functionally and architectures of microprocessors.

CO2: Understand the architecture of a microprocessor, including the addressing modes and instruction set of 8085.

CO3: Analyze assembly language programming concepts.

CO4: Apply various interfacing techniques to interface commonly used peripheral devices.

CO5: Design various programs to run several applications using 8085 and related microprocessors.

Unit	Topic	Key Learning
I	<b>Evolution of Microprocessor</b>	<ul style="list-style-type: none"> <li>• Typical organization of a microcomputer system and functions of its various blocks.</li> <li>• Microprocessor,</li> <li>• its evolution,</li> <li>• function and impact on modern society</li> </ul>
II	<b>Architecture of a Microprocessor (With reference to 8085 microprocessors)</b>	<ul style="list-style-type: none"> <li>• Concept of Bus,</li> <li>• bus organization of 8085,</li> <li>• Functional block diagram of 8085 and function of each block,</li> <li>• Pin details of 8085 and related signals,</li> <li>• Demultiplexing of address/data bus generation of read/write control signals,</li> <li>• steps to execute a stored programme</li> </ul>
III	<b>Instruction Timing and Cycles</b>	<ul style="list-style-type: none"> <li>• Instruction cycle, machine cycle and T-states,</li> <li>• Fetch and execute cycle</li> </ul>
IV	<b>Programming (with respect to 8085 microprocessor)</b>	<ul style="list-style-type: none"> <li>• Brief idea of machine and assembly languages,</li> <li>• Machines and Mnemonic codes.</li> <li>• Instruction format and Addressing mode.</li> <li>• Identification of instructions as to which addressing mode they belong.</li> <li>• Concept of Instruction set.</li> <li>• Explanation of the instructions of the following groups of instruction set.</li> <li>• Data transfer group,</li> <li>• Arithmetic Group,</li> </ul>

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		<ul style="list-style-type: none"> <li>• Logic Group,</li> <li>• Stack, I/O and Machine Control Group.</li> <li>• Programming exercises in assembly language.</li> </ul>
V	<b>Memories and I/O interfacing</b>	<ul style="list-style-type: none"> <li>• Concept of memory mapping,</li> <li>• partitioning of total memory space.</li> <li>• Address decoding,</li> <li>• concept of peripheral mapped I/O and memory mapped I/O.</li> <li>• Interfacing of memory mapped I/O devices.</li> </ul>

**Suggested Readings:**

- Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
- R.S. Gaonkar, "Microprocessor Architecture Programming and Application with 8085", Wiley Eastern Ltd., New Delhi, 2013.
- Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051, McGraw Hill Edu, 2013.

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**SUBJECT: PCB Assembly**

**CODE: 24DECE40**

Credit	Hours	Marks		
		I	E	To
2	30	15	35	50

### Objectives

This course will give each participant the ability to identify and use the key tools, components and processes that PCB assembly operators need to reliably and assemble and inspection PCB.

### Course Outcomes

After the completion of the course, the student will be able to

CO1: Utilize measuring instruments proficiently for the measurement of electrical quantities.

CO2: Identify and employ various electronics components, recognize their symbols and footprints, along with understanding their specifications.

CO3: Comprehend electronics circuits and PCB types, and demonstrate knowledge of component placement.

CO4: Perform soldering and de-soldering on electronics components as per the work sheet.

CO5: Inspect the assembled PCB and perform basic diagnosis of faults, and rectify them to enhance the entrepreneur skills.

### Unit 1 Introduction to Assembly process

Introduction of Electronics Industry and its various sub-sectors, Opportunities for PCB Assembly Operator, Roles and responsibilities of a PCB Assembly Operator, PCB Assembly Work Flow.

### Unit 2 Soldering

Soldering Tools, Soldering, handling the soldering iron, iron temperature, types of soldering, Soldering defects, Manual soldering, Wave Soldering.

### Unit 3 PCB Assembly Operations

PCB types, through-hole technology (THT), PTH, surface mount technology (SMT), and mixed technology, ESD, RoHS. Prerequisites to printed circuit board assembly, Assemble PCB.

### Unit 4 Testing of Assembled PCB

Set up Jigs for Testing, Types of Testing Methods, Testing PCB Components, Machine Troubleshooting, Common Problems and Troubleshooting of soldering, Visual Inspection, Functional test, types of errors identified during functional test.

### Unit 5 Work Effectiveness, safety and health practices at workplace

Effective communication, Coordination, discipline, work effectively, social diversity at workplace, Hazards, fire safety, First aid, Waste Management.

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**Suggested Readings:**

- Qualification Handbook: PCB Assembly Operator
- PCB Assembly Operator-ELE\_Q7804\_v3.0
- PCB Assembly Fundamentals: By Advanced Assembly
- Design for Testing Handbook: By Sierra Circuits
- The Electronics Assembly Handbook by Frank Riley, Electronic Packaging and Production

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**SUBJECT: PCB Assembly Lab**  
**CODE: 24DECE41**

Credit	Hours	Marks		
		I	E	To
2	60	35	15	50

### Objectives

This course will give each participant the adequate skill to carry out the PCB assembling duties efficiently according to the applicable quality standards, with minimum supervision.

### Course Outcomes

After the completion of the course, the student will be able to

CO1: Utilize measuring instruments proficiently for the measurement of electrical quantities.

CO2: Identify and employ various electronics components, recognize their symbols and footprints, along with understanding their specifications.

CO3: Comprehend electronics circuits and PCB types, and demonstrate knowledge of component placement.

CO4: Perform soldering and de-soldering on electronics components as per the work sheet.

CO5: Inspect the assembled PCB and perform basic diagnosis of faults, and rectify them to enhance the entrepreneur skills.

### List of Practicals

1. Identify & utilise the different types of meters for measuring AC & DC parameters.
2. Identify the different controls on the DSO front panel and observe the function of each control.
3. Measure the resistor value by colour code and verify the same by measuring with multimeter.
4. Identify the different capacitors and measure capacitance of various capacitors using multimeter/LCR.
5. Identify different transistors with respect to different package type, B-E-C pins, power switching transistor, heat sinks etc.
6. Test LEDs with DC supply and measure voltage drop and current using multimeter.
7. Familiarization with Different terms of PCB (Single Layer, Double Layer, Multi-layer, PTH).
8. Familiarizations of soldering technology, use of materials like solder, flux and cleaning solvents, usage of correct tools, component mounting, solderability testing.
9. Demonstrate soldering and de soldering using soldering and de-soldering stations.
10. Practice soldering on IC bases and PCBs.
11. Practice de-soldering using pump and wick. Join the broken PCB track and test.
12. Inspect soldered joints, detect the defects and test the PCB for rework.
13. Identification and Soldering the SMD components on the PCB.
14. Make the necessary settings on SMD soldering station to solder various SMD Components.
15. Make the necessary setting rework of defective component using soldering/de-soldering method.
16. Assembly and testing of a Dual power supply (5V & 12V) using Voltage regulator.

### Suggested Readings:

- Qualification Handbook: PCB Assembly Operator
- PCB Assembly Fundamentals: By Advanced Assembly

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## Diploma Industrial Electronics

### SEMESTER-6

**SUBJECT: Linear Control System**  
**CODE: 24DECE46**

Credit	Hours	Marks		
		I	E	To
4	60	30	70	100

#### Objectives

To understand concepts of the mathematical modeling, feedback control and stability analysis in Time and Frequency domains of the control systems

#### Course Outcomes

After the completion of the course, the student will be able to

CO1: Analyze and enhance the system performance by selecting a suitable controller and a compensator for a specific application.

CO2: Represent and formulate the mathematical model of the physical systems.

CO3: Analyze the stability of closed and open loop systems.

CO4: Design a system, component, or process to meet desired needs.

CO5: Analyze various time domain and frequency domain techniques to assess the system performance.

Unit	Topic	Key Learning
I	Introduction	<ul style="list-style-type: none"> <li>• Basic elements of control system</li> <li>• open loop control system, closed loop control system</li> <li>• control system terminology</li> <li>• manually controlled closed loop systems</li> <li>• automatic controlled closed loop systems</li> <li>• basic elements of a servo mechanism</li> </ul>
II	Controlling Systems	<ul style="list-style-type: none"> <li>• Examples of automatic control systems</li> <li>• use of equivalent systems for system analysis</li> <li>• linear systems, non-linear systems</li> <li>• control system examples from chemical systems, mechanical systems, electrical systems</li> <li>• introduction to laplace transform</li> </ul>
III	Control system representation	<ul style="list-style-type: none"> <li>• Transfer function</li> <li>• block diagram</li> <li>• reduction of block diagram</li> <li>• problems on block diagram</li> <li>• Mason's formula signal flow graph</li> </ul>
IV	Time Response Analysis	<ul style="list-style-type: none"> <li>• Standard test signals</li> <li>• time response of first and second-order system</li> <li>• time constant, time response of second order system</li> <li>• time response specifications,</li> </ul>

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		<ul style="list-style-type: none"> <li>• steady-state errors and error constants</li> <li>• problems in first and second order system</li> </ul>
V	Stability	<ul style="list-style-type: none"> <li>• Stability, definition of stability</li> <li>• Analysis of stable, unstable, critically stable and conditionally stable system</li> <li>• Routh Hurwitz Criterion: different cases and conditions</li> <li>• Root Locus</li> <li>• Bode Plotting using semi log graph paper</li> </ul>

**Suggested Readings:**

- Control Systems by Nagrath and Gopal
- Control Systems by KUO
- Control Systems by Ogata

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**SUBJECT: Programmable Logic Controller**  
**CODE: 24DECE47**

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

**Objectives**

Familiarize the students with basic concept of PLC, its instruction list and ladder programming to design related applications.

**Course Outcomes**

After the completion of the course, the student will be able to

CO1: Understand the fundamental concepts of Programmable Logic Controllers (PLC).

CO2: Demonstrate the working principles of a PLC.

CO3: Understand and apply the instruction set of PLC to design related applications to enhance the entrepreneur skills.

CO4: Perform ladder programming to design related applications to enhance the entrepreneur skills.

CO5: Gain exposure to different applications of PLC, fostering entrepreneurial skills.

Unit	Topic	Key Learning
I	<b>Introduction to PLC</b>	<ul style="list-style-type: none"> <li>• What is PLC, concept of PLC,</li> <li>• Building blocks of PLC, Functions of various blocks,</li> <li>• limitations of relays.</li> <li>• Advantages of PLCs over electromagnetic relays.</li> <li>• Different programming languages,</li> <li>• PLC manufacturer etc.</li> </ul>
II	<b>Working of PLC</b>	<ul style="list-style-type: none"> <li>• Basic operation and principles of PLC,</li> <li>• Architectural details processor, Memory structures,</li> <li>• I/O structure, Programming terminal,</li> <li>• power supply</li> </ul>
III	<b>Instruction Set</b>	<ul style="list-style-type: none"> <li>• Basic instructions like latch,</li> <li>• master control self-holding relays,</li> <li>• Timer instruction like retentive timers, resetting of timers,</li> <li>• Counter instructions like up counter,</li> <li>• down counter, resetting of counters,</li> <li>• Arithmetic Instructions (ADD, SUB, DIV, MUL etc.),</li> <li>• MOV instruction, RTC (Real Time Clock Function),</li> <li>• Comparison instructions like equal,</li> <li>• not equal, greater, greater than equal, less than, less than equal.</li> </ul>

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IV	<b>Ladder Diagram Programming</b>	<ul style="list-style-type: none"> <li>• Programming based on basic instructions,</li> <li>• timer,</li> <li>• counter,</li> <li>• sequencer, and</li> <li>• comparison instructions using ladder program.</li> </ul>
V	<b>Applications of PLC</b>	<ul style="list-style-type: none"> <li>• Assembly, Packaging, Process controls, Car parking, Doorbell operation, Traffic light control, Microwave Oven,</li> <li>• Washing machine, Motor in forward and reverse direction,</li> <li>• Star-Delta, DOL Starters, Paint Industry,</li> <li>• Filling of Bottles, Room Automation</li> </ul>

**Suggested Readings:**

- Programmable Logic Controllers by Thomas E.Kissel
- Design with Micro Controller by C Nagara, Murthy, S Ramgopal, Joshi B Peatman; McGraw Hill, 1988
- The 8051 Micro controller Architecture Programming and Applications, Second Edition by Kanneth J; Ayala Penram International Publishing (India) 1996
- Festo Didactic – Programmable Logic Controllers Basic Level – TP 301 – A Training Manual on PLCs
- Instrument Engineers Handbook Vol. II, by Liptak, P, Chittor Book Company

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**SUBJECT: Programmable Logic Controller (Lab)**  
**CODE: 24DECE48**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

### Objectives

Familiarize the students with basic concept of PLC, its instruction list and ladder programming to design related applications.

### Course Outcomes

After the completion of the course, the student will be able to

CO1: Understand the fundamental concepts of Programmable Logic Controllers (PLC).

CO2: Demonstrate the working principles of a PLC.

CO3: Understand and apply the instruction set of PLC to design related applications to enhance the entrepreneur skills.

CO4: Perform ladder programming to design related applications to enhance the entrepreneur skills.

CO5: Gain exposure to different applications of PLC, fostering entrepreneurial skills.

### List of practicals

1. Components/sub-components of a PLC, Learning functions of different modules of a PLC system.
2. Practical steps in programming a PLC (a) using a Hand-held programmer (b) using computer interface.
3. Introduction to step 5 programming language, ladder diagram concepts, instruction list syntax
4. Basic logic operations, AND, OR, NOT functions.
5. Basic logic operations, NAND, NOR functions.
6. Basic logic operations, EX- OR, EX-NOR functions.
7. Implementation of PLC Arithmetic Instructions
8. Logic control systems with time response as applied to clamping operation.
9. Sequence control system e.g. in lifting a device for packaging and counting.
10. Use of PLC for an application.

### Suggested Readings:

- Programmable Logic Controllers by Thomas E.Kissel
- Design with Micro Controller by C Nagara, Murthy, S Ramgopal, Joshi B Peatman; McGraw Hill, 1988
- The 8051 Micro controller Architecture Programming and Applications, Second Edition by Kanneth J; Ayala Penram International Publishing (India) 1996
- Festo Didactic – Programmable Logic Controllers Basic Level – TP 301 – A Training Manual on PLCs
- Instrument Engineers Handbook Vol.II, by Liptak, P, Chittor Book Company

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**SUBJECT: Transducers and Signal Conditioning**  
**CODE: 24DECE49**

Credit	Hours	Marks		
		I	E	To
4	60	30	70	100

**Objectives**

To understand the Basics of Transducers and Signal Conditioning including Principle of analog signal conditioning, Piezoelectric Transducers and Digital signal conditioning.

**Course Outcomes**

After the completion of the course, the student will be able to

CO1: Understand the basics of Transducers and Signal Conditioning

CO2: Explicate the construction and working of various industrial parameters / devices used to measure different parameters

CO3: Analyse, formulate and select suitable transducer for the given industrial applications.

CO4: Understand and apply the principle of analog signal conditioning to design signal conditioning equipment.

CO5: Acquire the concept of Digital signal conditioning for the configuration of Data Acquisition System and data conversion.

Unit	Topic	Key Learning
I	Basic Concepts	<ul style="list-style-type: none"> <li>• Definition and classification of transducers</li> <li>• Variable Resistance Transducers Construction, working principle, selection criteria and application of               <ol style="list-style-type: none"> <li>1. Potentiometer, strain gauge, load cell</li> <li>2. Hot wire anemometer, photo resistors</li> <li>3. Resistive temperature transducers</li> <li>4. Thermistors</li> <li>5. Carbon Microphones</li> </ol> </li> </ul>
II	Piezoelectric Transducers	<ul style="list-style-type: none"> <li>• Construction, basic principle, selection criteria and application of use of equivalent systems for system analysis               <ol style="list-style-type: none"> <li>i. Piezoelectric Transducer</li> <li>ii. Seismic pick up</li> <li>iii. Ultrasonic Transducer</li> </ol> </li> </ul>
III	Other types of transducers	<ul style="list-style-type: none"> <li>• Transducers based upon hall effect block diagram</li> <li>• Optical transducers-photo diode, photo transistor LDR, and LED</li> <li>• Digital transducer-single shaft encoder</li> <li>• Techo generator</li> </ul>
IV	Principle of analog signal conditioning	<ul style="list-style-type: none"> <li>• Linearization</li> <li>• Various types of conversions (from V to F, from F to V, V to I converters and I to V converters).</li> <li>• Filtering and impedance matching</li> <li>• Advantages, disadvantages and limitations</li> </ul>

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V	Digital signal conditioning	<ul style="list-style-type: none"> <li>• A/D conversion, D/A conversion</li> <li>• Multiplexer/ Demultiplexer</li> <li>• Encoder/Decoder</li> <li>• Sample and hold, Data Acquisition system (DAS)</li> </ul>
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**Suggested Readings:**

- Electrical and Electronics Measurement and Instrumentation by A.K. Shawney, Dhanpat Rai and Co., New Delhi
- Mechanical and industrial measurement by R.K. Jain, Khanna Publishers, New Delhi
- Transducers by Peter Norton
- Mechatronics by Bolton, Prentice Hall of India, New Delhi.

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**Subject: Linear Integrated Circuits**  
**Code: 24DECE50**

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

**Objectives**

- To introduce the basic building blocks of linear integrated circuits, the linear and non-linear applications of operational amplifiers along with analog multipliers and PLL.
- To introduce the concepts of ADC, DAC, waveform generation and introduce some special function ICs.

**Course Outcomes**

After the completion of the course, the student will be able to

CO1: Understand and design linear and non-linear applications of operational amplifiers (op-amps).

CO2: Design applications using analog multipliers and Phase-Locked Loops (PLL) to enhance the entrepreneur skills.

CO3: Design Analog-to-Digital Converters (ADC) and Digital-to-Analog Converters (DAC) using op-amps.

CO4: Generate waveforms using op – amp circuits.

CO5: Analyze special function Integrated Circuits (ICs) and apply them to design related applications to enhance entrepreneurial skills.

Unit	Topic	Key Learning
I	Differential Amplifier	<ul style="list-style-type: none"> <li>• Introduction, Classification,</li> <li>• DC and AC analysis of single/dual input Balanced and unbalanced output Configurations using BJTs,</li> <li>• Constant current bias,</li> <li>• Current mirror circuit.</li> </ul>
II	Operational Amplifier Basics	<ul style="list-style-type: none"> <li>• Op-amp Block Diagram,</li> <li>• ideal Op-amp Characteristics,</li> <li>• Equivalent circuit of Op-Amp,</li> <li>• Op-amp with feedback,</li> <li>• Op-Amp parameters &amp; Measurements,</li> <li>• Input and Output Offset voltages and currents,</li> <li>• Slew Rate, CMRR, PSRR.</li> <li>• Frequency Response and Compensation techniques</li> </ul>
III	Applications of Operational Amplifiers	<ul style="list-style-type: none"> <li>• Sign Changer, Scale Changer,</li> <li>• Phase Shift Circuits, Voltage Follower,</li> <li>• V-to-I and I-to-V converters,</li> <li>• Summing, scaling and averaging Amplifier, Integrator, Differentiator</li> </ul>

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IV	Analog to Digital and Digital to Analog Converters	<ul style="list-style-type: none"> <li>• Analog and Digital Data Conversions,</li> <li>• D/A converter</li> <li>• specifications</li> <li>• weighted resistor type, R-2R Ladder type.</li> </ul>
V	Waveform Generators and Special Functions	<ul style="list-style-type: none"> <li>• Sine-wave generators</li> <li>• Multivibrator and Triangular wave generator</li> <li>• Saw-tooth wave generator,</li> <li>• ICL8038 function generator.</li> </ul>

**Suggested Readings:**

- D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.
- Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, Tata Mc Graw-Hill, 2007.
- Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2001.
- Robert F. Coughlin, Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
- B. S. Sonde, "System design using Integrated Circuits", 2nd Edition, New Age Pub, 2001

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**Subject: Linear Integrated Circuits Lab**  
**Code: 24DECE51**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

### Objectives

- To introduce the basic building blocks of linear integrated circuits, the linear and non-linear applications of operational amplifiers along with analog multipliers and PLL.
- To introduce the concepts of ADC, DAC, waveform generation and introduce some special function ICs.

### Course Outcomes

After the completion of the course, the student will be able to

- CO1: Understand and design linear and non-linear applications of operational amplifiers (op-amps).  
CO2: Design applications using analog multipliers and Phase-Locked Loops (PLL) to enhance the entrepreneur skills.  
CO3: Design Analog-to-Digital Converters (ADC) and Digital-to-Analog Converters (DAC) using op-amps.  
CO4: Generate waveforms using op – amp circuits.  
CO5: Analyze special function Integrated Circuits (ICs) and apply them to design related applications to enhance entrepreneurial skills.

### List of Experiments:

1. To study the inverting operational amplifier (Op-Amp).
2. To study the non-inverting Op-Amp.
3. To study the Op-Amp as integrator.
4. To study the Op-Amp as differentiator.
5. To study the Op-Amp as Low Pass and High Pass filter
6. To study the Op-Amp as First order and second order filter.
7. To study the Op-Amp as summing, averaging and scaling.
8. To study Op-Amp as oscillator.
9. To measure Slew Rate and CMRR ratio of an Op-Amp.
10. Application of Op-Amp as Schmitt Trigger and VCO.

### Text Books:

- D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.
- Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, Tata Mc Graw-Hill, 2007.

### Reference Books:

- Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2001.
- Robert F. Coughlin, Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
- B.S. Sonde, "System design using Integrated Circuits", 2nd Edition, New Age Pub, 2001

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**SUBJECT: Principles of Quality Management**  
**CODE: 24DECE52**

Credit	Hours	Marks		
		I	E	To
4	60	30	70	100

**Objectives**

Develop the understanding of Quality Management to enhance knowledge and skill for continuous improvement

**Course Outcomes**

After the completion of the course, the student will be able to

- CO1: Explore and compare various quality policies to gain exposure to diverse perspectives.
- CO2: Apply quality management principles effectively in practical scenarios.
- CO3: Utilize available statistical tools proficiently in the context of quality management.
- CO4: Enhance product and process quality through the application of quality improvement methodologies.
- CO5: Evaluate and understand different quality systems implemented both in India and abroad.

Unit	Topic	Key Learning
I	INTRODUCTION	<ul style="list-style-type: none"> <li>• Introduction, definition and core concepts in quality management</li> <li>• Importance, scope and benefits of quality</li> <li>• Evolution of quality</li> <li>• Type and dimensions of quality</li> <li>• TQM principles</li> </ul>
II	QUALITY PRINCIPLES, POLICIES, AWARDS AND FRAMEWORK	<ul style="list-style-type: none"> <li>• Various principles of quality management systems</li> <li>• Quality policies and management (Manufacturing &amp; Service Sector)</li> <li>• Quality frameworks at national and international level</li> <li>• Quality awards in India and Abroad</li> <li>• Quality gurus and their philosophies</li> </ul>
III	QUALITY PLANNING, MONITORING AND GOVERNANCE	<ul style="list-style-type: none"> <li>• Quality planning in organizations</li> <li>• Quality monitoring in organizations</li> <li>• Quality implementation in organizations</li> <li>• Quality governance in organizations</li> <li>• Cost of Quality</li> </ul>
IV	QUALITY PROCESSES, TOOLS AND TERMINOLOGIES	<ul style="list-style-type: none"> <li>• Continuous process improvement</li> <li>• Statistical concepts in quality, not limited to (7QC, Control Charts, Process Capability)</li> <li>• Managing quality to achieve business excellence</li> <li>• Quality terminologies</li> <li>• Business Process Reengineering</li> </ul>
V	QUALITY SYSTEMS IN INDIA AND ABROAD	<ul style="list-style-type: none"> <li>• ISO Family with focus on 9000, 14000 &amp; 27001 Standards</li> <li>• Six Sigma (Green and Black Belt)</li> </ul>

*Nitin*

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	<ul style="list-style-type: none"> <li>• ZED (Zero Defect and Zero Effect)</li> <li>• CMMI, PCMM</li> <li>• AS 9100</li> </ul>
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**Suggested Portals:**

- <https://www.iso.org/home.html>
- <https://asq.org/>
- <https://www.pmi.org>
- <https://zed.org.in/>
- <https://www.isaca.org/>

**Suggested Books:**

- Total Quality Management – K Shridhara Bhat
- Out of the Crisis - W Edwards Deming
- Total Quality Management – Poornima M Charantimath
- Quality Management – Kanishka Bedi

**Suggested Literature:**

- Besterfield D. H. Quality Control. New Jersey, 2001. 471 p.
- Dale, B. G. Managing Quality. Oxford: Blackwell Publishing, 2002. 471 p.
- Evans J. R., Lindsay W. M. The management and control of quality. USA: South-Western college publishing, 1999.
- Foster T. S. Managing quality: An Integrative Approach. New Jersey: Prentice Hall, 2002. 476 p.
- Goetsch D. L., Davis S. B. Quality management. Introduction to TQM for production, processing and services. New Jersey: Prentice Hall, 2003.
- D. C. Montgomery, Introduction to Statistical Quality Control, John Wiley & Sons, 3rd Edition.
- Mitra A., Fundamentals of Quality Control and Improvement, PHI, 2nd Ed., 1998.
- J Evans and W Linsay, The Management and Control of Quality, 6'th Edition, Thomson, 2005
- Besterfield, D H et al., Total Quality Management, 3rd Edition, Pearson Education, 2008.
- D. C. Montgomery, Design and Analysis of Experiments, John Wiley & Sons, 6th Edition, 2004
- D. C. Montgomery and G C Runger, Applied Statistics and Probability for Engineers, John Wiley & Sons, 4th Edition.

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