SYLLABUS

FOR

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL ENGINEERING

Semester III to Semester VIII

DEPARTMENT OF ELECTRICAL ENGINEERING

UNIVERSITY OF KASHMIR

SRINAGAR

JULY – 2025

(Applicable to Batch 2025 & Onwards)

B.Tech. in Electrical Engineering

Programme Learning Outcomes (PLOs)

1. Engineering Knowledge: Apply knowledge of mathematics, science, and electrical engineering fundamentals to solve complex problems in power, control, and energy systems.

2. Problem Analysis: Identify and analyze electrical engineering problems using principles of circuit theory, electronics, power systems, and electromagnetic fields.

3. Design/Development of Solutions: Design electrical systems and components such as control circuits, machines, and energy systems considering safety, environment, and economic constraints.

4. Investigation of Complex Problems: Conduct experiments and investigations to analyze performance characteristics of electrical systems and interpret results using modern methods.

5. Modern Tool Usage: Use modern engineering tools such as Python, MATLAB, PSpice, PLCs, SCADA, and simulation software to model and analyze electrical systems.

6. The Engineer and Society: Apply contextual knowledge to assess social, health, legal, and cultural issues relevant to electrical system deployment and use.

7. Environment and Sustainability: Understand the impact of electrical engineering solutions in environmental and societal contexts and promote sustainable practices.

8. Ethics: Apply ethical principles and commit to professional responsibilities in electrical engineering practice.

9. Individual and Team Work: Function effectively as an individual and as a team member or leader in multidisciplinary environments.

10. Communication: Communicate effectively through technical reports, documentation, presentations, and drawings.

11. Project Management and Finance: Apply engineering and management principles for planning and executing electrical engineering projects within budget and time constraints.

12. Innovation, Entrepreneurship and Life-long Learning: Exhibit an innovative mindset and entrepreneurial skills for technology development or engage in lifelong learning to adapt to technological changes in electrical engineering and energy systems.

Accreditation Alignment

- The program is designed in accordance with NEP, AICTE, and NBA guidelines.
- Programme Learning Outcomes (POs) align with Washington Accord Competencies for Engineering Graduates.
- Courses incorporate UPSC and GATE syllabus alignment for research and higher education opportunities.

Course Code Formula

Position	1	2	3	4	5	6	7	8	9	10
Indicator	B	E	L	E	–	–	–	–	2	5

Example — BELECNA325 = Network Analysis, Semester III, Batch 2025

Digit Description

Digit	Description
1	Bachelor's Programme
2-4	Programme Code: Electrical Engineering = ELE
5	Indicator Alphabet in Course Code
6-7	Course Title
8	Semester (1 to 8)
9-10	Year of Launch

Indicator Alphabet

Indicator Alphabet	Description
H	Humanities & Social Science Course
B	Basic Science Course
E	Engineering Science Course
C	Programme Core Course
D	Programme Elective Course
O	Open Elective Course
L	Laboratory Course
P	Project/Internship
Y	Seminar
A	Audit Course

Examination Code

Examination Code	Description
MSE	Mid Semester Evaluation
IA	Internal Assessment
CIE	Continuous Internal Evaluation = MSE + IA
SEE	Semester End Evaluation

Examination Pattern

Semester-end Examination (SEE)

Section	No of questions	Marks	Sectional Marks
A	10	1	10
B	5	4	20
C	2 out of 5 (1 from each unit)	10	20
Total			50

Mid-term (MSE)

Section	No of questions	Marks	Sectional Marks
A	10	1	10
B	3	5	15
C	1 out of 2 (from unit 1 & 2)	10	10
Total			35

SCHOOL OF ENGINEERING, UNIVERSITY OF KASHMIR

Course Structure of B.Tech. Programme in Electrical Engineering (Semester III – VIII)

S.No	Course Code	Category	Course Title	L	T	P	Total	Credits
Semester III								
1	BELEBMT325	Basic Science Course	Engineering Mathematics–III	2	1	0	3	3
2	BELECNA325	Professional Core Course	Network Analysis	2	1	2	5	4
3	BELECAC325	Professional Core Course	Analog Electronic Circuits	2	1	2	5	4
4	BELECSS325	Professional Core Course	Signals and Systems	2	1	0	3	3
5	BELECEM325	Professional Core Course	Electrical Machines–I	2	1	2	5	4
6	BELELMX325	Laboratory Course	Introduction to Matrix Programming	1	0	2	3	2
TOTAL				**11**	**5**	**8**	**24**	**20**
Semester IV								
1	BELECDE425	Professional Core Course	Digital Electronics	2	1	2	5	4
2	BELECCS425	Professional Core Course	Control Systems	2	1	2	5	4
3	BELECME425	Professional Core Course	Electrical Measurement	2	1	2	5	4
4	BELECNC425	Professional Core Course	Non Conventional Energy Sources	1	1	0	2	2
5	BELECEM425	Professional Core Course	Electrical Machines–II	2	1	2	5	4
6	BELELPY425	Laboratory Course	Introduction to Python	1	0	2	3	2
TOTAL				**10**	**5**	**10**	**25**	**20**
Semester V								
1	BELECPS525	Professional Core Course	Power Systems – I	2	1	2	5	4
2	BELECPE525	Professional Core Course	Power Electronics	2	1	2	5	4
3	BELECPP525	Professional Core Course	Power Station Practices	2	1	0	3	3
4	BELECED525	Professional Core Course	Electric Drives & Control	2	1	2	5	4
5	BELEEMC525	Professional Core Course	Microprocessors	2	1	2	5	4
6	BELEPIT525	Internship	Industrial Training	0	0	2	2	1
TOTAL				**10**	**5**	**10**	**25**	**20**
Semester VI								
1	BELECPS625	Professional Core Course	Power Systems – II	2	1	2	5	4
2	BELECPG625	Professional Core Course	Power System Protection & Switchgear	2	1	2	5	4
3	BELECAE625	Professional Core Course	Advanced Power Electronics	2	1	2	5	4
4	BELED**625	Professional Elective Course	Professional Elective – I	2	1	0	3	3
5	BELEO**625	Open Elective Course	Open Elective - I	1	1	0	2	2
6	BELELES625	Laboratory Course	Embedded Systems	1	1	2	4	3
TOTAL				**10**	**6**	**8**	**24**	**20**
Semester VII								
1	BELECPA725	Professional Core Course	Power System Analysis	2	1	2	5	4
2	BELECEV725	Professional Core Course	Electric Vehicles	2	1	2	5	4
3	BELEDSC725	Professional Core Course	SCADA Systems	2	1	0	3	3
4	BELED**725	Professional Elective Course	Professional Elective – II	2	1	0	3	3
5	BELEO**725	Open Elective Course	Open Elective – II	2	1	0	3	3
6	BELEPMP725	Project	Minor Project	0	0	6	6	3
TOTAL				**10**	**5**	**10**	**25**	**20**
Semester VIII								
1	BELED**825	Professional Elective Course	Professional Elective – III	2	1	0	3	3
2	BELED**825	Professional Elective Course	Professional Elective – IV	2	1	0	3	3
3	BELEO**825	Open Elective Course	Open Elective -III	1	1	0	2	2
4	BELEPMP825	Project	Major Project	0	0	24	24	12
TOTAL				**5**	**3**	**24**	**32**	**20**

List of Professional Electives

S.No	Elective / Semester	Course Title	Course Code
1	**Professional Elective – I** *Semester VI*	Advanced Control Systems	BELEDAC625
2	**Professional Elective – I** *Semester VI*	Power Quality	BELEDPQ625
3	**Professional Elective – I** *Semester VI*	Design of Photovoltaic Systems	BELEDPV625
4	**Professional Elective – I** *Semester VI*	Electrical Machine Design	BELEDMD625
5	**Professional Elective – I** *Semester VI*	Electrical Materials	BELEDMA625
6	**Professional Elective – II** *Semester VII*	Power Plant Engineering	BELEDPP725
7	**Professional Elective – II** *Semester VII*	Optimization for Engineering Design	BELEDOE725
8	**Professional Elective – II** *Semester VII*	Energy Storage Systems	BELEDES725
9	**Professional Elective – II** *Semester VII*	Special Electrical Machines	BELEDSM725
10	**Professional Elective – II** *Semester VII*	High Voltage Engineering	BELEDHV725
11	**Professional Elective – III** *Semester VIII*	Smart Grid	BELEDSG825
12	**Professional Elective – III** *Semester VIII*	Distribution System Modelling & Analysis	BELEDDM825
13	**Professional Elective – III** *Semester VIII*	Microgrids and Distributed Generation	BELEDMG825
14	**Professional Elective – III** *Semester VIII*	FACTS	BELEDFS825
15	**Professional Elective – III** *Semester VIII*	Optimal Control	BELEDOC825
16	**Professional Elective – IV** *Semester VIII*	HVDC Transmission	BELEDHV825
17	**Professional Elective – IV** *Semester VIII*	Fuzzy Logic and Neural Networks	BELEDFL825
18	**Professional Elective – IV** *Semester VIII*	Restructuring of Power Systems	BELEDRP825
19	**Professional Elective – IV** *Semester VIII*	Utilization and Traction	BELEDUT825
20	**Professional Elective – IV** *Semester VIII*	Insulation Engineering and Diagnostics	BELEDIE825

List of Open Electives

S.No	Elective / Semester	Course Title	Course Code
1	**Open Elective – I** *Semester VI*	Communication Systems	BELEOCS625
2	**Open Elective – I** *Semester VI*	Thermal Engineering	BELEOTE625
3	**Open Elective – I** *Semester VI*	Energy Audit and Management	BELEOEA625
4	**Open Elective – II** *Semester VII*	Digital Signal Processing	BELEODS725
5	**Open Elective – II** *Semester VII*	Energy Management in Buildings	BELEOEB725
6	**Open Elective – II** *Semester VII*	Internet of Things for Engineers	BELEOIT725
7	**Open Elective – III** *Semester VIII*	Artificial Intelligence Applications in Engineering	BELEOAI825
8	**Open Elective – III** *Semester VIII*	Electrical Safety and Energy Conservation	BELEOSC825
9	**Open Elective – III** *Semester VIII*	Organisation of Engineering Systems and Human Resource Management	BELEOHR825

Average Course-wise Mapping of Programme Learning Outcomes

Semester III — Average Course-wise Mapping of Programme Learning Outcomes

S.No	Course Code	Course Title	Average Programme Learning Outcome (PLO) Score												Cum. Avg
			1	2	3	4	5	6	7	8	9	10	11	12	
1	BELEBMT325	Engineering Mathematics–III	3.0	2.8	1.6	1.2	1.2	0.2	0.4	0.0	0.4	0.8	0.2	1.4	**1.10**
2	BELECNA325	Network Analysis	3.0	2.8	2.2	2.0	2.0	0.2	0.6	0.0	0.8	1.0	0.2	1.8	**1.38**
3	BELECAC325	Analog Electronic Circuits	3.0	2.8	2.2	2.0	2.0	0.2	0.6	0.0	0.8	1.0	0.2	1.8	**1.38**
4	BELECSS325	Signals and Systems	3.0	2.8	1.6	1.2	1.2	0.2	0.4	0.0	0.4	0.8	0.2	1.4	**1.10**
5	BELECEM325	Electrical Machines–I	3.0	2.8	2.2	2.0	2.0	0.2	0.6	0.0	0.8	1.0	0.2	1.8	**1.38**
6	BELELMX325	Introduction to Matrix Programming	2.2	2.0	2.2	1.8	2.6	0.2	0.4	0.0	1.2	1.0	0.4	2.0	**1.33**
		Avg PLO	**2.9**	**2.7**	**2.0**	**1.7**	**1.8**	**0.2**	**0.5**	**0.0**	**0.7**	**0.9**	**0.2**	**1.7**	**1.27**

Semester IV — Average Course-wise Mapping of Programme Learning Outcomes

S.No	Course Code	Course Title	Average Programme Learning Outcome (PLO) Score												Cum. Avg
			1	2	3	4	5	6	7	8	9	10	11	12	
1	BELECDE425	Digital Electronics	3.0	2.8	2.2	2.0	2.0	0.2	0.6	0.0	0.8	1.0	0.2	1.8	**1.38**
2	BELECCS425	Control Systems	3.0	2.8	2.2	2.0	2.0	0.2	0.6	0.0	0.8	1.0	0.2	1.8	**1.38**
3	BELECME425	Electrical Measurement	3.0	2.8	2.2	2.0	2.0	0.2	0.6	0.0	0.8	1.0	0.2	1.8	**1.38**
4	BELECNC425	Non Conventional Energy Sources	2.6	2.4	2.2	1.8	1.8	2.0	2.4	0.4	0.8	1.0	0.6	2.2	**1.68**
5	BELECEM425	Electrical Machines–II	3.0	2.8	2.2	2.0	2.0	0.2	0.6	0.0	0.8	1.0	0.2	1.8	**1.38**
6	BELELPY425	Introduction to Python	2.2	2.0	2.2	1.8	2.6	0.2	0.4	0.0	1.2	1.0	0.4	2.0	**1.33**
		Avg PLO	**2.8**	**2.6**	**2.2**	**1.9**	**2.1**	**0.5**	**0.9**	**0.1**	**0.9**	**1.0**	**0.3**	**1.9**	**1.43**

Semester V — Average Course-wise Mapping of Programme Learning Outcomes

S.No	Course Code	Course Title	Average Programme Learning Outcome (PLO) Score												Cum. Avg
			1	2	3	4	5	6	7	8	9	10	11	12	
1	BELECPS525	Power Systems – I	2.8	2.6	2.0	1.8	1.8	1.4	1.6	0.2	0.6	1.0	0.4	1.8	**1.50**
2	BELECPE525	Power Electronics	3.0	2.8	2.2	2.0	2.0	0.2	0.6	0.0	0.8	1.0	0.2	1.8	**1.38**
3	BELECPP525	Power Station Practices	2.8	2.6	2.0	1.8	1.8	1.4	1.6	0.2	0.6	1.0	0.4	1.8	**1.50**
4	BELECED525	Electric Drives & Control	3.0	2.8	2.2	2.0	2.0	0.2	0.6	0.0	0.8	1.0	0.2	1.8	**1.38**
5	BELEEMC525	Microprocessors	2.6	2.4	2.2	2.0	2.4	0.2	0.4	0.0	1.0	1.0	0.4	2.0	**1.38**
6	BELEPIT525	Industrial Training	1.4	1.4	1.6	1.8	1.4	1.6	1.0	0.8	2.4	2.2	1.6	2.0	**1.60**
		Avg PLO	**2.6**	**2.4**	**2.0**	**1.9**	**1.9**	**0.8**	**1.0**	**0.2**	**1.0**	**1.2**	**0.5**	**1.9**	**1.45**

Semester VI — Average Course-wise Mapping of Programme Learning Outcomes

S.No	Course Code	Course Title	Average Programme Learning Outcome (PLO) Score												Cum. Avg
			1	2	3	4	5	6	7	8	9	10	11	12	
1	BELECPS625	Power Systems – II	2.8	2.6	2.0	1.8	1.8	1.4	1.6	0.2	0.6	1.0	0.4	1.8	1.50
2	BELECPG625	Power System Protection & Switchgear	2.8	2.6	2.0	1.8	1.8	1.4	1.6	0.2	0.6	1.0	0.4	1.8	1.50
3	BELECAE625	Advanced Power Electronics	3.0	2.8	2.2	2.0	2.0	0.2	0.6	0.0	0.8	1.0	0.2	1.8	1.38
4	BELED**625	Professional Elective – I	2.6	2.4	1.8	1.2	1.4	0.6	0.8	0.2	0.6	1.0	0.4	1.8	1.23
5	BELEO**625	Open Elective - I	2.6	2.4	1.8	1.2	1.4	0.6	0.8	0.2	0.6	1.0	0.4	1.8	1.23
6	BELELES625	Embedded Systems	2.2	2.0	2.2	1.8	2.6	0.2	0.4	0.0	1.2	1.0	0.4	2.0	1.33
Avg PLO			2.7	2.5	2.0	1.6	1.8	0.7	1.0	0.1	0.7	1.0	0.4	1.8	1.36

Semester VII — Average Course-wise Mapping of Programme Learning Outcomes

S.No	Course Code	Course Title	Average Programme Learning Outcome (PLO) Score												Cum. Avg
			1	2	3	4	5	6	7	8	9	10	11	12	
1	BELECPA725	Power System Analysis	2.8	2.6	2.0	1.8	1.8	1.4	1.6	0.2	0.6	1.0	0.4	1.8	1.50
2	BELECEV725	Electric Vehicles	2.6	2.4	2.2	1.8	1.8	2.0	2.4	0.4	0.8	1.0	0.6	2.2	1.68
3	BELEDSC725	SCADA Systems	2.6	2.4	1.8	1.2	1.4	0.6	0.8	0.2	0.6	1.0	0.4	1.8	1.23
4	BELED**725	Professional Elective – II	2.6	2.4	1.8	1.2	1.4	0.6	0.8	0.2	0.6	1.0	0.4	1.8	1.23
5	BELEO**725	Open Elective – II	2.6	2.4	1.8	1.2	1.4	0.6	0.8	0.2	0.6	1.0	0.4	1.8	1.23
6	BELEPMP725	Minor Project	2.0	2.2	2.4	2.2	2.0	1.2	1.0	0.6	2.2	2.4	2.0	2.2	1.87
Avg PLO			2.5	2.4	2.0	1.6	1.6	1.1	1.2	0.3	0.9	1.2	0.7	1.9	1.45

Semester VIII — Average Course-wise Mapping of Programme Learning Outcomes

S.No	Course Code	Course Title	Average Programme Learning Outcome (PLO) Score												Cum. Avg
			1	2	3	4	5	6	7	8	9	10	11	12	
1	BELED**825	Professional Elective – III	2.6	2.4	1.8	1.2	1.4	0.6	0.8	0.2	0.6	1.0	0.4	1.8	1.23
2	BELED**825	Professional Elective – IV	2.6	2.4	1.8	1.2	1.4	0.6	0.8	0.2	0.6	1.0	0.4	1.8	1.23
3	BELEO**825	Open Elective -III	2.6	2.4	1.8	1.2	1.4	0.6	0.8	0.2	0.6	1.0	0.4	1.8	1.23
4	BELEPMP825	Major Project	2.2	2.4	2.8	2.6	2.4	1.6	1.2	0.8	2.6	2.8	2.6	2.6	2.22
Avg PLO			2.5	2.4	2.0	1.5	1.6	0.8	0.9	0.4	1.1	1.4	1.0	2.0	1.47

Semester III Marks Distribution Scheme

S.No.	Course Code	Course Title	Hours per week (L T P Tot)	Credits	Course Type	Mid-Term Theory (15 CA + 35 Exam)	Mid-Term Lab (15 CA + 35 Exam)	Mid-Term (Total)	End-Term Theory	End-Term Lab	End-Term (Total)	Maximum Marks
1	BELEBMT325	Engineering Mathematics-III	2 1 0 3	3	Theory	50	0	50	50	0	50	100
2	BELECNA325	Network Analysis	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
3	BELECAC325	Analog Electronic Circuits	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
4	BELECSS325	Signals and Systems	2 1 0 3	3	Theory	50	0	50	50	0	50	100
5	BELECEM325	Electrical Machines-I	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
6	BELELMX325	Introduction to Matrix Programming	1 0 2 3	2	Theory & Lab	50	50	100	50	50	100	200

Semester IV Marks Distribution Scheme

S.No.	Course Code	Course Title	Hours per week (L T P Tot)	Credits	Course Type	Mid-Term Theory (15 CA + 35 Exam)	Mid-Term Lab (15 CA + 35 Exam)	Mid-Term (Total)	End-Term Theory	End-Term Lab	End-Term (Total)	Maximum Marks
1	BELECDE425	Digital Electronics	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
2	BELECCS425	Control Systems	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
3	BELECME425	Electrical Measurement	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
4	BELECNC425	Non Conventional Energy Sources	1 1 0 2	2	Theory	50	0	50	50	0	50	100
5	BELECEM425	Electrical Machines-II	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
6	BELELPY425	Introduction to Python	1 0 2 3	2	Theory & Lab	50	50	100	50	50	100	200

Semester V Marks Distribution Scheme

S.No.	Course Code	Course Title	Hours per week (L T P Tot)	Credits	Course Type	Mid-Term Theory (15 CA + 35 Exam)	Mid-Term Lab (15 CA + 35 Exam)	Mid-Term (Total)	End-Term Theory	End-Term Lab	End-Term (Total)	Maximum Marks
1	BELECPS525	Power Systems - I	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
2	BELECPE525	Power Electronics	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
3	BELECPP525	Power Station Practices	2 1 0 3	3	Theory	50	0	50	50	0	50	100
4	BELECED525	Electric Drives & Control	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
5	BELEEMC525	Microprocessors	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
6	BELEPIT525	Industrial Training	0 0 2 2	1	Lab	0	50	50	0	50	50	100

Semester VI Marks Distribution Scheme

S.No.	Course Code	Course Title	Hours per week (L T P Tot)	Credits	Course Type	Mid-Term Theory (15 CA + 35 Exam)	Mid-Term Lab (15 CA + 35 Exam)	Mid-Term (Total)	End-Term Theory	End-Term Lab	End-Term (Total)	Maximum Marks
1	BELECPS625	Power Systems - II	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
2	BELECPG625	Power System Protection & Switchgear	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
3	BELECAE625	Advanced Power Electronics	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
4	BELED**625	Professional Elective - I	2 1 0 3	3	Theory	50	0	50	50	0	50	100
5	BELEO**625	Open Elective - I	1 1 0 2	2	Theory	50	0	50	50	0	50	100
6	BELELES625	Embedded Systems	1 1 2 4	3	Theory & Lab	50	50	100	50	50	100	200

Semester VII Marks Distribution Scheme

S.No.	Course Code	Course Title	Hours per week (L T P Tot)	Credits	Course Type	Mid-Term Theory (15 CA + 35 Exam)	Mid-Term Lab (15 CA + 35 Exam)	Mid-Term (Total)	End-Term Theory	End-Term Lab	End-Term (Total)	Maximum Marks
1	BELECPA725	Power System Analysis	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
2	BELECEV725	Electric Vehicles	2 1 2 5	4	Theory & Lab	50	50	100	50	50	100	200
3	BELEDSC725	SCADA Systems	2 1 0 3	3	Theory	50	0	50	50	0	50	100
4	BELED**725	Professional Elective - II	2 1 0 3	3	Theory	50	0	50	50	0	50	100
5	BELEO**725	Open Elective - II	2 1 0 3	3	Theory	50	0	50	50	0	50	100
6	BELEPMP725	Minor Project	0 0 6 6	3	Lab	0	50	50	0	50	50	100

Semester VIII Marks Distribution Scheme

S.No.	Course Code	Course Title	Hours per week (L T P Tot)	Credits	Course Type	Mid-Term Theory (15 CA + 35 Exam)	Mid-Term Lab (15 CA + 35 Exam)	Mid-Term (Total)	End-Term Theory	End-Term Lab	End-Term (Total)	Maximum Marks
1	BELED**825	Professional Elective - III	2 1 0 3	3	Theory	50	0	50	50	0	50	100
2	BELED**825	Professional Elective - IV	2 1 0 3	3	Theory	50	0	50	50	0	50	100
3	BELEO**825	Open Elective - III	1 1 0 2	2	Theory	50	0	50	50	0	50	100
4	BELEPMP825	Major Project	0 0 24 24	12	Lab	0	50	50	0	50	50	100

Semester III

Course Code	*BELEBMT325*				*Semester*	*Semester III*	
Course Title	**Engineering Mathematics–III**					*Max marks*	
Scheme & Credits	*Hours Per Week*				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
	2	*1*	*0*	*3*	*3*	*100*	
Prerequisites	*Nil*					***100***	

Course Learning Outcomes (CLOs)

CLO1	Understand the Laplace transform and its properties.
CLO2	Apply the Laplace and inverse Laplace transformations to solve problems described by linear ODEs
CLO3	Understand the Fourier Transforms and its applications
CLO4	Understand the Z-Transforms for discrete systems
CLO5	Apply Z-transforms and its inverse for solving difference equations

Syllabus

Units	**Content**
1	Laplace Transforms: Definition of Laplace Transforms, Properties of Laplace Transforms, Laplace Transforms of standard inputs, Initial and Final value theorems
2	Inverse Laplace Transforms: Definition of Inverse Laplace Transforms, Convolution theorem and applications, use of Laplace Transforms in the solution of linear Differential equations.
3	Fourier Transform: Fourier series, Harmonic analysis, Definition of Fourier transform. Fourier sine and cosine transform. Fourier integral formula, Applications to solutions of boundary value problems.
4	Z- Transform: Definition, Linearity property, Z- transform of elementary functions, shifting theorems. Initial and Final value theorem. Convolution theorem.
5	Inverse Z-Transforms: Definition of Inverse Z-transforms, Finding the inverse operator using various methods, using the inverse Z-transforms to solve difference equations

CLO-PLO Mapping Matrix

CLO/PLO	**PLO1**	**PLO2**	**PLO3**	**PLO 4**	**PLO 5**	**PLO 6**	**PLO7**	**PLO 8**	**PLO 9**	**PLO10**	**PLO11**	**PLO12**	**Avg CLO**
CLO1	3	2	1	1	1	0	0	0	0	1	0	2	0.9166666667
CLO2	3	3	1	1	1	0	0	0	0	1	0	2	1
CLO3	3	3	2	2	1	0	1	0	0	1	0	2	1.25
CLO4	3	3	2	2	1	0	1	0	0	1	0	2	1.25
CLO5	3	3	2	2	1	0	1	0	0	1	0	2	1.25
Avg PLO	**3**	**2.8**	**1.6**	**1.6**	**1**	**0**	**0.6**	**0**	**0**	**1**	**0**	**2**	1.133333333

Suggested Reading

1	Erwin Kreyzing, Advanced Engineering Mathematics, 10th edition, Wiley Eastern Publications, 2020.
2	H. K. Das, Higher Engineering Mathematics, S. Chand
3	Murray R. Speigal, Laplace Transforms, Shaum's outlines, Mc-Graw Hill, 1965

Teaching-Learning Strategies

Interactive lectures integrating theory with demo sessions.
Case-based learning supported by seminars and discussion of real-world applications.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	NA

Course Code	*BELECNA325*				*Semester*	*Semester III*		
Course Title	Network Analysis					*Max marks*		
Scheme & Credits	*Hours Per Week*				*Credits*	*Theory*	*Practical*	
	L	*T*	*P*	*Total*				
	2	*1*	*2*	*5*	*4*	*100*	*100*	
Prerequisites	*Nil*					*200*		

Course Learning Outcomes (CLOs)

CLO1	Recall and explain the basic network theorems, describe the Laplace transformation properties and their application in solving network problems.
CLO2	Demonstrate an understanding of differential equations and their role in analyzing electrical circuits. Interpret the time domain behavior of circuits using pole-zero plots derived from network functions
CLO3	Apply the knowledge of network theorems and impedance functions to analyze and solve complex electrical circuits.
CLO4	Analyze synthesis problems and formulate strategies using positive real functions and Hurwitz polynomials.
CLO5	Synthesize LC and RC circuits with desired specifications, considering filter design principles. Synthesize constant K & m derived filters to meet specific frequency response requirements

Syllabus

Units	**Content**
1	Differential equation moddeling of networks: Review of the basic network theorems. First order differential equation: Differential equations as applied in solving networks, Application of initial conditions, Evaluating initial conditions in networks, Laplace Transformation properties, Solution of Network problems with Laplace transformation, Waveform analysis, and synthesis: The unit step, ramp, and impulse functions and their Laplace transforms, Initial and final value of f(t) from F(s), Convolution integral, convolution as summation
2	DC Circuit Analysis:Introduction, Star -Delta Transformation, Loop and Nodal methods of circuit analysis, Superposition theorem, Thevenin's and Norton's theorems, Maximum Power Theorem, Millmans Theorem, Tellegans Theorem, Reciprocity theorem, Substitution Theorem,
3	AC Circuit Analysis: Phasor and complex number representation, solutions of sinusoidally excited RLC circuits, Power and energy relations in A.C. circuits, Series and parallel AC circuits(RL,RC,RLC), Applications of network theorems to A.C. circuits, Power factor and its improvement, Concepts of active & reactive powers. Resonance in series and parallel circuits, Steady State A.C 3-phases Circuits: Concept of a 3-phase voltage, wye (Y) circuits. Delta (Δ) circuits, Current and voltage relations in Y and Δ Circuits, Characteristics of a 3-phase system
4	Two-port parameters: Introduction to two-port parameters - motivating real-world examples, Admittance, impedance, transmission, and hybrid parameters, Relationship between parameter sets, Parallel connection of two port Networks, Characteristics impedance of two-port networks
5	Filter fundamentals: Introduction to filters and motivating real-world examples, pass and stop band, filter classification based on their frequency characteristics, constant K & m derived filters, the behavior of characteristic impedance overpass & stop bands, design of filters, trade-offs between filter characteristics such as cutoff frequency and selectivity. Introduction to active filters, Practical applications of both passive and active filters in communication systems, audio engineering, and signal processing.

EXPERIMENTS

1	To study and verify Thevenin's Theorem.
2	To study and verify Norton's Theorem.
3	To study and verify Maximum Power Transfer Theorem.
4	To study and verify Superposition Theorem.
5	To plot the resonance curve for series and parallel resonance in circuits.
6	To study the Star-Delta interconnections.
7	To measure power factor and AC power in single-phase circuits with different linear load combinations.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	1	1	0	0	0	0	1	0	2	0.9166666667
CLO2	3	3	1	1	1	0	0	0	0	1	0	2	1
CLO3	3	3	2	2	1	0	1	0	0	1	0	2	1.25
CLO4	3	3	2	2	1	0	1	0	0	1	0	2	1.25
CLO5	3	3	2	2	1	0	1	0	0	1	0	2	1.25
Avg PLO	3	2.8	1.6	1.6	1	0	0.6	0	0	1	0	2	1.133333333

Suggested Reading

1	C. L. Van Valkenberg, Network Analysis, 3rd ed. Prentice-Hall,1959.
2	F. Kuo, Network Analysis & Synthesis, 2nd ed. Wiley, 2006.
3	A. Chakrabarti, "Circuit Theory (Analysis & Synthesis)," 7th edition, Dhanpat Rai & Co

Teaching-Learning Strategies

Interactive lectures integrating theory with demo sessions.
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Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Aasish Aheen

Course Code	*BELECAC325*				*Semester*	*Semester III*		
Course Title	**Analog Electronic Circuits**					*Max marks*		
Scheme & Credits	*Hours Per Week*				*Credits*	*Theory*		*Practical*
	L	*T*	*P*	*Total*				
	2	*1*	*2*	*5*	*4*	*100*		*100*
Prerequisites	*Nil*					**200**		

Course Learning Outcomes (CLOs)

CLO1	Understand the linear and switch mode power supplies, basic rectifier circuits along with the filters and regulators
CLO2	Learn about various power amplifier configurations and to analyze and design various power amplifier circuits for specific applications
CLO3	Understand the concept of feedback in electronic circuits and to design and analyze different oscillator circuits
CLO4	Learn and understand the OPAMP, its characteristics, and various applications.
CLO5	Design and analyze various filter circuits using OPAMP, have a basic understanding of comparators, Schmitt triggers, and multi-vibrators.

Syllabus

Units	Content
1	Linear and Switch Mode Power Supplies: Constituents of a linear power supply, designing main transformer, Half wave and full wave rectifier circuits and their characteristic parameters, Filters: inductor filter, capacitive filter, LC filter, CLC filter, Regulators, Switch mode power supplies, Buck and boost regulators.
2	Power Amplifiers: Introduction- definitions and amplifier types, series fed class A amplifier. Transformer-coupled class A amplifier, Class B amplifiers, transformer-coupled push-pull amplifier circuit, class C and class D amplifiers.
3	Feedback and Oscillator Circuits: Feedback concept, advantages of negative feedback, feedback connection types, Oscillator theory, Barkhausen Criteria, RC phase shift Oscillator, LC Oscillator, Wien bridge Oscillator, Hartley Oscillator, Colpitts Oscillator.
4	Operational Amplifiers and their Applications: Ideal OPAMP versus practical OPAMP, OPAMP characteristics, CMRR, Inverting & Non-Inverting Amplifier, Unity/Voltage follower, Summing & Subtracting Amplifier, Integrator & Differentiator Amplifier, Instrumentation Amplifier, voltage to current converter, current to voltage converter using OPAMP.
5	Filters, Comparators and Wave Shaping Circuits: Active filters: Low pass, High pass, Band pass, All Pass using OPAMP, Butterworth first & Second order filter, Comparators -Inverting & Non-Inverting Schmitt Trigger, Multi-vibrators: A-stable, Mono-stable & Bi-stable multi-vibrators.

EXPERIMENTS

1	Study V-I characteristics of transistors (PNP and NPN) and calculate the performance parameters of a Transistor.
2	To assemble a CE amplifier and observe its performance
3	To obtain frequency response of a RC coupled CE amplifier.
4	To assemble an emitter follower circuit and observe its performance.
5	To assemble a differential amplifier and obtain its CMRR
6	To study different applications of OP AMPS.: inverting amplifier, non-inverting amplifier, integrator, differentiator.
7	To assemble an RC phase shift oscillator.
8	To assemble a Class A power amplifier and to determine its power gain.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	2	1	2	2	1	0	0	1	0	2	1.333333333
CLO2	3	3	1	2	1	0	0	0	0	1	0	2	1.083333333
CLO3	3	2	2	2	1	0	1	0	0	1	0	2	1.166666667
CLO4	3	3	2	1	1	0	1	0	0	1	0	2	1.166666667
CLO5	3	2	3	3	3	2	2	1	2	2	2	3	2.333333333
Avg PLO	3	2.4	2	1.8	1.6	0.8	1	0.2	0.4	1.2	0.4	2.2	1.416666667

Suggested Reading

1	Electronic Devices and Circuit Theory by Boylestead and Nashelsky, 4th Edition, Longman Higher Education.
2	Electronic Devices and Circuit by Anil K. Maini and Varsha Agarwal, 2nd Edition, Wiley Publications.
3	Integrated Electronics by Millman & Halkias, 2nd Edition, Tata McGraw Hill Publications.

Teaching-Learning Strategies

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Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code						BELECSS325	Semester	Semester III	
Course Title	Signals and Systems							Max marks	
Scheme & Credits	Hours Per Week						Credits	Theory	Practical
	L	T	P	Total					
	2	1	0	3			3	100	
Prerequisites	Nil							100	

Course Learning Outcomes (CLOs)

CLO1	Understand the historical context and evolution of signals and systems and recognize the contributions of key pioneers in the field.
CLO2	Classify signals based on their properties and parameters and analyze their characteristics in the time and frequency domains.
CLO3	Apply Fourier series, Fourier transform, Laplace transform, and Z-transform for signal and system analysis
CLO4	Analyze the stability and causality of continuous-time and discrete-time systems using transform methods.
CLO5	Evaluate real-world applications of signals and systems in various engineering disciplines and assess their societal impact and ethical considerations.

Syllabus

Units	Content
1	Introduction to Signals and their Characteristics: Historical context and evolution of the discipline of signals and systems, Contributions of key pioneers in the field, Evolution of signal processing techniques and their impact on modern technology. Nature of signals: Continuous-time and discrete-time signals. Classification of signals: Periodic and non-periodic, even and odd, power and energy, Invertible and Noninvertible, Deterministic and Random. Elementary signals - exponential, sine, step, impulse, ramp, rectangular, sine, triangular, signum. Signal parameters: Amplitude, frequency, phase, and bandwidth. Signal properties: Symmetry, causality, and linearity. Signal operations: Amplitude scaling, addition, multiplication, time shifting, and time scaling.
2	Fourier Series and Fourier Transform: Historical development of Fourier series and its applications, Fourier series representation of continuous time periodic signals and their properties, Fourier series representation of discrete-time periodic signals and their properties. Fourier transform and its significance in signal analysis, Continuous-time Fourier transform (CTFT) and its properties, Discrete-Time Fourier Transform (DTFT) and its properties.
3	Linear Continuous-Time Systems: Systems: definition, classification – Linear and Nonlinear, Time Variant and Time-Invariant, Causal and Non-causal, Stable and Unstable, Static and Dynamic. The Convolution Integral. Properties of Linear Time-Invariant (LTI) systems. Causal LTI systems represented by linear constant-coefficient differential equations. Laplace transform, and its application in analyzing continuous-time LTI systems, Concept of Region of Convergence (ROC) for the Laplace transform.
4	Linear Discrete-Time Systems: Introduction to discrete-time systems and their classification, Analysis of Causal Linear discrete-time systems described by Linear constant-coefficient difference equations, The z-Transform, Region of Convergence (ROC). Properties of z-Transform: linearity, time shift, scaling, time-reversal, differentiation, Initial value theorem. Inverse z-Transform. Analysis and characterization of LTI systems using z-transforms.
5	Real-World Applications of Signals and Systems: Applications of signals and systems in communication systems, audio processing, and image processing, Signal processing in control systems and automation, Impact of signals and systems in medical imaging and biomedical engineering, Emerging trends and applications in signals and systems.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	2	1	2	2	1	0	0	1	0	2	1.333333333
CLO2	3	3	1	2	1	0	0	0	0	1	0	2	1.083333333
CLO3	3	2	2	2	1	0	1	0	0	1	0	3	1.25
CLO4	2	3	3	1	1	0	1	0	0	1	2	3	1.416666667
CLO5	3	2	3	3	3	2	2	1	2	2	2	3	2.333333333
Avg PLO	2.8	2.4	2.2	1.8	1.6	0.8	1	0.2	0.4	1.2	0.8	2.6	1.483333333

Suggested Reading

1	Oppenheim, A. V., Willsky, A. S., and Nawab, S. H., "Signals and Systems," 2nd ed. Upper Saddle River, NJ: Prentice-Hall, 1996.
2	Haykin, S., and Van Veen, B., "Signals and Systems," 2nd ed. Hoboken, NJ: Wiley, 2005.
3	Hsu, H. P., "Schaum's Outline of Signals and Systems," 3rd ed. New York: McGraw-Hill Education, 2013.

Teaching-Learning Strategies

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Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	NA

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Course Code	BELECEM325					Semester	Semester III	
Course Title	Electrical Machines–I						Max marks	
Scheme & Credits	Hours Per Week					Credits	Theory	Practical
	L	T	P	Total				
	2	1	2	5		4	100	100
Prerequisites	Nil						200	

Course Learning Outcomes (CLOs)

CLO1	Get acquainted with magnetic circuits, constructional features of transformers, electromotive force (e.m.f.) equation, equivalent circuit model, phasor diagrams, losses, efficiency, and voltage regulation of transformers
CLO2	Learn how to carry out different tests on transformers and parallel operation of transformers. To get familiar with Autotransformers, distribution and power transformers, three-phase transformers, and their different types of
CLO3	Understand the principles of operation, construction, windings, types, power stages, efficiency, commutation and armature reaction in DC generators and DC motors, torque equation, and electric braking of DC motors
CLO4	Analyze different types of DC generators and DC motors, their characteristics, and their industrial applications.
CLO5	Design the speed controlling techniques for various DC motors, the purpose of the starter in DC motors, and its design.

Syllabus

Units	Content
1	Single-phase Transformers: Fundamentals of magnetic circuits, magnetization curves, introduction to transformers, classification and construction of transformers, electromotive force (e. m. f.) equation, equivalent circuit model, phasor diagrams, KVA rating, losses and efficiency, voltage regulation.
2	Transformer tests and other types of Transformers: Transformer tests: polarity test, open circuit test, and short circuit test. Sumpner's back-to-back test, All day efficiency. Instrument transformers (Introduction), parallel operation of transformers, Autotransformers, saving of copper in autotransformers, distribution transformers, and power transformers.
3	Three-phase Transformers: Construction of three-phase transformers, different types of Connections: Star-Star, Star-Delta, Delta-Star, Delta-Delta, Vector group of transformers. Open delta connection, Scott connection, phase conversions: Three-phase to two-phase conversion and two-phase to three-phase conversion.
4	DC Generators: Introduction & principle of operation of DC Generators, construction of DC Generators, types of DC Generators, EMF equation, types of windings, power stages and efficiency, commutation and armature reaction, characteristics of DC Generators, applications of DC Generators.
5	DC Motors: Principles of operation of DC Motors, construction of DC Motors, types of DC Motors, Back EMF and torque equation, torque and speed of DC Motors, characteristics of various types of DC motors, speed control of DC motors, starting and electric braking. Performing the different tests to determine the efficiency of DC motors.

EXPERIMENTS

1	To perform open circuit and short circuit tests on a single-phase transformer
2	To perform polarity test on a single phase transformer
3	To determine the efficiency and voltage regulation of a single phase transformer
4	To study three phase connections on a bank of three single phase transformers
5	To study various parts of a dc machine and draw sketches of the same
6	To plot the saturation curve of a dc machine
7	To plot the external characteristics of a separately excited dc generator.
8	To study the voltage build-up of a dc shunt generator
9	To plot the external characteristic of a dc shunt generator
10	To plot the external characteristics of a dc series generator
11	To plot the external characteristic of a dc compound generator

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	2	1	2	2	1	0	0	1	0	2	1.333333333
CLO2	3	3	2	2	1	0	1	0	1	1	0	2	1.333333333
CLO3	2	2	3	2	1	0	1	0	0	2	0	3	1.333333333
CLO4	2	3	2	1	1	0	1	0	0	1	2	3	1.333333333
CLO5	3	3	3	3	3	3	2	1	2	2	2	3	2.5
Avg PLO	2.6	2.6	2.4	1.8	1.6	1	1.2	0.2	0.6	1.4	0.8	2.6	1.566666667

Suggested Reading

1	Electric Machinery Fundamentals by Chapman, McGraw Hill Education.
2	Electrical Machinery by P. S. Bhimbra, Khanna Publishers.
3	Electric Machines by Nagrath and Kothari, McGraw Hill Education.

Teaching-Learning Strategies

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Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code	*BELELMX325*					*Semester*	*Semester III*	
Course Title	**Introduction to Matrix Programming**						*Max marks*	
Scheme & Credits	*Hours Per Week*					*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*				
	1	*0*	*2*	*3*		*2*	*100*	*100*
Prerequisites	*Nil*						*200*	

Course Learning Outcomes (CLOs)

CLO1	Familiarization with the basic MATLAB environment and tools.
CLO2	Learn different matrix operations and manipulation.
CLO3	Understand the logic and syntax of programming with examples of different functions.
CLO4	Applying the programming skills in designing new polymorphic functions.
CLO5	Visualize various functions using plotting commands.

Syllabus

Units	Content
1	Introduction to MATLAB: Layout, Command Window, Workspace, Current directory, functions of various windows, docking, and undocking of windows, Help in MATLAB. Simulink: Simulink Library and basic model design in Simulink.
2	Basics of programming: Rules for coding, syntax, variable types, initializing variables, editor programs, and operators. Matrices and Arrays: Arrays and matrices entries, manipulation of arrays and matrices, operations on matrices, transpose and inverse of a matrix, Displaying output data.
3	Building Codes with MATLAB: Control Flow/Branching Statements: If – else statements, switch – case construct, related examples. Loops: While and for loop, nested loops, break and continue statements, and related examples.
4	Functions and Subfunctions: How to define a function, Simple examples to demonstrate the use of user-defined functions, Nested functions, and Polymorphic functions.
5	Errors and Plotting: Different types of errors and debugging of a program. Plotting: Simple 2D Plots (line color, line style, markers, legend, labeling axes, title, controlling axes), multiple plots on the same figure, multiple figures, subplots, Logarithmic and Polar plots, 3D Plots

EXPERMINENTS

1	Introduction to the MATLAB workspace, command window, and basic Simulink model design.
2	Writing basic scripts to initialize variables and use arithmetic operators.
3	Performing matrix operations including addition, multiplication, transpose, and inverse.
4	Implementing if-else and switch-case branching statements for logical control.
5	Using for and while loops, along with break and continue statements, to solve iterative problems.
6	Designing simple user-defined functions and subfunctions to modularize code.
7	Implementing nested and polymorphic functions to handle dynamic inputs.
8	Creating basic 2D plots with customized line styles, colors, markers, and legends.
9	Generating multiple plots in a single figure using the subplot command.
10	Creating logarithmic, polar, and 3D plots, and practicing basic code debugging techniques.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	2	2	3	2	3	1	2	1	2	3	2.166666667
CLO2	3	2	2	2	3	2	3	1	2	1	2	3	2.166666667
CLO3	2	2	2	1	2	2	2	1	2	1	2	3	1.833333333
CLO4	3	3	3	2	2	2	1	1	2	1	2	3	2.083333333
CLO5	3	3	3	2	2	3	2	2	2	2	2	3	2.416666667
Avg PLO	2.8	2.4	2.4	1.8	2.4	2.2	2.2	1.2	2	1.2	2	3	2.133333333

Suggested Reading

1	Getting Started with MATLAB: A Quick Introduction for Scientists & Engineering by Rudra Pratap, Oxford Press, 2010.
2	MATLAB Programming for Engineers, Stephen J Chapman, Cengage Publishers.
3	MATLAB For Dummies, Jim Sizemore and John Mueller

Teaching-Learning Strategies

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Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Semester IV

Course Code	*BELECDE425*				*Semester*	*Semester IV*			
Course Title	**Digital Electronics**					*Max marks*			
Scheme & Credits	*Hours Per Week*				*Credits*	*Theory*		*Practical*	
	L	*T*	*P*	*Total*					
	2	*1*	*2*	*5*	*4*	*100*		*100*	
Prerequisites	*Nil*					*200*			

Course Learning Outcomes (CLOs)

CLO1	Apply number system conversions, coding techniques, and Boolean algebra principles to analyze and represent digital information.
CLO2	Simplify and implement Boolean functions using logic gates and standard minimization techniques for digital circuit design.
CLO3	Analyze and design combinational logic circuits using arithmetic circuits, encoders, decoders, multiplexers, and demultiplexers.
CLO4	Analyze and design sequential logic circuits using flip-flops, registers, counters, and data conversion systems.
CLO5	Explain the operation of memory devices and compare the characteristics and applications of different digital logic families.

Syllabus

Units	**Content**
1	Review of Number systems, Radix conversion Complements 9's & 10's, Subtraction using 1's & 2's complements. Binary codes, Error detecting and Correcting codes, Theorems of Boolean algebra, Canonical forms,
2	Logic gates and implementation of Boolean functions with various types of logic gates. Circuit equivalence. Simplification techniques and minimization by map methods. Tabular method.
3	Combination logic and arithmetic circuits. Encoders and Decoders, multiplexers & de-multiplexers.
4	Sequential circuits –state diagrams and state tables, design and analysis of flip-flops, registers, counters. Synchronous and asynchronous operation of sequential circuits,Analog to digital convertor, digital to analog convertor.
5	Latches and memory organisation. ROM's, EPROM's and RAM's –Dynamic and static. Digital Logic Families: Introduction to bipolar Logic families: RTL, DCTL, DTL, TTL, ECL and MOS Logic families (NMOS, PMOS, CMOS), Details of TTL logic family- Totem pole, Open collector outputs, TTL subfamilies, Comparison of different logic families.

EXPERIMENTS

1	To verify the truth table of following logic gates: AND, OR and NOT NAND, NOR, XOR and XNOR
2	To realize the above gates using discrete active and passive components
3	To implement XOR and XNOR using universal logic gates
4	To verify DE Morgan's law using logic gates
5	To implement certain Boolean expressions and check their equality
6	To design and realize a) Half adder and verify its truth table. b) Full adder and verify its truth table. c) Half subtractor and verify its truth table. d) Full subtractor and verify its truth table
7	To design a multiplexer/ demultiplexer using two input NAND gates
8	To design a 4-bit binary to decimal convertor
9	To design a modulo 10 counter
10	Design and realize the following flip-flops using logic gates. a) RS flip flop b) JK flip flop. c) D flip flop d) T flip flop.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	1	2	0	0	0	0	1	0	1	0.9166666667
CLO2	3	3	2	1	2	0	0	0	0	1	0	1	1.083333333
CLO3	3	3	3	2	2	0	0	0	0	1	0	1	1.25
CLO4	3	3	3	2	2	0	0	0	0	1	0	1	1.25
CLO5	2	2	1	1	2	0	0	0	0	1	0	2	0.9166666667
Avg PLO	2.8	2.6	2	1.4	2	0	0	0	0	1	0	1.2	1.083333333

Suggested Reading

1	M.Moris Mano, Digital Logic, Pearson.
2	A.P. Malvino, Digital Principles and Applications, T.M.Hill
3	Anil K. Maini,Digital Electronics, Wiley

Teaching-Learning Strategies

Interactive classroom lectures supported by numerical problem-solving and circuit design examples.
Laboratory experiments and simulation-based learning using digital circuit design software.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code	BELECCS425					Semester	Semester IV	
Course Title	Control Systems						Max marks	
Scheme & Credits	Hours Per Week					Credits	Theory	Practical
	L	T	P	Total				
	2	1	2	5		4	100	100
Prerequisites	Nil						200	

Course Learning Outcomes (CLOs)

CLO1	Explain the fundamentals of control systems and develop mathematical models using transfer functions, block diagrams, and signal flow graphs
CLO2	Analyze the time-domain response and steady-state performance of first- and second-order control systems.
CLO3	Determine the stability of control systems using pole locations and the Routh stability criterion.
CLO4	Analyze control system performance using frequency-response techniques and root locus methods.
CLO5	Design basic PID controllers and compensators and explain the fundamentals of state-space modeling

Syllabus

Units	Content
1	Introduction to continuous control systems: Definition of a control system, open-loop, closed loop (automatic and manual) control. Mathematical modeling: Transfer functions, block diagrams, Mason's signal flow graph
2	First and second order system: Example of first and second order systems, responses of these systems to step, ramp, parabolic and sinusoidal inputs, transient, steady state and error analysis
3	Stability studies: Definition of stability, stability and pole locations, Routh Table
4	Frequency response: Bode plot, polar plot, Nyquist's criterion, root locus.
5	Proportional, Integral, Derivative (P.I.D) control. Compensator design Lead – lag compensators. Modelling of dynamic systems in state space (Introduction).

EXPERIMENTS

1	Use of MATLAB / SIMULINK /Control System tool boxes, neural & fuzzy toolboxes.
2	Analysis of Control Systems in MATLAB.
3	To study the computer simulation of a number of systems
4	To study the torque-speed characteristics of an AC servo motor.
5	To study the time response of a variety of simulated linear systems.
6	To study the role of feedback in a DC speed control system.
7	To study the role of feedback in a DC position control system.
8	To study the role of a combination of P,I and D control actions in a variety of simulated linear systems
9	System identification using frequency domain techniques
10	Lead/ lag compensator design
11	Computer control of systems
12	Control of stepper motor
13	Control system (State Space) study

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	1	2	0	0	0	0	1	0	1	0.9166666667
CLO2	3	3	1	2	2	0	0	0	0	1	0	1	1.083333333
CLO3	3	3	1	3	2	0	0	0	0	1	0	1	1.166666667
CLO4	3	3	2	3	2	0	0	0	0	1	0	1	1.25
CLO5	3	2	3	2	3	0	0	0	0	1	0	2	1.333333333
Avg PLO	3	2.6	1.6	2.2	2.2	0	0	0	0	1	0	1.2	1.15

Suggested Reading

1	Norman S. Nise, Control Systems Engineering, John Wiley.
2	M. Gopal , Control Systems (Principles and Design) , Tata McGraw Hill.
3	A. Anand Kumar, Control Systems, PHI Learning Private Limited.
4	Stefani, Design of Feedback Control Systems, Oxford University Press.

Teaching-Learning Strategies

Design basic PID controllers and compensators and explain the fundamentals of state-space modeling
Simulation-based learning using control system software tools for response and stability analysis.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code	*BELECME425*				*Semester*	*Semester IV*	
Course Title	**Electrical Measurement**					*Max marks*	
Scheme & Credits	*Hours Per Week*				*Credits*	*Theory*	*Practical*
	L	*T*	*P*	*Total*			
	2	*1*	*2*	*5*	*4*	*100*	*100*
Prerequisites	*Nil*					**200**	

Course Learning Outcomes (CLOs)

CLO1	Explain the principles, standards, characteristics, and sources of error in electrical and electronic measurement systems.
CLO2	Analyze and select suitable analog and digital instruments for measurement of electrical quantities.
CLO3	Apply bridge methods, transducers, and sensor technologies for accurate measurements.
CLO4	Evaluate modern electronic instruments including oscilloscopes, digital meters, signal analyzers and DAQ systems.
CLO5	Design and interpret measurement systems for industrial automation, power systems and smart-grid applications.

Syllabus

Units	**Content**
1	Fundamentals of Measurements and Instrumentation: standards, calibration, accuracy, precision, uncertainty, errors and instrument characteristics
2	Electrical Measuring Instruments: PMMC, MI, Electrodynamometer, Electrostatic, Induction instruments, CTs, PTs, power, energy and power factor measurement
3	Measurement of Circuit Parameters: resistance measurement, bridges, Megger, inductance and capacitance measurement, Q-meter and LCR meter.
4	Electronic Instruments and Digital Measurement Systems: DVM, DMM, CRO, DSO, frequency counters, spectrum analyzers, DAQ and virtual instrumentation
5	Sensors, Transducers and Smart Instrumentation: RTD, thermocouple, LVDT, strain gauges, smart sensors, IoT instrumentation, PMU and SCADA overview

EXPERIMENTS

1	Measurement of resistance by color coding & Ohm's Law.
2	Measurement of resistance by Wheat Stone bridge.
3	To find the Dielectric constant of different materials.
4	Perform an experiment to find very low resistance, medium resistance and very high resistance using suitable
5	LVDT and capacitance pickup – characteristics and Calibration and assessing the performance with a simulator.
6	Calibration and testing of single phase energy meters
7	Measurement of Inductance using Anderson Bridge.
8	Measurement of capacitance using Schering Bridge.
9	Measurement of Dielectric strength of oil using H.T testing kit.
10	Resistance Strain Gauge-Strain Measurements and Calibration and assessing the measurement with Strain Gauge simulator.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	2	1	2	0	0	0	0	1	0	1	1
CLO2	3	3	2	2	2	0	0	0	0	1	0	1	1.166666667
CLO3	3	3	3	2	2	0	0	0	0	1	0	1	1.25
CLO4	3	3	3	2	2	0	0	0	0	1	0	1	1.25
CLO5	3	3	3	2	3	0	1	0	0	1	0	2	1.5
Avg PLO	3	2.8	2.6	1.8	2.2	0	0.2	0	0	1	0	1.2	1.233333333

Suggested Reading

1	Sawhney, A. K., Electrical and Electronic Measurements and Instrumentation, 19th ed., Dhanpat Rai Publications.
2	Bell, D. A., Electronic Instrumentation and Measurements, 2nd ed., Oxford University Press, New Delhi, 2013.
3	Nakra, B. C. and Chaudhry, K. K., Instrumentation, Measurement and Analysis, 5th ed., McGraw Hill Education

Teaching-Learning Strategies

Interactive lectures integrating theory with coding and simulation sessions.
Hands-on laboratory sessions and simulation exercises (using open-source tools).
Case-based learning supported by seminars and discussion of real-world design challenges.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

Course Code		BELECNC425					Semester	Semester IV	
Course Title		Non Conventional Energy Sources						Max marks	
Scheme & Credits		Hours Per Week					Credits	Theory	Practical
		L	T	P	Total				
		1	1	0	2		2	100	
Prerequisites		Nil						100	

Course Learning Outcomes (CLOs)

CLO1	Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
CLO2	Understand the basic physics of wind and solar power generation.
CLO3	Understand the power electronic interfaces for wind and solar generation.
CLO4	Understand the issues related to the grid-integration of solar and wind energy systems.
CLO5	Describe other non-conventional energy sources (small hydro, biomass, ocean energy) and the challenges of grid integration for renewable energy systems.

Syllabus

Units	Content
1	Classification of energy resources, Importance of non-conventional energy sources (NCES), present status and growth of energy sector, Various aspects of energy conservation. Energy Storage: Necessity and methods, Pumped storage, flywheel storage, Battery storage, Superconducting magnetic energy storages, super/ultra-capacitor storage, applications
2	Solar thermal systems: Introduction, Solar energy basics, classification, solar water heater, solar refrigeration and air-conditioning systems, solar cookers, solar pond electric-power plant, central receiver power plant
3	Solar Photovoltaic (PV) systems: introduction, solar cell characteristics and equivalent circuit, design of solar PV module and array in solar PV system, MPPT, standalone and grid connected solar PV system, Other Applications
4	Wind Energy: Introduction, Applications of wind power, power extraction from wind, torque developed by the wind turbine, wind turbine classifications, wind generators, wind energy conversion systems,Hybrid standalone and grid connected systems
5	Other NCES (small hydro resources, biomass, ocean energy and geothermal energy): introduction, classification, essential components and principle.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	1	1	0	0	0	0	1	0	1	0.8333333333
CLO2	3	3	1	1	1	0	0	0	0	1	0	1	0.9166666667
CLO3	3	3	1	2	1	0	0	0	0	1	0	1	1
CLO4	3	3	1	2	1	0	0	0	0	1	0	1	1
CLO5	3	2	2	2	2	0	0	0	0	1	0	2	1.166666667
Avg PLO	3	2.6	1.2	1.6	1.2	0	0	0	0	1	0	1.2	0.9833333333

Suggested Reading

	B. H. Khan, Non-conventional energy resources, McGraw Hill
2	J.Twidell and T.Weir, Renewable Energy Resources, Taylor and Francis Group
3	M.Patel, Wind & Solar Power System, CRC Press

Teaching-Learning Strategies

Case-Based Learning & Real-World Grid Integration Scenarios
Interactive Simulation-Based & Virtual Lab Learning

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	NA

Course Code		BELECEM425				Semester	Semester IV	
Course Title		Electrical Machines–II					Max marks	
Scheme & Credits		Hours Per Week				Credits	Theory	Practical
		L	T	P	Total			
		2	1	2	5	4	100	100
Prerequisites		Nil					200	

Course Learning Outcomes (CLOs)

CLO1	Explain the fundamental principles of AC rotating electrical machines, including rotating magnetic fields, torque production, losses, and efficiency.
CLO2	Analyze the construction, operation, performance characteristics, testing, and speed control of three-phase induction motors and induction generators.
CLO3	Explain the operation, testing, and applications of single-phase motors and special-purpose AC motors.
CLO4	Analyze the construction, operation, equivalent circuits, and performance characteristics of synchronous machines.
CLO5	Evaluate the steady-state and transient performance of synchronous machines, including excitation control, parallel operation, and power-angle characteristics.

Syllabus

Units	Content
1	Basic Concepts in A.C. Rotating Electrical Machines: The rotating magnetic field, Magneto-motive force and flux distribution, Induced voltage, Production of torque, Leakage fluxes, losses and efficiency
2	Three Phase Induction Motors: Construction, Types, Principle of operation of an induction motor,Cogging and crawling, Equivalent circuit, Torque/speed characteristics, Induction motor tests, Speed control, Principle of operation of Induction generator.
3	Single-Phase Motors: Types of single phase induction motors, Starting of single phase induction motors, analysis and testing of single phase induction motors, universal motor, Schrage motor, Applications of single phase motors.
4	Synchronous Machines: Construction & Types, working principle, field and armature windings, Equivalent circuit, voltage regulation and its determination, Synchronous reactance, saturation effect, parallel operation, Two-axis theory.
5	Salient type machines, steady-state power-angle characteristics, Excitation systems, V-curves, synchronous capacitors,Hunting, synchronous Machine Transients, Analysis of sudden 3-phase short circuit, Transient power-angle characteristics.

EXPERIMENTS

1	To study the different parts of an Induction motor.
2	To determine the equivalent–circuit parameters of a 3 -f Induction motor by (i) No load test (ii) Blocked rotor test
3	To determine the Torque / speed characteristics of a 3-f Induction motor
4	To study the speed control of an Induction motor by pole-changing method
5	To study the speed control of an Induction motor by varying voltage
6	To study the speed control of an Induction motor by changing rotor resistance
7	To Study of the construction of a synchronous machine
8	To obtain the OCC and SCC of a synchronous machine by Synchronous impedance method
9	To find voltage regulation of an alternator by actual loading
10	To obtain the V-curves and inverted V-curves of a synchronous motor
11	To conduct slip-test on a salient-pole synchronous machine and hence determine its direct and quadrature – axis reactances

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	1	1	0	0	0	0	1	0	1	0.8333333333
CLO2	3	3	2	2	1	0	0	0	0	1	0	1	1.083333333
CLO3	3	3	2	2	1	0	0	0	0	1	0	1	1.083333333
CLO4	3	3	2	2	1	0	0	0	0	1	0	1	1.083333333
CLO5	3	3	2	2	1	0	1	0	0	1	0	2	1.25
Avg PLO	3	2.8	1.8	1.8	1	0	0.2	0	0	1	0	1.2	1.066666667

Suggested Reading

1	Kingslay Umans, Electric Machinery by Fitzgerald, T. M. Hill.
2	Nagrath and Kothari, Electric Machines, T.M. Hill.
3	Chapman, Electrical Machinery Fundamentals, T.M. Hill.
4	Irving Kosow, Electric Machinery and Transformers, Pearson.

Teaching-Learning Strategies

Interactive classroom lectures supported by numerical problem-solving and phasor-diagram analysis.
Laboratory demonstrations and simulation-based studies of induction and synchronous machines.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.

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Course Code		BELELPY425					Semester	Semester IV	
Course Title		Introduction to Python						Max marks	
Scheme & Credits		Hours Per Week					Credits	Theory	Practical
		L	T	P	Total				
		1	0	2	3		2	100	100
Prerequisites		Nil						200	

Course Learning Outcomes (CLOs)

CLO1	Understand Python fundamentals, core data types, control flow statements, and basic syntax for problem-solving.
CLO2	Develop modular Python programs using functions, modules, file handling techniques, and robust exception handling.
CLO3	Apply scientific and numerical computing libraries such as NumPy for array operations and linear algebra problems.
CLO4	Perform structured data manipulation, cleaning, and exploratory analysis using the Pandas library.
CLO5	Create 2D and 3D data visualizations and graphical plots using Matplotlib and Seaborn for technical applications.

Syllabus

Units	Content
1	Introduction to Python Basics Introduction to Python, features, and advantages. Installing Python and using the IDLE/Interpreter. Basic syntax, comments, variables, and dynamic typing. Core data types: integers, floats, strings, and booleans. Basic input and output (print() and input()). Arithmetic, relational, and logical operators.
2	Control Flow Statements Decision-making statements: if, if-else, and elif constructs. Looping structures: while loops and for loops. The range() function. Loop control statements: break, continue, and pass. Writing simple algorithms using control structures.
3	Basic Data Structures Introduction to strings: indexing, slicing, and basic string methods. Lists: creating lists, accessing elements, appending, removing, and sorting. Tuples: creation, accessing, and immutability. Dictionaries: key-value pairs, adding, updating, and retrieving data.
4	Functions Concept of modular programming. Defining and calling user-defined functions (def). Passing arguments (positional and default). Returning values from functions. Local and global variable scope. Overview of useful built-in functions (e.g., len(), type(), max(), min()).
5	File Handling and Modules Introduction to file handling: opening, reading, writing, and appending text files (.txt). Closing files securely using the with statement. Introduction to importing standard modules (e.g., math, random). Basic error handling using try and except blocks.

EXPERIMENTS

1	Basics and Operators: Write a Python program to read user input, perform basic arithmetic operations (addition, subtraction, multiplication, division), and demonstrate the use of different data types.
2	Control Structures: Write a Python program using conditional statements to find the largest of three numbers, and a loop to generate the Fibonacci sequence up to N terms.
3	Data Structures: Write a Python program to create a list of numbers, append a new number, sort the list, and use a dictionary to store and retrieve a student's name and marks.
4	Functions: Write a Python program to create a user-defined function that accepts a number as an argument and calculates its factorial using a loop.
5	File Handling: Write a Python program to create a new text file, write a few lines of text into it, read the contents back, and print the total number of words on the screen.

CLO-PLO Mapping Matrix

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	2	2	3	0	0	0	0	1	0	2	1.333333333
CLO2	3	3	2	2	3	0	0	0	0	1	0	2	1.333333333
CLO3	3	2	2	2	3	0	0	0	0	1	0	3	1.333333333
CLO4	3	2	3	2	3	0	0	0	1	1	0	2	1.416666667
CLO5	2	2	3	2	3	0	0	0	1	2	1	2	1.5
Avg PLO	2.8	2.4	2.4	2	3	0	0	0	0.4	1.2	0.2	2.2	1.383333333

Suggested Reading

1	Eric Matthes, Python Crash Course: A Hands-On, Project-Based Introduction to Programming, 3rd Edition, No Starch Press.
2	Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter, 3rd Edition, O'Reilly Media.
3	Charles Severance, Python for Everybody: Exploring Data in Python 3, CreateSpace Independent Publishing.
4	Hans Petter Langtangen, A Primer on Scientific Programming with Python, 5th Edition, Springer.

Teaching-Learning Strategies

Interactive classroom lectures integrating theoretical concepts with live coding sessions.
Hands-on computational problem-solving and algorithmic exercises.

Evaluation Scheme

Theory	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks
Practical	Continuous Internal Evaluation (CIE): 35 Marks (Mid-term Examination) + 15 Marks (Class Assessment: Attendance, Viva, Quiz, Presentation, Surprise Test, Open-book Test, Mini-project, etc) Semester End Examination (SEE): 50 marks.