

**Scheme and Syllabus**  
**of**  
**D.Voc**  
**Industrial Electronics**  
**(With Padget Electronics Pvt. Ltd.)**

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 (Padget Electronics Pvt. Ltd.)

#### Scheme of The First Semester

Effective from 2023-24 Onwards

Semester-I															
Category	Subject Code	Subject Name	Credits			Marks						Hrs			
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
General Education Component		Language (English)													
		Language (English)-Lab	2	1	3	15	35	50	35	15	50	100	60	30	90
		Applied Mathematics-1	2	0	2	30	70	100	-	-	-	100	60		60
		EVS	1.5	0	1.5	30	70	100	-	-	-	100	45		45
		Total	5.5	1	6.5	75	175	250	35	15	50	300	165	30	195
Skill Education Component		Electrical Engineering Drawing Lab	0	3	3	-	-	-	70	30	100	100	-	90	90
		Applied Physics													
		Applied Physics Lab	2	2	4	15	35	50	35	15	50	100	60	60	120
		Basics of Electrical & Electronics Engineering													
		Basics of Electrical & Electronics Engineering Lab	2	2	4	15	35	50	35	15	50	100	60	60	120
		Engineering Science	1.5	1	2.5	15	35	50	35	15	50	100	45	30	75
		Engineering Workshop													
	Total	5.5	8	13.5	45	105	150	175	75	250	300	180	180	360	
Grand Total			11	9	20	120	280	400	210	90	300	600	390	210	600

**Note:** The scheme and syllabus of D.Voc Industrial Electronics (East West Automation Pvt. Ltd. and Padget Electronics Pvt. Ltd.) is common for 1<sup>st</sup> year.

The above scheme is approved in Certificate/Diploma Programs BoS held on September 13, 2023.

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 Dean Engineering  
 Shri Vishwakarma Skill University

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## Skill Faculty of Engineering and Technology

### Skill Department of Industry 4.0

D.Voc Industrial Electronics (Padget Electronics Pvt. Ltd.)

#### Scheme of The First Semester

Effective from 2023-24 Onwards

Semester-I															
Category	Subject Code	Subject Name	Credits			Marks						Hrs			
			T	P	TO	Theory			Practical			Total (T+P)	T	P	TO
						I	E	TO	I	E	TO				
General Education Component	23DENL01	Language (English)	2	1	3	15	35	50	35	15	50	100	60	30	90
	23DENL02	Language (English)-Lab													
	23DAMM01	Applied Mathematics-1	2	0	2	30	70	100	-	-	-	100	60		60
	23DEVS01	EVS	1.5	0	1.5	30	70	100	-	-	-	100	45		45
		Total	5.5	1	6.5	75	175	250	35	15	50	300	165	30	195
Skill Education Component	23DEED02	Electrical Engineering Drawing Lab	0	3	3	-	-	-	70	30	100	100	-	90	90
	23DAPH01	Applied Physics	2	2	4	15	35	50	35	15	50	100	60	60	120
	23DAPH02	Applied Physics Lab													
	23DELE01	Basics of Electrical & Electronics Engineering	2	2	4	15	35	50	35	15	50	100	60	60	120
	23DELE02	Basics of Electrical & Electronics Engineering Lab													
	23DESC01	Engineering Science	1.5	1	2.5	15	35	50	35	15	50	100	45	30	75
	23DESC02	Engineering Workshop													
		Total	5.5	8	13.5	45	105	150	175	75	250	400	165	240	405
<b>Grand Total</b>			<b>11</b>	<b>9</b>	<b>20</b>	<b>120</b>	<b>280</b>	<b>400</b>	<b>210</b>	<b>90</b>	<b>300</b>	<b>700</b>	<b>330</b>	<b>270</b>	<b>600</b>

Note: The scheme and syllabus of D.Voc Industrial Electronics (East West Automation Pvt. Ltd. and Padget Electronics Pvt. Ltd.) is common for 1<sup>st</sup> year.

The above scheme is approved in Certificate/Diploma Programs BoS held on September 13, 2023.

*Mitun Singh*

*MBS*

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**D.Voc Industrial Electronics (Padget Electronics Pvt. Ltd.)**

**Session (2023-26)**

**Scheme of The Second Semester**

Category	Subject Code	Subject Name	Semester-II										Hrs					
			Credits			Marks						Total (T+P)	T	P	TO			
			T	P	TO	Theory			Practical									
General Education Component	24DECE01	Electronic Device Circuits																
	24DECE02	Electronic Device Circuits Lab	2	2	4	15	35	50	35	15	50	100	60	60	120			
	23DMTH02	Applied Mathematics-II	2	0	2	30	70	100	-	-	-	100	60	-	60			
	23DETH01	Value Education and Professional Ethics	1	0	1	30	70	100	-	-	-	100	30	-	30			
		<b>Total</b>		5	2	7	75	175	250	35	15	50	300	150	60	210		
Skill Education Component	24DECE03	Digital Electronics																
	24DECE04	Digital Electronics Lab	2	2	4	15	35	50	35	15	50	100	60	60	120			
	24DCSE01	Basics of Computer with programming in C																
	24DCSE02	Basics of Computer with programming in C Lab	2	2	4	15	35	50	35	15	50	100	60	60	120			
	24DECE05	Wiring Harness and PCB Assembly	2	0	2	30	70	100	-	-	-	100	60	-	60			
	24DECE06	Wiring Harness Assembly Lab	0	3	3	-	-	-	70	30	100	100	-	90	90			
		<b>Total</b>		6	7	13	60	140	200	140	60	200	400	180	210	390		
<b>Grand Total</b>			<b>11</b>	<b>9</b>	<b>20</b>	<b>135</b>	<b>315</b>	<b>450</b>	<b>175</b>	<b>75</b>	<b>200</b>	<b>700</b>	<b>330</b>	<b>270</b>	<b>600</b>			

Note: The scheme and syllabus of D.Voc Industrial Electronics (East West Automation Pvt. Ltd. and Padget Electronics Pvt. Ltd.) is common for 1<sup>st</sup> year.

The above scheme is approved in Certificate/Diploma Programs BoS held on Feb. 19, 2024.

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Session (2023-26)

Scheme of The Third Semester

Semester-III															
Category	Subject Code	Subject Name	Credits			Marks							Hrs		
			T	P	TO	Theory			Practical			Total (T+P)	T	P	TO
						I	E	TO	I	E	TO				
General Education Component	24DECE09	Linear Integrated Circuits	2	1	3	15	35	50	35	15	50	100	60	30	90
	24DECE10	Linear Integrated Circuits Lab													
	24DECE11	Programmable Logic Controller	2	1	3	15	35	50	35	15	50	100	60	30	90
	24DECE12	Programmable Logic Controller Lab													
	24DMEE01	Quality Management	2	0	2	30	70	100	-	-	-	100	60	0	60
		<b>Total</b>		6	2	8	60	140	200	70	30	100	300	180	60
Skill Education Component	24DECE13	Analog Electronics	2	2	4	15	35	50	35	15	50	100	60	60	120
	24DECE14	Analog Electronics Lab													
	24DECE15	Transducers and Signal Conditioning	2	0	2	30	70	100	-	-	-	100	60	0	60
	24DECE16	Electronics Instruments and Measurements	2	1	3	15	35	50	35	15	50	100	60	30	90
	24DECE17	Electronics Instruments and Measurements Lab													
	24DECE18	PCB Assembly Lab	0	3	3	-	-	-	70	30	100	100	0	90	90
		<b>Total</b>		6	6	12	60	140	200	140	60	200	400	180	180
<b>Grand Total</b>			<b>12</b>	<b>8</b>	<b>20</b>	<b>120</b>	<b>280</b>	<b>400</b>	<b>210</b>	<b>90</b>	<b>300</b>	<b>700</b>	<b>360</b>	<b>240</b>	<b>600</b>

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D.Voc Industrial Electronics (Padget Electronics Pvt. Ltd.)

Session (2023-26)

Scheme of The Fourth Semester

Semester-IV															
Category	Subject Code	Subject Name	Credits			Marks						Hrs			
			T	P	TO	Theory			Practical			Total (T+P)	T	P	TO
						I	E	TO	I	E	TO				
General Education Component	24DMGT01	Employability Skills	2	0	2	30	70	100	-	-	-	100	60	0	60
	24DECE19	Linear Control System	2	0	2	30	70	100	-	-	-	100	60	0	60
	24DECE20	Signals and Systems	2	2	4	15	35	50	35	15	50	100	60	60	120
	24DECE21	Signals and Systems Lab													
		Total	6	2	8	75	175	250	35	15	50	300	180	60	240
Skill Education Component	24DECE22	Microprocessors and Peripheral Devices	2	0	2	30	70	100	-	-	-	100	60	0	60
	24DELE01	Electrical Machines	2	2	4	15	35	50	35	15	50	100	60	60	120
	24DELE02	Electrical Machines Lab													
	24DCSE03	Spreadsheet Modelling Lab	0	0	2	-	-	-	70	30	100	100	0	60	60
	24DECE23	Major Project	-	4	4	-	-	-	140	60	200	200	-	120	120
		Total	4	8	12	45	105	150	245	105	350	500	120	240	360
	Grand Total		10	10	20	120	280	400	280	120	400	800	300	300	600

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D.Voc Industrial Electronics (Padget Electronics Pvt. Ltd.)

Session (2023-26)

Scheme of The Fifth Semester

Semester-V														
Subject Code	Subject Name	Credits			Marks							Hrs		
					Theory			Practical			Total			
		T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
24DECE07	NSQF aligned On Job Training	-	20	20	-	-	-	420	180	600	600	-	600	600
	Total	-	20	20	-	-	-	420	180	600	600	-	600	600

Scheme of The Sixth Semester

Semester-VI														
Subject Code	Subject Name	Credits			Marks							Hrs		
					Theory			Practical			Total			
		T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
24DECE08	NSQF aligned On Job Training	-	20	20	-	-	-	420	180	600	600	-	600	600
	Total	-	20	20	-	-	-	420	180	600	600	-	600	600

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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. Wire Harness & PCB Assembly 2. Wire Harness Assembly Lab
	ELE/N6307: Assemble the components of wire harness	(108 Hours)	1. Wire Harness & PCB Assembly 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

*Mithu Kumar*  
19/02/2024

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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. Wire Harness & PCB Assembly 2. PCB Assembly Lab 3. On the Job Training
	ELE/N9905: Work effectively at the workplace	(40 Hours)	1. Wire Harness & 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

*Nitin Kumar*  
19/2/2024



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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 & PCB Assembly 2. PCB Assembly Lab 3. 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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19/02/24

**Syllabus  
of  
D.Voc  
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**D.Voc Industrial Electronics (Padget Electronics Pvt. Ltd.)**

**Syllabus of The First Semester**

**SUBJECT: Language (English)**

**CODE: 23DENL01**

**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	15	35	50

**Objectives**

- Augment students overall communication and interpersonal skills by making them realize the importance of good oral and written English Language in professional life.
- Enrich their reading capability with special emphasis on expanding vocabulary and grammatical formations.
- Build exceptional speaking, reading and writing skills by correcting grammatical errors and pronunciation through practice.
- Enhances soft skills by fostering self awareness, confidence and a positive attitude in students' ability to communicate effectively in English.

**Learning Outcomes**

- Able to differentiate in the vowels and consonants that can help the students to pronounce words better and be able to learn phonetics.
- Learn the correct pronunciation of the words helping in the reduction of Mother Tongue Influence.  
Able to communicate effectively and will have improved verbal communication.
- Learn to frame the sentences properly with the correct formation. This will improve the written skills of the students.
- Able to write paragraphs on different topics with the correct usage of vocabulary and will improve the written as well as verbal communication.
- Learn the correct usage of the punctuation marks, will draft formal & informal emails and will comprehend the article.

Unit	Topic	Key Learning
I	<b>Communication</b>	<ul style="list-style-type: none"><li>• Meaning of Communication, Importance of Communication,</li><li>• Types of Communication, Process of Communication,</li><li>• Communication network in an organization, Barriers to Communication, Essentials of good Communication.</li></ul>
II	<b>Grammar and Usage</b>	<ul style="list-style-type: none"><li>• Subject and verb agreement,</li><li>• Tenses: simple past (negatives/interrogatives) present perfect,</li></ul>

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		<ul style="list-style-type: none"> <li>• past perfect continuous, past perfect, expressing future time (will and going to),</li> <li>• Passive voice (perfect tenses and modals), Modals (must, should, ought to, would),</li> <li>• Linking words (to like because although, instead of, if, as, since, who, which that, when however, in spite of),</li> <li>• Reported speech, statements, questions (yes/no).</li> </ul>
III	<b>Reading Skills</b>	<ul style="list-style-type: none"> <li>• Prose texts: The Gift of the Magi by O. Henry</li> <li>• Poems: 1. Death the Leveller by James Shirely</li> <li>• 2. Mending wall – Robert Frost</li> <li>• Drama: Refund by Fritz Karinthy</li> </ul>
IV	<b>Listening Skills</b>	<ul style="list-style-type: none"> <li>• The process of listening,</li> <li>• Types of listening,</li> <li>• Benefits of effective listening,</li> <li>• Barriers to listening.</li> </ul>
V	<b>Writing Skills</b>	<ul style="list-style-type: none"> <li>• Paragraph Writing:(Describing objects, describing people, Narrating events, stories)</li> <li>• Letter Writing: Application for leave Application for jobs, asking for information from various agencies (e.g. Last date for getting prospects; price of items before placing orders) Note making</li> <li>• Ending (punctuation, spelling, appropriate vocabulary, structures)</li> </ul>

#### Suggested Readings:

- Sethi, J et al. A Practice Course in English Pronunciation, Prentice Hall of India, New Delhi.
- Sen, Leena. Communication Skills, Prentice Hall of India, New Delhi.
- Prasad, P. Communication Skills, S.K. Kataria & Sons.
- Bansal, R.K. and J.B. Harrison. Spoken English, Orient Language.
- Roach Peter. English Phonetics and Phonology.
- A. S. Hornby, Oxford Advanced Learners Dictionary of Current English, 7th Edition.
- Prasad, P. The Functional Aspects of Communication Skills, Delhi.
- McCarthy, Michael. English Vocabulary in Use, Cambridge University Press.
- Rajinder Pal and Prem Lata. English Grammar and Composition, Sultan Chand Publication.
- Idioms & Phrases (English-Hindi), Arihant Publication (India) Pvt. Ltd.
- One Word Substitution, Dr. Ashok Kumar Singh, Arihant Publications (India) Pvt. Ltd

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**SUBJECT: Language English Lab**  
**CODE: 23DENL02**  
**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

### Objectives

- Augment student's overall communication and interpersonal skills by making them realize the importance of good oral and written English Language in professional life.
- Enrich their reading capability with special emphasis on expanding vocabulary and grammatical formations.
- Build exceptional speaking, reading and writing skills by correcting grammatical errors and pronunciation through practice.
- Enhances soft skills by fostering self awareness, confidence and a positive attitude in students' ability to communicate effectively in English.

### Learning Outcomes

- Able to differentiate in the vowels and consonants that can help the students to pronounce words better and be able to learn phonetics.
- Learn the correct pronunciation of the words helping in the reduction of Mother Tongue Influence. Able to communicate effectively and will have improved verbal communication.
- Learn to frame the sentences properly with the correct formation. This will improve the written skills of the students.
- Able to write paragraphs on different topics with the correct usage of vocabulary and will improve the written as well as verbal communication

### List of Practical's

1. Greetings and starting a conversation.
2. Nov Verbal Communication Techniques during conversation.
3. Verbal Communication Techniques during Conversation.
4. PPT presentation.
5. Debate.
6. Situational dialogues / Role play.
7. Telephonic skills.
8. Group Discussions

### Suggested Readings:

- Sethi, J et al. A Practice Course in English Pronunciation, Prentice Hall of India, New Delhi.
- Sen, Leena. Communication Skills, Prentice Hall of India, New Delhi.
- Prasad, P. Communication Skills, S.K. Kataria & Sons.
- Bansal, R.K. and J.B. Harrison. Spoken English, Orient Language.

**SUBJECT: Applied Mathematics -I**  
**CODE: 23DAMM01**  
**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	30	70	100

**Objectives**

- To impart basic knowledge of engineering mathematics
- To develop the knowledge in the area of algebraic functions to solve engineering problems.
- To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering

**Learning Outcomes**

- Learn the applications of Sets, Relations and Functions.
- Learn to solve special series and sequences
- Understand basic arithmetic and calculation methods.
- Learn co-ordinate Geometry.
- Learn to solve Statistics and Probability related problems.

Unit	Topic	Key Learning
I	<b>Sets, Relations and Functions</b>	<ul style="list-style-type: none"> <li>• Theory of Sets,</li> <li>• Relations,</li> <li>• Functions,</li> <li>• Polynomials and Graphical Representation</li> </ul>
II	<b>Sequence and Series</b>	<ul style="list-style-type: none"> <li>• Introduction to Sequence and Series,</li> <li>• Arithmetic Progression (A.P.),</li> <li>• Geometric Progression (G.P.),</li> <li>• Harmonic Progression (H.P.)</li> </ul>
III	<b>Algebra-I</b>	<ul style="list-style-type: none"> <li>• Partial Fraction,</li> <li>• Permutation,</li> <li>• Combination,</li> <li>• Binomial Theorem</li> </ul>
IV	<b>Trigonometry</b>	<ul style="list-style-type: none"> <li>• Trigonometric Ratio,</li> <li>• Compound Angles,</li> <li>• Multiple and sub multiple angles,</li> <li>• Transformations of products into sums or differences and vice versa</li> </ul>
V	<b>Straight Lines</b>	<ul style="list-style-type: none"> <li>• Cartesian and Polar Coordinate,</li> <li>• Different Forms of a Straight Line,</li> <li>• General Equation of a Line,</li> <li>• Distance of a Point from a Line</li> </ul>

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**SUBJECT: EVS**  
**CODE: 23DEVS01**  
**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
1.5	45	30	70	100

**Objectives**

- Create awareness between the students about our ecosystem, related problems and our role in that.

**Learning Outcomes**

- Encourage to solve the environment related problems and Make other people aware about environment problems
- Comply with the safety policies of ecosystem and environment
- Identify and recommend the opportunity for improving the environment hazards to the organization and society
- Report the polices and procedure need to adapt for environmental safety
- Create awareness among the employees and the society regarding the hazards of environmental pollution

Unit	Topic	Key Learning
I	<b>Understanding our Environment</b>	<ul style="list-style-type: none"> <li>• Definition, Scope and Importance,</li> <li>• Natural Resources</li> <li>• Forest Resources</li> <li>• Water Resources</li> <li>• Mineral Resources</li> <li>• Energy Resources</li> <li>• Food Resources</li> <li>• Land Resources</li> </ul>
II	<b>Living things in Ecosystem</b>	<ul style="list-style-type: none"> <li>• What is Ecosystem, Habitat and ecological niche</li> <li>• interaction of species with each other</li> <li>• adapting to environment</li> <li>• bio geographic zones of India</li> <li>• Energy flow in ecosystem</li> <li>• cycling of materials</li> <li>• Kinds of ecosystem.</li> </ul>
III	<b>Atmosphere and Climate</b>	<ul style="list-style-type: none"> <li>• The atmosphere,</li> <li>• layers of the atmosphere,</li> <li>• climate, greenhouse effect,</li> <li>• the Ozone layer,</li> <li>• deforestation,</li> <li>• soil erosion</li> </ul>
IV	<b>Urbanisation</b>	<ul style="list-style-type: none"> <li>• Causes of urbanisation, Manifestations of Urbanisation</li> <li>• social economic and environmental problems in urbanisation,</li> </ul>

		<ul style="list-style-type: none"> <li>• Agriculture, Unsustainable patterns of modern industrialised agriculture</li> <li>• green revolution.</li> </ul>
V	<b>Environmental Pollution</b>	<ul style="list-style-type: none"> <li>• Causes of Air pollution, major air pollutants,</li> <li>• classification of air pollutants,</li> <li>• thermal inversions,</li> <li>• photochemical smog,</li> <li>• acid preparation in air, impact of air pollution</li> </ul>

**Suggested Readings:**

- Industrial Safety and Health management” Pearson Prentice Hall,2003 by C. Ray Asfahl
- National Safety Council, “Accident Prevention Manual for Industrial Operations”, N. S. C. Chicago, 1988.
- Industrial Accident Prevention” McGraw-Hill Company, New York,1980 by Heinrich H.W.

**SUBJECT: Electrical Engineering Drawing (Lab)**

**CODE: 23DEED02**

**CATEGORY: Skill Education Component**

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.

### Learning Outcomes

- Read, understand and interpret engineering drawings.
- Communicate and co-relate through sketches and drawings.
- Prepare working drawings of panels, transmission and distribution.
- Effectively design various engineering components.
- 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).

### 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: Applied Physics**  
**CODE: 23DAPH01**  
**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	15	35	50

### Objectives

- To enhance the learning activities and the required knowledge of students in the area of basic physics and Optics.
- To make the students competent to understand basic concepts and applications of engineering physics and apply its principles in their respective fields at global platform.

### Learning Outcomes

- Able to differentiate between fundamental and derived units.
- Able to understand the concept of surface tension and viscosity.
- Able to explore different types of vibrations.
- Able to understand the concept of heat.
- Able to demonstrate the concept of light using reflection and refraction.

Unit	Topic	Key Learning
I	Units & Dimensions	<ul style="list-style-type: none"> <li>• M.K.S. fundamentals &amp; derived units,</li> <li>• S.I. base units' supplementary units and derived units,</li> <li>• Dimensions of various physical quantities,</li> <li>• uses of dimensional analysis.</li> </ul>
II	Surface Tension and Viscosity	<ul style="list-style-type: none"> <li>• Molecular forces,</li> <li>• molecular theory of surface tension,</li> <li>• surface energy,</li> <li>• capillary action,</li> <li>• concept of viscosity,</li> <li>• coefficient of viscosity,</li> <li>• principle and construction of viscometers.</li> </ul>
III	Vibrations	<ul style="list-style-type: none"> <li>• Vibration as simple spring mass system,</li> <li>• elementary and qualitative concept of free and forced vibrations,</li> <li>• resonance. Effects of vibrations on building bridges and machines members.</li> </ul>
IV	Heat	<ul style="list-style-type: none"> <li>• Temperature and its measurement,</li> <li>• thermoelectric,</li> <li>• platinum resistance thermometers and pyrometers.</li> <li>• Conduction through compound media and laws of radiations.</li> </ul>
V	Optics	<ul style="list-style-type: none"> <li>• Nature of light,</li> <li>• reflection and refraction of a wave from a plane surface.</li> <li>• Overhead projector and Epidiascope.</li> </ul>

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**Suggested Readings:**

- Concept of Physics, Prof. H.C. Verma, Part-1 (Bharti Bhawan)
- Concept of Physics, Prof. H.C. Verma, Part-2 (Bharti Bhawan)
- A Text Book of Applied Physics: Egale Parkashan, Jullandhar

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**SUBJECT: Applied Physics Lab**

**CODE: 23DAPH02**

**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	35	15	50

### Objectives

- To enhance the learning activities and the required knowledge of students in the area of basic physics and Optics.
- To make the students competent to understand basic concepts and applications of engineering physics and apply its principles in their respective fields at global platform.

### Learning Outcomes

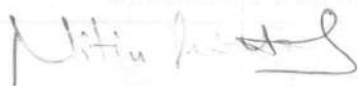
- Able to differentiate between fundamental and derived units.
- Able to understand the concept of surface tension and viscosity.
- Able to explore different types of vibrations.
- Able to understand the concept of heat.
- Able to demonstrate the concept of light using reflection and refraction.

### List of Practical's

1. To determine the surface tension of a liquid by rise in capillary.
2. To determine the viscosity of a given liquid.
3. To determine the frequency of tuning fork using a Sonometer.
4. To determine the frequency of AC main using Sonometer.
5. Time period of a cantilever.
6. Familiarisation with vernier calliper, screw gauge and spherometer and determination of their vernier constants and least counts
7. To find diameter of solid cylinder using a vernier calliper
8. To find diameter of hollow cylinder using vernier calliper
9. To find area of cross-section of wire/needle using screw gauge
10. To find thickness of glass strip using spherometer.

### Suggested Readings:

- Concept of Physics, Prof. H.C. Verma, Part-1 (Bharti Bhawan)
- Concept of Physics, Prof. H.C. Verma, Part-2 (Bharti Bhawan)
- A Text Book of Applied Physics: Egale Parkashan, Jullandhar







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

**CODE: 23DELE01**

**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	15	35	50

**Objectives**

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

**Learning Outcomes**

- Able to understand and remember various electrical quantities and their units.
- Able to understand and apply the electromagnetic effects and its laws.
- Able to derive Ohm's Law, Kirchhoff's Laws and make use of its applications by performing experiments on breadboard circuit.
- Able to design and analyse the capacitors & resistance based circuits and use them in series and parallel connection.
- Able to 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 Engineering Lab**

**CODE: 23DELE02**

**CATEGORY: Skill Education Component**

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.

### Learning Outcomes

- Able to understand and remember various electrical quantities and their units.
- Able to understand and apply the electromagnetic effects and its laws.
- Able to derive Ohm's Law, Kirchhoff's Laws and make use of its applications by performing experiments on breadboard circuit.
- Able to design and analyse the capacitors & resistance based circuits and use them in series and parallel connection.
- Able to 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

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

Sl. No.	Topic	Remarks
I	Measurement of resistance	
II	Measurement of current	
III	Measurement of voltage	
IV	Measurement of power	
V	Measurement of energy	

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**SUBJECT: Engineering Science**  
**CODE: 23DESC01**  
**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
1.5	45	15	35	50

### Objectives

- Enhance the technical skills for performing electrical wiring and earthing.

### Learning Outcomes

- Able to understand and work with different types of measuring instruments such as voltmeter, ammeter and wattmeter etc.
- Able to identify and draw different symbols for electrical devices and equipment.
- Will be able to differentiate between different types of wires used and apply knowledge for the selection of wiring system.
- Able to do earthing of wires and measure the earth resistance.
- Able to take necessary precautions while handling electrical equipment's and aware about the electrical safety.

Unit	Topic	Key Learning
I	<b>Measuring Instruments</b>	<ul style="list-style-type: none"> <li>• Construction and working principles of moving iron and moving coil voltmeters and ammeters,</li> <li>• dynamometer type wattmeter,</li> <li>• ohm meter,</li> <li>• megger and induction type energy meter- their circuit connection and application for measurement of electrical quantities.</li> </ul>
II	<b>Electrical Engineering Drawing</b>	<ul style="list-style-type: none"> <li>• Schematic and wiring diagram for domestic simple wiring,</li> <li>• symbols used for different electrical devices and equipment's.</li> </ul>
III	<b>Electrical Wiring</b>	<ul style="list-style-type: none"> <li>• Types of wiring – cleat wiring, casing and capping, C.T.S./T.R.S. wiring, metal sheath wiring,</li> <li>• conduit wiring and concealed wiring – their procedure.</li> <li>• Factors of selection of a particular wiring system,</li> <li>• importance of switch,</li> <li>• Fuse, Types of fuse and their uses.</li> </ul>
IV	<b>Earthing</b>	<ul style="list-style-type: none"> <li>• Necessity of earthing,</li> <li>• definitions of fundamental terms in earthing like earth,</li> <li>• earth lead,</li> <li>• earth electrode,</li> </ul>

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		<ul style="list-style-type: none"> <li>• earth wire,</li> <li>• Types of earthing,</li> <li>• detailed study of pipe earthing,</li> <li>• Strip earthing and plate earthing,</li> <li>• Specifications of materials used for earthing,</li> <li>• Measurement of Earth resistance</li> </ul>
V	<b>Safety Precautions</b>	<ul style="list-style-type: none"> <li>• Precautions in handling tools,</li> <li>• Electric shock – First Aid in Electric Shock,</li> <li>• Precautions to be observed while installing different electrical appliances in houses,</li> <li>• Electricity rules regarding wiring</li> </ul>

**Suggested Readings:**

- Mechanical and Industrial Measurement of by RK Jain, Khanna Publishers, New Delhi
- Industrial Instrumentation by Donald P Eickrman
- Electrical and Electronics Measurement of by AK Shawney, Dhanpat Rai and Company, New Delhi
- Advanced Instrumentation and Control by MF Kureshi

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Chairperson  
Dept. of Instrumentation

**SUBJECT: Engineering Workshop**  
**CODE: 23DESC02**  
**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

**Objectives:** Enhance the technical skills for developing electrical and electronics circuits and applications related to engineering workshop.

### Learning Outcomes

- Able to understand and work with different types of measuring instruments such as voltmeter, ammeter and wattmeter etc.
- Able to apply and analyse the principles of operation of different instruments.
- Able to apply Ohm's law, Kirchoff's law and various network theorems to the electrical networks.
- Able to formulate problems and design solutions by applying design procedure for 555 timer IC.
- Able to analyse various analog and digital circuits and devices to evaluate various electronics parameters.

### List of Practical's

1. Learn about common electrical and electronic components like resistors, capacitors, diodes, transistors, LEDs, and integrated circuits. Understand their symbols and how they function.
2. Measurement of resistance by ammeter and voltmeter method and Ohm meter.
3. Calibration of ammeter, and voltmeter with the help of standard meters.
4. Study of a Digital Storage Oscilloscope and store a transient on it.
5. Create a basic LED circuit powered by a battery and controlled by a switch.
6. To verify Ohm's law by drawing a graph between voltage and current using breadboard.
7. Build series and parallel circuits to understand how current and voltage behave in different arrangements of components.
8. Verification of Kirchoff's Current and Voltage Laws in a DC circuit on bread board.
9. Verification of Thevenin's theorem.
10. Verification of Norton's theorem.
11. Verification of Superposition theorem.
12. Verification of Maximum Power theorem.
13. Voltage and current analysis of RC circuit using breadboard.
14. Voltage and current analysis of RLC circuit using breadboard.
15. Design (i) Astable (ii) Monostable multivibrators using IC-555 timer
16. To measure unknown frequency & capacitance using Wein's bridge.

### Suggested Readings:

- Mechanical and Industrial Measurement by RK Jain, Khanna Publishers, New Delhi
- Industrial Instrumentation by Donald P Eickrman
- Electrical and Electronics Measurement by AK Shawney, Dhanpat Rai and Company, New Delhi
- Advanced Instrumentation and Control by MF Kureshi

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## SEMESTER-2

**SUBJECT:** Electronic Device Circuits  
**CODE:** 24DECE01  
**CATEGORY:** General Education Component

Credit	Hours	Marks		
		I	E	To
2	60	15	35	50

### Objectives

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

### Learning Outcomes

- Demonstrate understanding of the foundational aspects of constructing semiconducting materials, fabricating elements, and the working principles and operation of semiconductors.
- Analyze the concept with the working principles of forward and reverse bias characteristics of semiconductor diodes.
- Design and analyze simple rectifiers and voltage regulators using diodes to enhance the entrepreneur skills.
- Discriminate the principle, construction and operation of BJTs, FETs and MOSFETs.
- 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></ul>

		<ul style="list-style-type: none"> <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> <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</li> <li>• Construction, operation and characteristics of MOSFET in depletion and enhancement modes and its applications.</li> <li>• Comparison of JFET, MOSFET and BJT</li> </ul>
V	<b>Power Devices</b>	<ul style="list-style-type: none"> <li>• Silicon-controlled rectifiers (SCRs)</li> <li>• Silicon-controlled switches (SCSs)</li> <li>• Shockley diodes and Diacs</li> <li>• Triacs</li> <li>• Phototransistors and opto-isolators</li> <li>• Unijunction transistors</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: 24DECE02**  
**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	35	15	50

### Objectives

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

### Learning Outcomes

- Demonstrate understanding of the foundational aspects of constructing semiconducting materials, fabricating elements, and the working principles and operation of semiconductors.
- Analyze the concept with the working principles of forward and reverse bias characteristics of semiconductor diodes.
- Design and analyze simple rectifiers and voltage regulators using diodes to enhance the entrepreneur skills.
- Discriminate the principle, construction and operation of BJTs, FETs and MOSFETs.
- 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, 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.

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**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: Applied Mathematics-II**

**CODE: 23DMTH02**

**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	30	70	1000

### Objectives

The primary objective of this learning program is to acquire proficiency in beginner-level calculus. Learners will use a variety of tools to solve application problems in engineering and technology.

### Learning Outcomes

Upon successful completion of this course, students will be able to:

- To graphically represent commonly used functions.
- Solve problems using matrices and determinant.
- Compute limits and derivatives.
- Compute area using integrals.
- Apply geometrical concepts of vectors in 3-dimensional setting.

Unit	Topic	Key Learning
I	<b>Relations and Functions</b>	<ul style="list-style-type: none"><li>• Graphs and Equations</li><li>• Relations and Functions</li><li>• Finding Domain and Range</li><li>• Examples of Linear and Nonlinear Functions</li></ul>
II	<b>Matrices</b>	<ul style="list-style-type: none"><li>• Algebra of Matrices</li><li>• Determinant of matrices</li><li>• Inverse of a matrix</li><li>• Application of matrices to solve linear equations</li></ul>
III	<b>Limits and Differentiation</b>	<ul style="list-style-type: none"><li>• Limits: A Numerical and Graphical Approach</li><li>• Differentiation Techniques: The Power and Sum—Difference Rules</li><li>• Differentiation Techniques: The Product and Quotient Rules</li><li>• The Chain Rule</li><li>• Higher-Order Derivatives</li></ul>
IV	<b>Integration</b>	<ul style="list-style-type: none"><li>• Antiderivative</li><li>• Integration Techniques: Substitution</li><li>• Integration Techniques: Integration by Parts</li><li>• Area and Definite Integrals</li></ul>
V	<b>Vectors</b>	<ul style="list-style-type: none"><li>• Algebra of Vectors</li><li>• Scalar and vector product</li><li>• Coordinate Axes and Coordinate Planes in Three Dimensional Space</li><li>• Section Formula</li></ul>

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**Suggested Readings:**

- Mathematics Textbook for Class XII by NCERT.
- Marvin L. Bittinger, David J. Ellenbogen, Scott A. Surgent, Calculus and Its Applications, Tenth Edition, Addison-Wesley, 2012.

**Digital Content Links:**

- Relations and Functions - [https://people.ucsc.edu/~miglor/chapter%20pdf/Ch04\\_SE.pdf](https://people.ucsc.edu/~miglor/chapter%20pdf/Ch04_SE.pdf)
- Matrices - <https://home.iitk.ac.in/~peeyush/102A/Lecture-notes.pdf>
- Differentiation - <https://www.mathcentre.ac.uk/resources/Refresher%20Booklets/basic%20diff3/020refresh1Emathcentre/final0203-ltsn-basicdiffpdf>
- Integration - <https://www.mathcentre.ac.uk/resources/uploaded/mc-ty-intrevdiff-2009-1.pdf>
- Vectors and Geometry - <http://www.numbertheory.org/book/cha8.pdf>

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Dept. of Chemistry 4.0

**SUBJECT: Value Education and Professional Ethics**

**CODE: 23DETH01**

**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
1	30	30	70	100

### Objectives

Objective of this course is to impart professional values in the student.

### Learning Outcomes

At the end of the course, students will attain

- Understanding of Human values for self (NiYama), and for interaction with outer world (Yama).
- Ability to exhibit Professional Ethics in performing a professional task with excellence– योगः कर्मसु कौशलम्
- Understanding of Professional Ethics that demands to see the unseen with emphasis on
- Sustainable development / eco-friendly implementation of the task.
- Ability to work in team with human values and professional ethics

Unit	Topic	Key Learning
I	<b>Human Values-1</b>	Morals, Values (Niyam): -Understanding values, Types of values, Role of tracking values for individual & social wellbeing. And Ethics (Yama): Integrity: - Understanding integrity and role of integrity in social harmony –Trustworthiness Work Ethics – Service-Learning – Civic Virtue – Respect for others – Living Peacefully –Caring – Sharing. Honesty: -Understanding honesty and its role in personal and social –Courage – Value Time.Co-operation:- Understanding cooperation and significance of cooperation its family, work team and social cohesiveness, wellbeing and development – Commitment. Tutorial Module: Rational Behavior versus Ethical Behavior:Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi) or any other literatures.
II	<b>Human Values-2</b>	Empathy: Basic Concept on Empathy– Self-confidence – Spirituality- Character. Truthfulness: Understanding truthfulness, need for truthfulness and role of truthfulness in relationship, social interaction, integrity, faiths & dependence – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties – Aspirations and Harmony (I,

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		<p>We &amp; Nature) – Gender Bias – Emotional Intelligence– Emotional Competencies – Conscientiousness.</p> <p>Being, body, brain &amp; mind: Effective &amp; efficient use of body, brain and mind is personal and social well being Value Judgments, Facts &amp; Values, how values are justified, Aesthetics, Selection of Values, Universal Values, Human Values, Value Education</p> <p>Tutorial Module: Empathy and its types: Case Studies from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature.</p>
III	<b>Professional Ethics aiming at excellence and Harmony</b>	<p>Value Based Life and Profession, Professional Ethics and Right Understanding, Competence in Professional Ethics, Issues in Professional Ethics – The Current scenario.</p> <p>Positive and constructive dynamism of power, politics and leadership.</p> <p>Tutorial Module: Ethical decision making: Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature)</p>
IV	<b>Professional Ethics: Global Prospective</b>	<p>Globalization and MNCs –Cross Culture Issues – Business Ethics – Media Ethics – Environmental Ethics –Endangering Lives – Bio Ethics – Computer Ethics – War Ethics</p> <p>Tutorial Module: Ethics and Social Networks: Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature)</p>
V	<b>Duties and Rights in Profession</b>	<p>Concept of Duty – Professional Duties – Collegiality – Techniques for Achieving Collegiality – Senses of Loyalty – Consensus and Controversy – Professional and Individual Rights – Confidential and Proprietary Information – Conflict of Interest-Ethical egoism – Collective Bargaining – Confidentiality – Gifts and Bribes, Plagiarism</p> <p>Tutorial Module: Ethics in Corporate: Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature)</p>

#### Suggested Readings:

- New Approaches in Ethics for the Caring Professions: Taking Account of Change for Caring Professions 2005 Edition, by Richard Hugman, Publisher: Red Globe Press; 2005 edition
- Rethinking Values and Ethics in Social Work 1st ed. 2017 Edition, Kindle Edition by Richard Hugman, Jan Carter, Publisher: Red Globe Press; 1st ed. 2017 edition
- Professional Ethics and Human Values Paperback – 2015 by A. Alavudeen, R. Kalil Rahman, M. Jayakumaran, Publisher:Laxmi Publications; First edition (2015)
- A Foundation Course in Human Values and Professional Ethics by R.R. Gaur, R. Sangal, G.P. Bagaria, Publisher: Excel Books
- Living Issues in Philosophy (9th Edition) (1995) by Titus, Smith and Nolan, Publisher: Oxford University Press, New York
- Foundation of Ethics and Management by B P Banerjee, Publisher: Excel Books, 2005

**SUBJECT: Digital Electronics**

**CODE: 24DECE03**

**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	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.

### Learning Outcomes

- Analyze the structure of number systems and proficiently convert between different number systems.
- Apply logic simplification rules effectively for the design of digital logic.
- Illustrate the reduction of logical expressions using boolean algebra, k-map, and tabulation method, and implement functions using logic gates.
- Realize combinational circuits for specific applications, demonstrating entrepreneurial skills.
- 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: 24DECE04**  
**CATEGORY: Skill Education Component**

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.

### Learning Outcomes

- Analyze the structure of number systems and proficiently convert between different number systems.
- Apply logic simplification rules effectively for the design of digital logic.
- Illustrate the reduction of logical expressions using boolean algebra, k-map, and tabulation method, and implement functions using logic gates.
- Realize combinational circuits for specific applications, demonstrating entrepreneurial skills.
- 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 McGraw 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.



**SUBJECT: Basics of Computer with Programming in C**  
**CODE: 24DCSE01**  
**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	15	35	50

### Objectives

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

### Learning Outcomes

- Differentiate among various data types and variables, demonstrating understanding of their respective applicability.
- Evaluate programming skills through proficient debugging techniques, ensuring the correctness of the program.
- Apply algorithmic principles effectively to solve simple problems and implement them in a functional program.
- Analyze program logic with reasoning abilities to demonstrate effective problem-solving skills.
- 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 Structure and Control Structures</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>

		<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**  
**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	35	15	50

### Objectives

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

### Learning Outcomes

- Differentiate among various data types and variables, demonstrating understanding of their respective applicability.
- Evaluate programming skills through proficient debugging techniques, ensuring the correctness of the program.
- Apply algorithmic principles effectively to solve simple problems and implement them in a functional program.
- Analyze program logic with reasoning abilities to demonstrate effective problem-solving skills.
- 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.



**SUBJECT: Wiring Harness and PCB  
Assembly**

**CODE: 24DECE05**

**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	30	70	100

### **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.

### **Learning Outcomes**

- Describe the role and responsibilities of a Wiring Harness Assembly Operator and demonstrate the step-by-step process of assembling a wire harness.
- Employ various techniques for performing pre-assembly operations of the harness.
- Perform the crimping, taping and soldering operations on wires.
- Demonstrate the process of assembling wire harness components and apply proper techniques for recording assembly testing results in prescribed formats.
- Perform soldering and desoldering on components, inspect the assembled PCB and demonstrate basic diagnosis to enhance the entrepreneur skills.

### **Unit 1 Integrate 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, Connectors, Various types of connectors. 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 Cutting, Crimping, Connector and Bonding Assembly**

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 PCB Assembly Operations**

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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, PCB types, Soldering Tools, Soldering, handling the soldering iron, iron temperature, types of soldering, through-hole technology (THT), PTH, surface mount technology (SMT), and mixed technology, ESD, RoHS, Solder material.

### Unit 5 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, Reporting Structure, Introduction to 5 S.

### Suggested Readings:

Qualification Handbook: Wiring Harness Assembly Operator

Qualification Handbook: PCB Assembly Operator

Automotive harness Assembly, 3G e-learning

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: Wiring Harness Assembly Lab**  
**CODE: 24DECE06**  
**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
3	90	70	30	100

### 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.

### Learning Outcomes

- Describe the role and responsibilities of a Wiring Harness Assembly Operator and demonstrate the step-by-step process of assembling a wire harness.
- Employ various techniques for performing pre-assembly operations of the harness.
- Perform the crimping and taping operations on wires.
- Demonstrate the process of assembling wire harness components and apply proper techniques for recording assembly testing results in prescribed formats.
- 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

### SEMESTER-3

Subject: Linear Integrated Circuits  
Code: 24DECE09  
CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
2	60	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.

#### Learning Outcomes

- Design linear and non-linear applications of operational amplifiers (op-amps).
- Design applications using analog multipliers and Phase-Locked Loops (PLL) to enhance the entrepreneur skills.
- Design Analog-to-Digital Converters (ADC) and Digital-to-Analog Converters (DAC) using op-amps.
- Generate waveforms using op – amp circuits.
- 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,</li><li>• 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,</li><li>• Scale Changer,</li><li>• Phase Shift Circuits,</li><li>• Voltage Follower,</li><li>• V-to-I and I-to-V converters,</li></ul>

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		<ul style="list-style-type: none"> <li>• Summing, scaling and averaging Amplifier, Integrator, Differentiator</li> </ul>
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:** 24DECE10  
**CATEGORY:** General Education Component

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.

### Learning Outcomes

- Design linear and non-linear applications of operational amplifiers (op-amps).
- Design applications using analog multipliers and Phase-Locked Loops (PLL) to enhance the entrepreneur skills.
- Design Analog-to-Digital Converters (ADC) and Digital-to-Analog Converters (DAC) using op-amps.
- Generate waveforms using op – amp circuits.
- 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: Programmable Logic Controller**

**CODE: 24DECE11**

**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	15	35	50

### Objectives

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

### Learning Outcomes

- Understand the fundamental concepts of Programmable Logic Controllers (PLC).
- Demonstrate the working principles of a PLC.
- Understand and apply the instruction set of PLC to design related applications to enhance the entrepreneur skills.
- Perform ladder programming to design related applications to enhance the entrepreneur skills.
- Gain exposure to different applications of PLC, fostering entrepreneurial skills.

Unit	Topic	Key Learning
I	Introduction to PLC	<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	Working of PLC	<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	Instruction Set	<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>
IV	Ladder Diagram Programming	<ul style="list-style-type: none"><li>• Programming based on basic instructions,</li><li>• timer,</li><li>• counter,</li><li>• sequencer, and</li></ul>

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		<ul style="list-style-type: none"> <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: 24DECE12**

**CATEGORY: General Education Component**

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.

### Learning Outcomes

- Understand the fundamental concepts of Programmable Logic Controllers (PLC).
- Demonstrate the working principles of a PLC.
- Understand and apply the instruction set of PLC to design related applications to enhance the entrepreneur skills.
- Perform ladder programming to design related applications to enhance the entrepreneur skills.
- 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: Quality Management**  
**CODE: 24DMEE01**  
**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	30	70	100

**Objectives**

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

**Learning Outcomes**

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

Unit	Topic	Key Learning
I	<b>INTRODUCTION</b>	<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	<b>QUALITY PRINCIPLES, POLICIES, AWARDS AND FRAMEWORK</b>	<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	<b>QUALITY PLANNING, MONITORING AND GOVERNANCE</b>	<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	<b>QUALITY PROCESSES, TOOLS AND TERMINOLOGIES</b>	<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>

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V	<b>QUALITY SYSTEMS IN INDIA AND ABROAD</b>	<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> <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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**SUBJECT: Analog Electronics**  
**CODE: 24DECE13**  
**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	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.

### Learning Outcomes

- Design and analyze simple rectifiers and voltage regulators using diodes to enhance the entrepreneur skills.
- Design and analyze simple BJT and MOSFET circuits to enhance the entrepreneur skills.
- Analyze oscillator designs, perform frequency response calculations using mathematical expressions.
- Comprehend fundamental concepts in feedback amplifier circuits.
- Create circuit design analyses, 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: 24DECE14**

**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	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.

### Learning Outcomes

- Design and analyze simple rectifiers and voltage regulators using diodes to enhance the entrepreneur skills.
- Design and analyze simple BJT and MOSFET circuits to enhance the entrepreneur skills.
- Analyze oscillator designs, perform frequency response calculations using mathematical expressions.
- Comprehend fundamental concepts in feedback amplifier circuits.
- Create circuit design analyses, 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: Transducers and Signal Conditioning****CODE: 24DECE15****CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	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.

**Learning Outcomes**

- Understand the basics of Transducers and Signal Conditioning
- Explicate the construction and working of various industrial parameters / devices used to measure different parameters
- Analyse, formulate and select suitable transducer for the given industrial applications.
- Understand the principle of analog signal conditioning to design signal conditioning equipment.
- 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>
V	Digital signal conditioning	<ul style="list-style-type: none"> <li>• A/D conversion, D/A conversion</li> <li>• Multiplexer/ Demultiplexer</li> </ul>

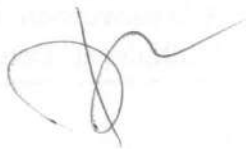
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	<ul style="list-style-type: none"><li>• Encoder/Decoder</li><li>• Sample and hold, Data Acquisition system (DAS)</li></ul>
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**Suggested Readings:**

- 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: Electronic Instruments and Measurement**  
**CODE: 24DECE16**  
**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	30	70	100

### Objectives

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

### Learning Outcomes

- Describe and demonstrate the specifications (accuracy, precision, sensitivity, resolution, range, errors, loading effects) of measuring instruments.
- Demonstrate the working principle of measuring instruments like multi-meter, CRO, DSO and measure the frequency, voltage, time period and phase
- Measure the loading effect of a multi-meter and describe the limitation of multi-meter for high frequency measurement.
- Learn the functioning, specification, and applications of signal analysing instruments such as logic pulser, logic analyzer and signature analyser.
- Measure various parameters using proper instruments without errors using CRO and DSO.

Unit	Topic	Key Learning
I	Basics of Measurements	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	Voltage, Current and Resistance Measurement	<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	Cathode Ray Oscilloscope	<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	Impedance Bridge Q Meters	<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: 24DECE17**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

**CATEGORY: Skill Education Component**

### Objectives

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

### Learning Outcomes

- Describe and demonstrate the specifications (accuracy, precision, sensitivity, resolution, range, errors, loading effects) of measuring instruments.
- Demonstrate the working principle of measuring instruments like multi-meter, CRO, DSO and measure the frequency, voltage, time period and phase
- Measure the loading effect of a multi-meter and describe the limitation of multi-meter for high frequency measurement.
- Learn the functioning, specification, and applications of signal analysing instruments such as logic pulser, logic analyzer and signature analyser.
- 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/NITTR.

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**SUBJECT:** PCB Assembly Lab  
**CODE:** 24DECE18  
**CATEGORY:** Skill Education Component

Credit	Hours	Marks		
		I	E	To
3	90	70	30	100

**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.

#### Learning Outcomes

- Utilize measuring instruments proficiently for the measurement of electrical quantities.
- Identify and employ various electronics components, recognize their symbols and footprints, along with understanding their specifications.
- Comprehend electronics circuits and PCB types, and demonstrate knowledge of component placement.
- Perform soldering and desoldering on electronics components.
- Inspect assembled PCB and perform basic diagnosis of faults, and rectify them.

#### List of Practicals

1. Identify & utilise the different types of meters for measuring AC & DC parameters.
2. Identify the different controls on the CRO 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.
12. Join the broken PCB track and test.
13. Inspect soldered joints, detect the defects and test the PCB for rework.
14. Identification and Soldering the SMD components on the PCB.
15. Make the necessary settings on SMD soldering station to solder various SMD Components.
16. Make the necessary setting rework of defective component used soldering /de-soldering method.
17. 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





IV	<b>Entrepreneurship Skills</b>	Entrepreneurship Skills: Business basics, Understanding business models, Basics of entrepreneurship Financial Literacy for Entrepreneurs: Budgeting and financial planning, Fundraising and investment basics
V	<b>Interview Skills</b>	Resume Building and Interview Skills: Crafting effective resumes, Interview preparation and techniques Job Search Strategies: Utilizing job portals, Networking for job opportunities

**Suggested Readings:**

"Employability Skills for the Future" by Imogen Bertin and Lisa LaRue

"Employability Skills: Brush Up Your Business Studies" by Lisa O'Donnell and Danielle Lyssimachou

Employability Skills, Student Workbook.

[https://bharatskills.gov.in/pdf/E\\_Books/CTS/ES/English/ES\\_60Hour\\_module\\_English.pdf](https://bharatskills.gov.in/pdf/E_Books/CTS/ES/English/ES_60Hour_module_English.pdf)

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**SUBJECT: Linear Control System**

**CODE: 24DECE19**

**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
2	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

### Learning Outcomes

- Analyze and enhance the system performance by selecting a suitable controller and a compensator for a specific application.
- Represent and formulate the mathematical model of the physical systems.
- Analyze the stability of closed and open loop systems.
- Design a system, component, or process to meet desired needs.
- 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><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></ul>

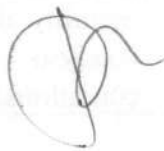
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		<ul style="list-style-type: none"> <li>• Routh Hurwitz Criterion: different cases and conditions</li> <li>• Root Locus</li> <li>• Bode Plotting using semi log graph paper</li> </ul>
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**Suggested Readings:**

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

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**SUBJECT: Signals and Systems**

**CODE: 24DECE20**

**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	15	35	50

### Objectives

This course deals with the basics of signals and systems analysis, different operations on discrete-time and continuous-time signals and study of different systems (linear, non-linear, time variant, time-invariant, stable and unstable systems).

### Learning Outcomes

- Understand and analyse the mathematical description and representation of continuous and discrete time signals and systems.
- Develop input-output relationships for linear shift-invariant systems and understand the convolution operator for continuous and discrete time systems.
- Understand and resolve signals in frequency domain using Fourier series and Fourier transforms.
- Demonstrates the effect of sampling in continuous-time signals and explain the application of sampling theorem in signal processing.
- Recognize the similarities and differences between the mathematical tools needed for dealing with continuous-time systems/signals versus their discrete-time counterparts.

Unit	Topic	Key Learning
I	TYPES OF SIGNALS	<ul style="list-style-type: none"><li>• Deterministic and Stochastic,</li><li>• periodic and aperiodic,</li><li>• impulse functional sequences,</li><li>• analog and discrete,</li><li>• singular functions.</li><li>• Signal representation in terms of singular functions,</li><li>• orthogonal functions and their use in signal representation.</li><li>• Fourier series, Fourier and Laplace transforms.</li><li>• Convolution theorem, geometrical interpretation and application.</li></ul>
II	PROBABILITY CONCEPTS	<ul style="list-style-type: none"><li>• Probability concepts,</li><li>• random variable,</li><li>• pdf, cdf, moments, distributions, correlation functions.</li><li>• characterization of stochastic signals.</li></ul>
III	DISCRETE SIGNALS	<ul style="list-style-type: none"><li>• Discretisation of analog signals – sampling, sampling theorem and its proof.</li><li>• Effect of under sampling,</li><li>• recovery of analog signals from sampled signal,</li><li>• characterization of discrete signals –in terms of impulse sequences,</li><li>• Z-transforms</li></ul>

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		<ul style="list-style-type: none"> <li>• Properties, inversion and applications of Laplace, Fourier and Z-transforms.</li> </ul>
IV	SYSTEM	<ul style="list-style-type: none"> <li>• Classification linear and non-linear, time invariant and time varying, Lumped and distributed.</li> <li>• Deterministic and Stochastic.</li> <li>• Casual and non-causal,</li> <li>• Analog and Discrete/Digital memory and memory less,</li> <li>• 1 – port and N – port,</li> <li>• SISO, SIMO, MISO, MIMO.</li> </ul>
V	SYSTEM MODELING	<ul style="list-style-type: none"> <li>• System modeling in terms of differential equations, state variables, difference equations and transfer functions.</li> <li>• Linear time invariant system properties,</li> <li>• elementary idea of response determination to deterministic and stochastic signals.</li> <li>• Concept of impulse response.</li> </ul>

**Suggested Readings:**

- Fred J Taylor –“Principles of Signals and System”, MGH.
- Simon Haykins – “Signal & Systems”, Wiley Eastern
- A Papoulis – “Circuit and System” Modern Approach HRW

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**SUBJECT: Signals and Systems Lab**

**CODE: 24DECE21**

**CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	35	15	50

### Objectives

This course deals with the basics of signals and systems analysis, different operations on discrete-time and continuous-time signals and study of different systems (linear, non-linear, time variant, time-invariant, stable and unstable systems).

### Learning Outcomes

- Understand and analyse the mathematical description and representation of continuous and discrete time signals and systems.
- Develop input-output relationships for linear shift-invariant systems and understand the convolution operator for continuous and discrete time systems.
- Understand and resolve signals in frequency domain using Fourier series and Fourier transforms.
- Demonstrates the effect of sampling in continuous-time signals and explain the application of sampling theorem in signal processing.
- Recognize the similarities and differences between the mathematical tools needed for dealing with continuous-time systems/signals versus their discrete-time counterparts.

### List of Experiments:

1. To familiarize with the MATLAB fundamentals and basic functions.
2. To familiarize with various commands/functions used in MATLAB.
3. To familiarize with various commands used for plotting 2D and 3D graphs in MATLAB.
4. To develop programs based on 2D and 3D graphics plotting in MATLAB.
5. Write a program for subplot that divides the current figure into rectangular panes that are numbered row wise.
6. To generate various types of signals:
  - a. Unit impulse
  - b. Unit Step
  - c. Unit Ramp
  - d. Exponential
7. To plot the following discrete-time signals in the range  $-10 \leq n \leq 10$ :
  - a.  $x(n) = u(n) - u(n - 3)$
  - b.  $x(n) = u(3 - n)$
  - c.  $x(n) = 0.5n [u(n) - u(n - 5)]$
  - d.  $x(n) = e^{jn}$

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e.  $x(n) = \cos(\pi n/2) \cos(\pi n/4)$

8. To develop program modules based on operation on sequences like signal shifting, signal folding, signal addition and signal multiplication.
9. Different operations on continuous time signals: Addition of two signals, Even and odd signals, Multiplication of signals, Subtraction of signals, Amplitude and time scaling of signals.
10. To check different properties of given systems: Causal and Non-causal Systems, Static (Memoryless) and Dynamic (with Memory) Systems, Linear and Nonlinear Systems, Time-Invariant and Time-Variant Systems.
11. Transformation of signals into time and frequency domain
12. To develop program for discrete convolution and correlation.
13. To develop program for computing inverse Z-transform.
14. To develop program for finding magnitude and phase response of LTI system described by system function  $H(z)$ .

**Suggested Readings:**

- Fred J Taylor – “Principles of Signals and System”, MGH.
- Simon Haykins – “Signal & Systems”, Wiley Eastern
- A Papoulis – “Circuit and System” Modern Approach HRW

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P2



**SUBJECT:** Microprocessors and Peripheral Devices  
**CODE:** 24DECE22  
**CATEGORY:** Skill Education Component

Credit	Hours	Marks		
		I	E	To
2	60	30	70	100

### Objectives

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

### Learning Outcomes

- Understand the organization of microcomputer system and compare the functionally and architectures of microprocessors.
- Understand the architecture of a microprocessor, including the addressing modes and instruction set of 8085.
- Analyze assembly language programming concepts.
- Understand interfacing techniques and apply them to interface commonly used peripheral devices.
- Design various programs to run several applications using 8085 and related microprocessors.

Unit	Topic	Key Learning
I	Evolution of Microprocessor	<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	Architecture of a Microprocessor (With reference to 8085 microprocessors)	<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	Instruction Timing and Cycles	<ul style="list-style-type: none"> <li>• Instruction cycle, machine cycle and T-states,</li> <li>• Fetch and execute cycle</li> </ul>
IV	Programming (with respect to 8085 microprocessor)	<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> </ul>

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		<ul style="list-style-type: none"> <li>• Arithmetic Group,</li> <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: Electrical Machines**  
**CODE: 24DELE01**  
**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	15	35	50

**Objectives**

- To will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc.
- To be competent to repair and maintain these machines and give suggestions to improve their performance and capable of performing various tests on the machines as per latest specifications.

**Learning Outcomes**

- Memorize fundamental principles and equations related to Stationary and rotating electrical machines, such as emf, torque, and power.
- Interpret diagrams and graphs related to the performance characteristics of electrical machines.
- Solve numerical problems involving the performance of electrical machines, such as calculating torque, power, efficiency, and losses.
- Evaluate the performance of electrical machines and identify factors affecting efficiency and losses.
- Compare and design innovative solutions for improving the efficiency, performance, or control of electrical machines.

Unit	Topic	Key Learning
I	Three Phase Supply	<ul style="list-style-type: none"> <li>• Advantage of three-phase system over single-phase system, Star Delta connections</li> <li>• Relation between phase and line voltage and current in a three-phase system</li> </ul>
II	Transformers	<ul style="list-style-type: none"> <li>• Principle of operation and constructional details of single-phase Transformer.</li> <li>• Voltage Regulation of a transformer, Losses in a transformer</li> <li>• Efficiency, condition for maximum efficiency and all-day efficiency</li> </ul>
III	Introduction to Rotating Electrical Machines	<ul style="list-style-type: none"> <li>• E.M.F induced in a coil rotating in a magnetic field</li> <li>• Definition of motor and generator</li> <li>• Basic principle of a generator and a motor</li> <li>• Torque due to alignment of two magnetic fields and the concept of Torque angle</li> <li>• Basic Electromagnetic laws (Faraday's laws of Electromagnetic Induction)</li> </ul>
IV	DC Machines	<ul style="list-style-type: none"> <li>• Principle of working of d.c motors and d.c generator, their constructional details.</li> </ul>

		<ul style="list-style-type: none"> <li>• Function of the commutator for motoring and generating action</li> <li>• Factors determining the speed of a DC motor</li> <li>• Different types of excitation</li> <li>• Characteristics of different types of DC machines</li> <li>• Starting of DC motors and starters</li> </ul>
V	A.C. Motors	<ul style="list-style-type: none"> <li>• Revolving magnetic field produced by poly phase supply</li> <li>• Brief introduction about three phase induction motors, its principle of operation</li> <li>• Principle and working of Synchronous Machines</li> <li>• Application of Synchronous Machines</li> </ul>

**Suggested Readings:**

- Electrical Machine by SK Bhattacharya, Tata McGraw Hill Education Pvt Ltd, New Delhi
- Electrical Machines by Nagrath and Kothari, Tata McGraw Hill Education Pvt Ltd, New Delhi
- Experiments in Basic Electrical Engineering: by S.K. Bhattacharya, KM Rastogi: New Age International (P) Ltd. Publishers, New Delhi
- Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
- Electrical Engineering by JB Gupta, SK Kataria & Sons, New Delhi

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**SUBJECT: Electrical Machines Lab**  
**CODE: 24DELE02**  
**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	35	15	50

### Objectives

- To will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc.
- To be competent to repair and maintain these machines and give suggestions to improve their performance and capable of performing various tests on the machines as per latest specifications.

### Learning Outcomes

- Memorize fundamental principles and equations related to Stationary and rotating electrical machines, such as emf, torque, and power.
- Interpret diagrams and graphs related to the performance characteristics of electrical machines.
- Solve numerical problems involving the performance of electrical machines, such as calculating torque, power, efficiency, and losses.
- Evaluate the performance of electrical machines and identify factors affecting efficiency and losses.
- Compare and design innovative solutions for improving the efficiency, performance, or control of electrical machines.

### List of Practicals

1. To study the Operating Characteristics of DC Series Motor.
2. To study & verify Speed Control of DC Series Motor.
3. To study and obtain the losses and efficiency of a DC Shunt Generator.
4. To study & verify Load Characteristics of DC Compound Motor.
5. To study & verify Characteristics of DC Shunt Generator.
6. To Study the characteristic of DC Series Generator.
7. To study the Running and Reversing Phenomenon in a Three Phase Induction Motor.
8. To study No Load and Block rotor Test in a Three phase Induction Motor.
9. To Study the Slip Test in Induction Motor.
10. Speed control of Self Excited DC Shunt Motor by Flux Field Current Control Method.
11. Study and obtain the efficiency of Self Excited DC Shunt Motor.
12. To Study Single-Phase Step up and Step-down transformer.
13. To Study and obtain efficiency through Open Circuit test and short circuit test of Single-Phase Transformer.

### Suggested Readings:

- Electrical Machine by SK Bhattacharya, Tata McGraw Hill Education Pvt Ltd, New Delhi
- Electrical Machines by Nagrath and Kothari, Tata McGraw Hill Education Pvt Ltd, New Delhi

- Experiments in Basic Electrical Engineering: by S.K. Bhattacharya, KM Rastogi: New Age International (P) Ltd. Publishers, New Delhi
- Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
- Electrical Engineering by JB Gupta, SK Kataria & Sons, New Delhi

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**SUBJECT: Spreadsheet Modeling Lab**  
**CODE: 24DCSE03**  
**CATEGORY: Skill Education Component**

Credit	Hours	Marks		
		I	E	To
2	60	35	15	50

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

### Learning Outcomes

- Work with spreadsheets and save them in different formats for developing proper formats.
- Create mathematical and logical formulas using standard spreadsheet functions.
- Choose, create and format charts to communicate information meaningfully.
- Work with tables and lists to analyze, filter and sort data to analyze the results for different data sets.
- 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.

Nitin Singh

Chairperson  
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