ST. THOMAS COLLEGE (AUTONOMOUS) THRISSUR

Affiliated to

UNIVERSITY OF CALICUT

SYLLABUS FOR DEGREE OF

B.Sc. ELECTRONICS HONOURS

(MAJOR, MINOR AND GENERAL FOUNDATION COURSES)

SYLLABUS & MODEL QUESTION PAPERS
w.e.f. 2024 admission onwards

St. Thomas College Four Year Under Graduate Programme

[STCFYUGP]

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(STCFYUGP Regulations 2024)

B.Sc. ELECTRONICS HONOURS

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SYLLABUS

PROGRAMME OUTCOMES (PO):

At the end of the graduate programme St.Thomas College, a student would:

PO1	Knowledge Acquisition: Demonstrate a profound understanding of knowledge trends and their impact on the chosen discipline of study.
PO2	Communication, Collaboration, Inclusiveness, and Leadership: Become a team player who drives positive change through effective communication, collaborative acumen, transformative leadership, and a dedication to inclusivity.
PO3	Professional Skills: Demonstrate professional skills to navigate diverse career paths with confidence and adaptability.
PO4	Digital Intelligence: Demonstrate proficiency in varied digital and technological tools to understand and interact with the digital world, thus effectively processing complex information.
PO5	Scientific Awareness and Critical Thinking: Emerge as an innovative problem-solver and impactful mediator, applying scientific understanding and critical thinking to address challenges and advance sustainable solutions.
PO6	Human Values, Professional Ethics, and Societal and Environmental Responsibility: Become a responsible leader, characterized by an unwavering commitment to human values, ethical conduct, and a fervent dedication to the well-being of society and the environment.
PO7	Research, Innovation, and Entrepreneurship: Emerge as a researcher and entrepreneurial leader, forging collaborative partnerships with industry, academia, and communities to contribute enduring solutions for local, regional, and global development.

PROGRAMME SPECIFIC OUTCOMES (PSO):

At the end of the BSc Electronics Honours programme at St.Thomas College, a student would:

PSO1	Analyze, design, and develop solutions by applying foundational concepts of electronics and communication.
PSO2	Apply design principles in the development of quality products for science and commercial applications.
PSO3	Develop essential skills for developing, troubleshooting, and managing electronic hardware and software systems.
PSO4	Discuss the theoretical understanding of core subjects, including the principles and applications of electronic components, electronic measuring and testing instruments, as well as analog and digital integrated circuits (ICs)
PSO5	Illustrate proficiency in programming using both assembly language and high-level languages, as well as the ability to interface electronic devices with computers.
PSO6	Create capability in assessing and implementing computer-based systems, processes, components, or programs to fulfil specific requirements.

MINIMUM CREDIT REQUIREMENTS OF THE DIFFERENT PATHWAYS IN THE THREE-YEAR PROGRAMME IN CUFYUGP

Sl. No.	Academic Pathway	Major	Minor/ Other Disciplines	Foundation Courses AEC: 4 MDC: 3 SEC: 3 VAC: 3	Intern-ship	Total Credits	Example
		Each course has 4 credits		Each course has 3 credits			
1	Single Major (A)	68 (17 courses)	24 (6 courses)	39 (13 courses)	2	133	Major: Electronics + six courses in different disciplines in different combinations
2	Major (A) with Multiple Disciplines (B, C)	68 (17 courses)	12 + 12 (3 + 3 = 6 courses)	39 (13 courses)	2	133	Major: Electronics + Computer Science and Mathematics
3	Major (A) with Minor (B)	68 (17 courses)	24 (6 courses)	39 (13 courses)	2	133	Major: Electronics Minor: Computer Science
4	Major (A) with Vocational Minor (B)	68 (17 courses)	24 (6 courses)	39 (13 courses)	2	133	Major: Electronics Minor: AI, Robotics and Consumer
5	Double Major (A, B)	A: 48 (12 courses) B: 44 (11 courses)	-	12 + 18 + 9	2	133	Electronics and Computer Appl./ Sc. Or Electronics and Physics
			The 24 credits in the Minor stream are distributed between the two Majors. 2 MDC, 2 SEC, 2 VAC and the Internship should be in Major A. Total credits in Major A should be 48 + 20 = 68 (50% of 133)				

			1 MDC, 1 SEC and 1 VAC should be in Major B. Total credits in Major B should be 44 + 9 = 53 (40% of 133)		
Exit with UG Degree / Proceed to Fourth Year with 133 Credits					

B.Sc. ELECTRONICS HONOURS PROGRAMME

COURSE STRUCTURE FOR PATHWAYS 1 – 4

1. Single Major
2. Major with Multiple Disciplines
3. Major with Minor
4. Major with Vocational Minor

Semester	Course Code	Course Title	Total Hours	Hours/ Week	Credits	Marks		
						Internal	External	Total
1	ELE1CJ 101/ ELE1MN1 00	Core Course 1 in Major – Electrical and Electronic Fundamentals (P)	75	5	4	30	70	100
		Minor Course 1	60/ 75	4/ 5	4	30	70	100
		Minor Course 2	60/ 75	4/ 5	4	30	70	100
	ENG1FA 101(2)	Ability Enhancement Course 1– English	60	4	3	25	50	75
		Ability Enhancement Course 2 – Additional Language	45	3	3	25	50	75
		Multi-Disciplinary Course 1 – Other than Major	45	3	3	25	50	75
		Total		**23/ 25**	**21**			**525**
2	ELE2CJ 101/ ELE2MN1 00	Core Course 2 in Major – Semiconductor Devices and Circuits (P)	75	5	4	30	70	100
		Minor Course 3	60/ 75	4/ 5	4	30	70	100
		Minor Course 4	60/ 75	4/ 5	4	30	70	100
	ENG2FA 103(2)	Ability Enhancement Course 3– English	60	4	3	25	50	75
		Ability Enhancement Course 4 – Additional Language	45	3	3	25	50	75
		Multi-Disciplinary Course 2 – Other than Major	45	3	3	25	50	75
		Total		**23/ 25**	**21**			**525**

3	ELE 3CJ 201	Core Course 3 in Major – Foundational Mathematics	60	4	4	30	70	100
	ELE3CJ 202/ ELE3MN200	Core Course 4 in Major – Digital Electronics (P)	75	5	4	30	70	100
		Minor Course 5	60/ 75	4/ 5	4	30	70	100
		Minor Course 6	60/ 75	4/ 5	4	30	70	100
		Multi-Disciplinary Course 3 – Kerala Knowledge System	45	3	3	25	50	75
	ENG3FV 108(2)	Value-Added Course 1 – English	45	3	3	25	50	75
		Total		**23/ 25**	**22**			**550**
4	ELE4CJ 203	Core Course 5 in Major – Network Analysis (P)	75	5	4	30	70	100
	ELE4CJ 204	Core Course 6 in Major – Microprocessors and Microcontrollers(P)	75	5	4	30	70	100
	ELE4CJ 205	Core Course 7 in Major – Analog Electronics (P)	75	5	4	30	70	100
	ENG4FV 109(2)	Value-Added Course 2 – English	45	3	3	25	50	75
		Value-Added Course 3 – Additional Language	45	3	3	25	50	75
	ENG4FS 111(2)	Skill Enhancement Course 1 – English	60	4	3	25	50	75
		Total		**25**	**21**			**525**
5	ELE5CJ 301	Core Course 8 in Major – Field Theory	60/75	4/5	4	30	70	100
	ELE5CJ 302	Core Course 9 in Major – Python Programming (P)	75	5	4	30	70	100
	ELE5CJ 303	Core Course 10 in Major – Signals and Systems(P)	75	5	4	30	70	100
	ELE5EJ 304 /ELE5EJ 305	Elective Course 1 in Major	60	4	4	30	70	100

	ELE5EJ 306 /ELE5EJ 307	Elective Course 2 in Major	60	4	4	30	70	100
	ELE 5FS 112/ ELE1VN 101/ ELE2VN10 2	Skill Enhancement Course 2- Computer Aided Design and 3D printing	45	3	3	25	50	75
		Total		**25**	**23**			**575**
6	ELE6CJ 304 /ELE8MN3 04	Core Course 11 in Major – Opto Electronics	60/75	4/5	4	30	70	100
	ELE6CJ 305/ ELE8MN3 05	Core Course 12 in Major– Analog and Digital communication (P)	75	5	4	30	70	100
	ELE 6CJ 306/ ELE8MN3 06	Core Course 13 in Major – Embedded System Design with IOT (P)	75	5	4	30	70	100
	ELE6EJ 307/ ELE6EJ 308	Elective Course 3 in Major	60	4	4	30	70	100
	ELE6EJ 309/ ELE6EJ 310	Elective Course 4 in Major	60	4	4	30	70	100
	ELE 6FS 113 /ELE1VN 101/ ELE2VN10 2	Skill Enhancement Course 3 – EV Technology	45	3	3	25	50	75
	ELE 6CJ 349	Internship in Major (Credit for internship to be awarded only at the end of Semester 6)	60		2	50	-	50

		Total		**25**	**25**				**625**

Total Credits for Three Years					**133**				**3325**
7	ELE7CJ 401	Core Course 14 in Major – Digital System Design (P)	75	5	4	30	70	100
	ELE7CJ 402	Core Course 15 in Major – Antennas and RF Technology (P)	75	5	4	30	70	100
	ELE7CJ 403	Core Course 16 in Major – Advanced Digital Signal Processing (P)	75	5	4	30	70	100
	ELE7CJ 404	Core Course 17 in Major – Control System Engineering(P)	75	5	4	30	70	100
	ELE7CJ 405	Core Course 18 in Major – Digital Image Processing(P)	75	5	4	30	70	100
		Total		**25**	**20**			**500**
8	ELE8CJ 406/ ELE8MN4 06	Core Course 19 in Major – Optical Fiber Communication	60/75	4/5	4	30	70	100
	ELE8CJ 407 /ELE8MN4 07	Core Course 20 in Major – Satellite and Radar Systems	60/75	4/5	4	30	70	100
	ELE8CJ 408/ ELE8MN4 08	Core Course 21 in Major – Optimisation Algorthms	60/75	4/5	4	30	70	100
	OR (instead of Core Courses 19 – 21 in Major)							
	ELE8CJ 449	Project (in Honours programme)	360*	13*	12	90	210	300
	ELE8CJ 499	Project (in Honours with Research programme)	360*	13*	12	90	210	300
	ELE8EJ 409/ ELE8EJ 410	Elective Course 5 in Major / Minor Course 7	60	4	4	30	70	100

	ELE8EJ 411/ ELE8EJ 412	Elective Course 6 in Major / Minor Course 8	60	4	4	30	70	100
	ELE8EJ 413/ ELE8EJ 414	Elective Course 7 in Major / Minor Course 9 / Major Course in any Other Discipline	60	4	4	30	70	100
	OR (instead of Elective Course 7 in Major, in the case of Honours with Research Programme)							
	ELE8CJ 489	Research Methodology in Electronics	60	4	4	30	70	100
		Total		**25**	**24**			**600**
Total Credits for Four Years					**177**			**4425**

* The teacher should have 13 hrs/week of engagement (the hours corresponding to the three core courses) in the guidance of the Project(s) in Honours programme and Honours with Research programme, while each student should have 24 hrs/week of engagement in the Project work. Total hours are given based on the student's engagement.

CREDIT DISTRIBUTION FOR PATHWAYS 1 – 4

1. Single Major
2. Major with Multiple Disciplines
3. Major with Minor
4. Major with Vocational Minor

Semester	Major Courses	Minor Courses	General Foundation Courses	Internship/ Project	Total
1	4	4 + 4	3 + 3 + 3	-	21
2	4	4 + 4	3 + 3 + 3	-	21
3	4 + 4	4 + 4	3 + 3	-	22
4	4 + 4 + 4	-	3 + 3 + 3	-	21
5	4 + 4 + 4 + 4 + 4	-	3	-	23
6	4 + 4 + 4 + 4 + 4	-	3	2	25
Total for Three Years	**68**	**24**	**39**	**2**	**133**
7	4 + 4 + 4 + 4 + 4	-	-	-	20
8	4 + 4 + 4	4 + 4 + 4	-	12*	24
* Instead of three Major courses					

Total for Four Years	**88 + 12 = 100**	**36**	**39**	**2**	**177**

DISTRIBUTION OF MAJOR COURSES IN ELECTRONICS FOR PATHWAYS 1 – 4

1. Single Major

2. Major with Multiple Disciplines

3. Major with Minor 4. Major with Vocational Minor

Semester	Course Code	Course Title	Hours/ Week	Credits
1	ELE1CJ 101/ ELE1MN100	Core Course 1 in Major – Electrical and Electronic Fundamentals (P)	5	4
2	ELE2CJ 101/ ELE2MN100	Core Course 2 in Major – Semiconductor Devices and Circuits (P)	5	4
3	ELE 3CJ 201	Core Course 3 in Major – Foundational Mathematics	4	4
	ELE3CJ 202/ ELE3MN200	Core Course 4 in Major – Digital Electronics (P)	5	4
4	ELE4CJ 203	Core Course 5 in Major – Network Analysis (P)	5	4
	ELE4CJ 204	Core Course 6 in Major – Microprocessors and Microcontrollers(p)	5	4
	ELE4CJ 205	Core Course 7 in Major – Analog Electronics (P)	5	4
5	ELE5CJ 301	Core Course 8 in Major – Field Theory	5	4
	ELE5CJ 302	Core Course 9 in Major – Python Programming (P)	5	4
	ELE5CJ 303	Core Course 10 in Major – Signals and Systems(P)	4	4
	ELE5EJ 304 /ELE5EJ 305	Elective Course 1 in Major	4	4
	ELE5EJ 306 /ELE5EJ 307	Elective Course 2 in Major	4	4

6	ELE6CJ 304/ ELE8MN304	Core Course 11 in Major – Opto Electronics	5	4
	ELE6CJ 305/ ELE8MN305	Core Course 12 in Major – Analog and Digital communication (P)	5	84
	ELE 6CJ 306/ ELE8MN306	Core Course 13 in Major – Embedded System Design with IOT (P)	4	4
	ELE6EJ 307/ ELE6EJ 308	Elective Course 3 in Major	4	4
	ELE6EJ309/ ELE6EJ310	Elective Course 4 in Major	4	4
	ELE6CJ 349	Internship in Major	-	2
Total for the Three Years				**70**
	ELE7CJ 401	Core Course 14 in Major – – Digital System Design (P)	5	4
	ELE7CJ 402	Core Course 15 in Major – Antennas and RF Technology (P)	5	4
	ELE7CJ 403	Core Course 16 in Major – Advanced Digital Signal Processing (P)	5	4

	ELE7CJ 404	Core Course 17 in Major – Control System Engineering(P)	5	4
	ELE7CJ 405	Core Course 18 in Major – Digital Image Processing(P)	5	4
	ELE8CJ 406/ ELE8MN406	Core Course 19 in Major – Optical Fiber Communication	5	4

8	ELE8CJ 407/ ELE8MN407	Core Course 20 in Major – Satellite and Radar Systems	4	4
	ELE8CJ 408/ ELE8MN408	Core Course 21 in Major – Optimisation Algorithms	4	4
	OR (instead of Core Courses 19 – 21 in Major)			
	ELE8CJ 449	Project (in Honours programme)	13	12
	ELE8CJ 499	Project (in Honours with Research programme)	13	12
	ELE8EJ 409/ ELE8EJ 410	Elective Course 5 in Major	4	4
	ELE8EJ 411/ ELE8EJ 412	Elective Course 6 in Major	4	4
	ELE8EJ 413/ ELE8EJ 414	Elective Course 7 in Major	4	4
	OR (instead of Elective course 7 in Major, in Honours with Research programme)			
	ELE8CJ 489	Research Methodology in Electronics	4	4
Total for the Four Years				**114**

ELECTIVE COURSES IN ELECTRONICS WITH SPECIALISATION

Group No.	Sl. No.	Course Code	Title	Semester	Total Hrs	Hrs/ Week	Credits	Marks		
								Internal	External	Total
1		**SEMICONDUCTOR ICs & ARTIFICIAL INTELLIGENCE**								

	1	ELE5EJ 304	Semiconductor Fabrication Technology	5	60	4	4	30	70	100
	2	ELE5EJ 306	Smart Materials	5	60	4	4	30	70	100
	3	ELE6EJ 307	VLSI Technology	6	60	4	4	30	70	100
	4	ELE6EJ309	Introduction to Artificial Intelligence	6	60	4	4	30	70	100
	5	ELE8EJ 409	Introduction to Machine Learning	8	60	4	4	30	70	100
	6	ELE8EJ 411	Drone Technology	8	60	4	4	30	70	100
	7	ELE8EJ 413	Integrating AI with Flutter	8	60	4	4	30	70	100
2		**INDUSTRIAL ELECTRONICS & ROBOTICS**								
	1	ELE5EJ 305	Computer Hardware & Network Maintenance	5	60	4	4	30	70	100
	2	ELE5EJ 307	Power Electronics	5	60	4	4	30	70	100
	3	ELE6EJ 308	Medical Electronics	6	60	4	4	30	70	100
	4	ELE6EJ 310	Mobile Communication	6	60	4	4	30	70	100
	5	ELE8EJ 410	Light and Audio Systems Engineering	8	60	4	4	30	70	100
	6	ELE8EJ 412	Fundamentals of Robotics and Applications	8	60	4	4	30	70	100
	7	ELE8EJ 414	Industrial Automation	8	60	4	4	30	70	100

GROUPING OF MINOR COURSES IN ELECTRONICS

(Title of the Minor: **MODERN ELECTRONICS)**

*The Minor courses given below should not be offered to students who have taken Electronics as the Major discipline. They should be offered to students from other Major disciplines.

Group No.	Sl. No.	Course Code	Title	Semester	Total Hrs	Hrs/ Week	Credits	Marks		
								Internal	External	Total
1		**ANALOG / DIGITAL FUNDAMENTALS & EMBEDDED C PROGRAMMING** (preferable for Computer Appl./ Sc. and Physics students)								
	1	ELE1MN 101	Electronic Fundamentals (P)	1	75	5	4	30	70	100
	2	ELE2MN 101	Fundamentals of Digital Electronics (P)	2	75	5	4	30	70	100
	3	ELE3MN 201	Arduino Coding with Embedded C (P)	3	75	5	4	30	70	100
2		**INTERNET OF THINGS & PYTHON PROGRAMMING FOR IOT** (preferable for Computer Appl./ Sc. and Physics students)								
	1	ELE1MN 102	Arduino Programming (P)	1	75	5	4	30	70	100
	2	ELE2MN 102	IOT Hardware and Interfacing (P)	2	75	5	4	30	70	100
	3	ELE3MN 202	Python Programming for IOT Applications (P)	3	75	5	4	30	70	100
3		**APP DEVELOPMENT & DEPLOYMENT** (for all BA /B.Sc. /B.Com. students of any discipline)								
	1	ELE1MN 103	Introduction to App Development (P)	1	75	5	4	30	70	100
	2	ELE2MN 103	Intermediate App Development (P)	2	75	5	4	30	70	100
	3	ELE3MN 203	Advanced App Development and Deployment (P)	3	75	5	4	30	70	100

GROUPING OF VOCATIONAL MINOR COURSES IN ELECTRONICS

(Title of the Vocational Minor: **VOCATIONAL ELECTRONICS)**

* The Vocational Minor courses given below should not be offered to students who have taken Electronics as the Major discipline. They should be offered to students from other Major disciplines.

			Title					Marks

Group No.	Sl. No.	Course Code		Semester	Total Hrs	Hrs/ Week	Credits	Internal	External	Total
1		**AI & ROBOTICS**								
	1	ELE1VN 101	Fundamentals Of Artificial Intelligence	1	75	5	4	30	70	100
	2	ELE2VN 101	Mobile Phone Technology	2	75	5	4	30	70	100
	3	ELE3VN 201	Robotics & Drone Technology	3	75	5	4	30	70	100
	4	ELE8VN 301	AI And Flutter	8	60	4	4	30	70	100
2		**RENEWABLE ENERGY & CONSUMER ELECTRONICS**								
	1	ELE1VN 102	Basics of Electricals and Electronics	1	75	5	4	30	70	100
	2	ELE2VN 102	Solar Power Technology	2	75	5	4	30	70	100
	3	ELE3VN 202	Consumer Electronics	3	75	5	4	30	70	100
	4	ELE8VN 302	Light & Sound Engineering	8	60	4	4	30	70	100

(i). Students in Single Major pathway can choose course/courses from any of the Minor/ Vocational Minor groups offered by a discipline other than their Major discipline.

(ii). Students in Major with Multiple Disciplines pathway can choose as one of the multiple disciplines, all the three courses from any one of the Minor/ Vocational Minor groups offered by any discipline, including their Major discipline. If they choose one of the Minor/ Vocational Minor groups offered by their Major discipline as the first one of the multiple disciplines, then their choice as the second one of the multiple disciplines should be any one of the Minor/ Vocational Minor groups offered by a discipline other than the Major discipline. If the students choose any one of the Minor/ Vocational Minor groups in Electronics as given above, then the title of the group will be the title of that multiple discipline.

(iii). Students in Major with Minor pathway can choose all the courses from any two Minor groups offered by any discipline. If the students choose any two Minor groups in Electronics as given above, then the title of the Minor will be **Modern Electronics.**

(iv). Students in Major with Vocational Minor pathway can choose all the courses from any two Vocational Minor groups offered by any discipline. If the students choose any two Vocational Minor groups in Electronics as given above, then the title of the Vocational Minor will be **Vocational Electronics.**

DISTRIBUTION OF GENERAL FOUNDATION COURSES IN ELECTRONICS

Semester	Course Code	Course Title	Total Hours	Hours/ Week	Credits	Marks		
						Internal	External	Total
1	ELE1FM 105	Multi-Disciplinary Course 1 – Clean Energy Solution	45	3	3	25	50	75
2	ELE2FM 106	Multi-Disciplinary Course 2 – Mobile App Development	45	3	3	25	50	75
3	ELE3FV 108	Value-Added Course 1 – Green Energy for Sustainable Development	45	3	3	25	50	75
4	ELE4FV 110	Value-Added Course 2 – E-Waste Management	45	3	3	25	50	75
5	ELE5FS 112	Skill Enhancement Course 2 – Computer Aided Design and 3D printing	45	3	3	25	50	75
6	ELE6FS 113	Skill Enhancement Course 3 – EV Technology	45	3	3	25	50	75

COURSE STRUCTURE FOR BATCH A1(B2) IN PATHWAY 5: DOUBLE MAJOR

A1: 68 credits in Electronics (Major A) ***B1: 68 credits in Major B***

A2: 53 credits in Electronics (Major A) ***B2: 53 credits in Major B***

The combinations available to the students: (A1 & B2), (B1 & A2)

Note: Unless the batch is specified, the course is for all the students of the class

Semester	Course Code	Course Title	Total Hours	Hours/ Week	Credits	Marks		
						Internal	External	Total

1	ELE1CJ 101 / ELE1MN 100	Core Course 1 in Major Electronics – Electrical and Electronic Fundamentals (P)	75	5	4	30	70	100
	BBB1CJ 101	Core Course 1 in Major B –	60/ 75	4/ 5	4	30	70	100
	ELE1CJ 102 / ELE2CJ 102 / ELE 4CJ 205*	Core Course 2 in Major Analog Electronics(P) (for batch A1 only)	75	5	4	30	70	100
	ENG1FA 101(2)	Ability Enhancement Course 1 – English	60	4	3	25	50	75
		Ability Enhancement Course 2 – Additional Language	45	3	3	25	50	75
	ELE1FM 105	Multi-Disciplinary Course 1 in Electronics – Clean Energy Solution (for batch A1 only)	45	3	3	25	50	75
		Total		**24/ 25**	**21**			**525**
2	ELE2CJ 101 / ELE2MN 100	Core Course 3 in Major Electronics – Semiconductor Devices and Circuits(P)	75	5	4	30	70	100
	BBB2CJ 101	Core Course 2 in Major B –	60/ 75	4/ 5	4	30	70	100
	BBB2CJ 102 / BBB1CJ 102	Core Course 3 in Major B – (for batch B2 only)	60/ 75	4/ 5	4	30	70	100
	ENG2FA 103(2)	Ability Enhancement Course 3 – English	60	4	3	25	50	75
		Ability Enhancement Course 4 – Additional Language	45	3	3	25	50	75
	ELE2FM 106 / ELE3FM 106	Multi-Disciplinary Course 2 in Electronics – Mobile App Development	45	3	3	25	50	75
		Total		**23 – 25**	**21**			**525**

3	ELE3CJ 201	Core Course 4 in Major Electronics – Foundational Mathematics	60	4	4	30	70	100
	ELE3CJ 202 / ELE3MN 200	Core Course 5 in Major Electronics – Digital Electronics(P)	75	5	4	30	70	100
	BBB3CJ 201	Core Course 4 in Major B	60/ 75	4/ 5	4	30	70	100
	BBB3CJ 202	Core Course 5 in Major B	60/ 75	4/ 5	4	30	70	100
	BBB3FM 106 / BBB2FM 106	Multi-Disciplinary Course 1 in B –	45	3	3	25	50	75
	ELE3FV 108	Value-Added Course 1 in Electronics – Green Energy for Sustainable Development (for batch A1 only)	45	3	3	25	50	75
		Total		**23 – 25**	**22**			**550**
4	ELE4CJ 203	Core Course 6 in Major Electronics – Network Analysis(P)	75	5	4	30	70	100
		Core Course 6 in Major B	60/ 75	4/ 5	4	30	70	100
	ELE4CJ 204	Core Course 7 in Major Electronics – Microprocessor and Microcontrollers (P) (for batch A1 only)	75	5	4	30	70	100
	ELE4FV 110	Value-Added Course 2 in Electronics – E-Waste Management	45	3	3	25	50	75
	BBB4FV 110	Value-Added Course 1 in B –	45	3	3	25	50	75
	ELE4FS 112 / ELE5FS 112	Skill Enhancement Course 2 in Electronics – Computer Aided Design and 3D printing	45	3	3	25	50	75
		Total		**23/ 24**	**21**			**525**
5	ELE5CJ 302	Core Course 8 in Major Electronics – Python Programming(P)	75	5	4	30	70	100
		Core Course 7 in Major B –	60/ 75	4/ 5	4	30	70	100

	ELE5CJ 303	Core Course 9 in Major Electronics – Signals and Systems(P)(for batch A1 only)	60	4	4	30	70	100
		Elective Course 1 in Major Electronics	60	4	4	30	70	100
		Elective Course 1 in Major B	60	4	4	30	70	100
	BBB5FS 112 / BBB4FS 112	Skill Enhancement Course 1 in B	45	3	3	25	50	75
		Total		**24/ 25**	**23**			**575**
	ELE6CJ 305/ ELE8MN 305	Core Course 10 in Major Electronics – Analog and Digital Communication(P)	75	5	4	30	70	100
		Core Course 8 in Major B –	60/ 75	4/ 5	4	30	70	100
	BBB6CJ 305	Core Course 9 in Major B – (for batch B2 only)	60	4	4	30	70	100
6		Elective Course 2 in Major Electronics	60	4	4	30	70	100
		Elective Course 2 in Major B	60	4	4	30	70	100
	ELE6FS 113	Skill Enhancement Course 3 in Electronics – EV Technology (for batch A1 only)	45	3	3	25	50	75
	ELE6CJ 349	Internship in Major Electronics (Credit for internship to be awarded only at the end of Semester 6)	60		2	50	-	50
		Total		**24/ 25**	**25**			**625**
Total Credits for Three Years					**133**			**3325**

For batch A1(B2), the course structure in semesters 7 and 8 is the same as for pathways 1 – 4, except tha the number of the core and elective courses is in continuation of the number of courses in the two categories completed at the end of semester 6.

[*] The course code of the same course as used for the pathways 1 – 4

CREDIT DISTRIBUTION FOR BATCH A1(B2)

IN PATHWAY 5: DOUBLE MAJOR

Semester	Major Courses in Electronics	General Foundation Courses in Electronics	Internship/ Project in Electronics	Major Courses in B	General Foundation Courses in B	AEC	Total
1	4 + 4	3	-	4	-	3 + 3	21
2	4	3	-	4 + 4	-	3 + 3	21
3	4 + 4	3	-	4 + 4	3	-	22
4	4 + 4	3 + 3	-	4	3	-	21
5	4 + 4 + 4	-	-	4 + 4	3	-	23
6	4 + 4	3	2	4 + 4 + 4	-	-	25
Total for Three Years	**48**	**18**	**2**	**44**	**9**	**12**	**133**
	68			**53**		**12**	**133**
	Major Courses in Electronics	Minor Courses					
7	4 + 4 + 4 + 4 + 4	-			-	-	20
8	4 + 4 + 4	4 + 4 + 4	12*		-	-	24
* Instead of three Major courses							
Total for Four Years	**88 + 12 = 100**	**12**					**177**

COURSE STRUCTURE FOR BATCH B1(A2)
IN PATHWAY 5: DOUBLE MAJOR

A1: 68 credits in Electronics (Major A) ***B1: 68 credits in Major B***

A2: 53 credits in Electronics (Major A) ***B2: 53 credits in Major B***

The combinations available to the students: (A1 & B2), (B1 & A2)

Note: Unless the batch is specified, the course is for all the students of the class

Semester	Course Code	Course Title	Total Hours	Hours/ Week	Credits	Marks		
						Internal	External	Total
1	ELE1CJ 101 / ELE1MN 100	Core Course 1 in Major Electronics – Electrical and Electronic Fundamentals (P)	75	5	4	30	70	100

	BBB1CJ 101	Core Course 1 in Major B –	60/ 75	4/ 5	4	30	70	100
	BBB1CJ 102 / BBB2CJ 102	Core Course 2 in Major B – (for batch B1 only)	60/ 75	4/ 5	4	30	70	100
	ENG1FA 101(2)	Ability Enhancement Course 1 – English	60	4	3	25	50	75
		Ability Enhancement Course 2 – Additional Language	45	3	3	25	50	75
	BBB1FM 105	Multi-Disciplinary Course 1 in B – (for batch B1 only)	45	3	3	25	50	75
		Total		**23 – 25**	**21**			**525**
2	ELE2CJ 101 / ELE2MN 100	Core Course 2 in Major Electronics – Semiconductor Devices and Circuits (P)	75	5	4	30	70	100
	BBB2CJ 101	Core Course 3 in Major B –	60/ 75	4/ 5	4	30	70	100
	ELE2CJ 102 / ELE1CJ 102 / ELE4CJ 205*	Core Course 3 in Major Analog Electronics(P) (for batch A2 only)	75	5	4	30	70	100
	ENG2FA 103(2)	Ability Enhancement Course 3 – English	60	4	3	25	50	75
		Ability Enhancement Course 4 – Additional Language	45	3	3	25	50	75
	ELE2FM 106 / ELE3FM 106	Multi-Disciplinary Course 1 in Electronics – Clean Energy Solution	45	3	3	25	50	75
		Total		**24/ 25**	**21**			**525**
3	ELE3CJ 201	Core Course 4 in Major Electronics – Foundational Mathematics	75	5	4	30	70	100
	ELE3CJ 202 / ELE3MN 200	Core Course 5 in Major Electronics – Digital Electronics (P)	75	5	4	30	70	100

	BBB3CJ 201	Core Course 4 in Major B	60/ 75	4/ 5	4	30	70	100
	BBB3CJ 202	Core Course 5 in Major B	60/ 75	4/ 5	4	30	70	100
	BBB3FM 106 / BBB2FM 106	Multi-Disciplinary Course 2 in B –	45	3	3	25	50	75
	BBB3FV 108	Value-Added Course 1 in B – (for batch B1 only)	45	3	3	25	50	75
		Total		**23 – 25**	**22**			**550**
4	ELE4CJ 203	Core Course 6 in Major Electronics – Network Analysis(P)	75	5	4	30	70	100
		Core Course 6 in Major B	60/ 75	4/ 5	4	30	70	100
		Core Course 7 in Major B – (for batch B1 only)	60/ 75	4/ 5	4	30	70	100
	ELE4FV 110	Value-Added Course 1 in Electronics – E-Waste Management	45	3	3	25	50	75
	BBB4FV 110	Value-Added Course 2 in B –	45	3	3	25	50	75
	ELE4FS 112 / ELE5FS 112	Skill Enhancement Course 1 in Electronics – Computer Aided Design and 3D printing	45	3	3	25	50	75
		Total		**22 – 24**	**21**			**525**
5	ELE5CJ 302	Core Course 7 in Major Electronics – Python Programming (P)	75	5	4	30	70	100
		Core Course 8 in Major B –	60/ 75	4/ 5	4	30	70	100
		Core Course 9 in Major B – (for batch B1 only)	60	4	4	30	70	100
		Elective Course 1 in Major Electronics	60	4	4	30	70	100
		Elective Course 1 in Major B	60	4	4	30	70	100

	BBB5FS 112 / BBB4FS 112	Skill Enhancement Course 1 in B	45	3	3	25	50	75

		Total		**24/ 25**	**23**			**575**
6	ELE6CJ 305/ ELE8MN 305	Core Course 8 in Major Electronics – Analog and Digital Communication (P)	75	5	4	30	70	100
		Core Course 10 in Major B –	60/ 75	4/ 5	4	30	70	100
	ELE6CJ 306/ ELE8MN 306	Core Course 9 in Major Electronics – Embedded System Design with IOT (P) (for batch A2 only)	75	5	4	30	70	100
		Elective Course 2 in Major Electronics	60	4	4	30	70	100
		Elective Course 2 in Major B	60	4	4	30	70	100
	BBB6FS 113	Skill Enhancement Course 2 in B – (for batch B1 only)	45	3	3	25	50	75
	BBB6CJ 349	Internship in Major B (Credit for internship to be awarded only at the end of Semester 6)	60		2	50	-	50
		Total		**24/ 25**	**25**			**625**
Total Credits for Three Years					**133**			**3325**

To continue to study Electronics in semesters 7 and 8, batch B1(A2) needs to earn additional 15 credits in Electronics to make the total credits of 68. Suppose this condition is achieved, and the student of batch B1(A2) proceeds to the next semesters to study Electronics. The course structure in semesters 7 and 8 is the same as for pathways 1 – 4, except that the number of the core and elective courses is in continuation of the number of courses in the two categories completed at the end of semester 6, taking into account the number of courses in Electronics taken online to earn the
additional 15 credits.

* The course code of the same course as used for the pathways 1 – 4

Python Programming(P)

CREDIT DISTRIBUTION FOR BATCH B1(A2)

IN PATHWAY 5: DOUBLE MAJOR

Semester	Major Courses in B	General Foundation Courses in B	Internship/ Project in B	Major Courses in Electronics	General Foundation Courses in Electronics	AEC	Total
1	4 + 4	3	-	4	-	3 + 3	21
2	4	-	-	4 + 4	3	3 + 3	21
3	4 + 4	3 + 3	-	4 + 4	-	-	22
4	4 + 4	3	-	4	3 + 3	-	21
5	4 + 4 + 4	3	-	4 + 4	-	-	23
6	4 + 4	3	2	4 + 4 + 4	-	-	25
Total for Three Years	**48**	**18**	**2**	**44**	**9**	**12**	**133**
	68			**53**		**12**	**133**
	Major Courses in B	Minor Courses					
7	4 + 4 + 4 + 4 + 4	-			-	-	20
8	4 + 4 + 4	4 + 4 + 4	12*		-	-	24
* Instead of three Major courses							
Total for Four Years	**88 + 12 = 100**	**12**					**177**

EVALUATION SCHEME

1. The evaluation scheme for each course contains two parts: internal evaluation (about 30%) and external evaluation (about 70%). Each of the Major and Minor courses is of 4-credits. It is evaluated for 100 marks, out of which 30 marks is from internal evaluation and 70 marks, from external evaluation. Each of the General Foundation course is of 3-credits. It is evaluated for 75 marks, out of which 25 marks is from internal evaluation and 50 marks, from external evaluation.
2. The 4-credit courses (Major and Minor courses) are of two types: (i) courses with only theory and (ii) courses with 3-credit theory and 1-credit practical.

- In 4-credit courses with only theory component, out of the total 5 modules of the syllabus, one open-ended module with 20% content is designed by the faculty member teaching that course, and it is internally evaluated for 10 marks. The internal evaluation of the remaining 4 theory modules is for 20 marks.
- In 4-credit courses with 3-credit theory and 1-credit practical components, out of the total 5 modules of the syllabus, 4 modules are for theory and the fifth module is for practical. The practical component is internally evaluated for 20 marks. The internal evaluation of the 4 theory modules is for 10 marks.

3. All the 3-credit courses (General Foundational Courses) in Electronics are with only theory component. Out of the total 5 modules of the syllabus, one open-ended module with 20% content is designed by the faculty member teaching that course, and it is internally evaluated for 5 marks. The internal evaluation of the remaining 4 theory modules is for 20 marks.

Sl. No.	Nature of the Course		Internal Evaluation in Marks (about 30% of the total)		External Exam on 4 modules (Marks)	Total Marks
			Open-ended module / Practical	On the other 4 modules		
1	4-credit course	only theory (5 modules)	10	20	70	100
2	4-credit course	Theory (4 modules) + Practical	20	10	70	100
3	3-credit course	only theory (5 modules)	5	20	50	75

1. MAJOR AND MINOR COURSES

1.1. INTERNAL EVALUATION OF THEORY COMPONENT

Sl. No.	Components of Internal Evaluation of Theory Part of a Major / Minor Course	Internal Marks for the Theory Part of a Major / Minor Course of 4-credits			
		Theory Only		Theory + Practical	
		4 Theory Modules	Open-ended Module	4 Theory Modules	Practical
1	Test paper/ Mid-semester Exam	10	4	5	-
2	Seminar/ Viva/ Quiz	6	4	3	-
3	Assignment	4	2	2	-
		20	10	10	20*
	Total	30		30	

* Refer the table in section 1.2 for the evaluation of practical component

1.2. EVALUATION OF PRACTICAL COMPONENT

The evaluation of practical component in Major and Minor courses is completely by internal evaluation.

- Continuous evaluation of practical by the teacher-in-charge shall carry a weightage of 50%.
- The end-semester practical examination and viva-voce, and the evaluation of practical records shall be conducted by the teacher in-charge and an internal examiner appointed by the Department Council.
- The process of continuous evaluation of practical courses shall be completed before 10 days from the commencement of the end-semester examination.
- Those who passed in continuous evaluation alone will be permitted to appear for the end-semester examination and viva-voce.

The scheme of continuous evaluation and the end-semester examination and viva-voce of practical component shall be as given below:

Sl. No.	Evaluation of Practical Component of Credit-1 in a Major / Minor Course	Marks for Practical	Weightage
1	Continuous evaluation of practical/ exercise performed in practical classes by the students	10	50%
2	End-semester examination and viva-voce to be conducted by teacher-in-charge along with an additional examiner arranged internally by the Department Council	7	35%
3	Evaluation of the Practical records submitted for the end semester viva–voce examination by the teacher-in- charge and additional examiner	3	15%
	Total Marks	20	

1.3. EXTERNAL EVALUATION OF THEORY COMPONENT

External evaluation carries 70% marks. Examinations will be conducted at the end of each semester. Individual questions are evaluated in marks and the total marks are converted into grades by the University based on 10-point grading system (refer section 5).

PATTERN OF QUESTION PAPER FOR MAJOR AND MINOR COURSES

Duration	Type	Total No. of Questions	No. of Questions to be Answered	Marks for Each Question	Ceiling of Marks
2 Hours	Short Answer	10	8 – 10	3	24
	Paragraph/ Problem	8	6 – 8	6	36
	Essay	2	1	10	10
				Total Marks	70

2. INTERNSHIP

- All students should undergo Internship of 2-credits during the first six semesters in a firm, industry or organization, or training in labs with faculty and researchers of their own institution or other Higher Educational Institutions (HEIs) or research institutions.
- Internship can be for enhancing the employability of the student or for developing the research aptitude.
- Internship can involve hands-on training on a particular skill/ equipment/ software. It can be a short project on a specific problem or area. Attending seminars or workshops related to an area of learning or skill can be a component of Internship.
- A faculty member/ scientist/ instructor of the respective institution, where the student does the Internship, should be the supervisor of the Internship.

2.1. GUIDELINES FOR INTERNSHIP

1. Internship can be in Electronics or allied disciplines.
2. There should be minimum 60 hrs. of engagement from the student in the Internship.
3. Summer vacations and other holidays can be used for completing the Internship.
4. In BSc. Electronics Honours programme, institute/ industry visit or study tour is a requirement for the completion of Internship. Visit to minimum one national research institute, research laboratory and place of scientific importance should be part of the study tour. A brief report of the study tour has to be submitted with photos and analysis.
5. The students should make regular and detailed entries in to a personal log book through the period of Internship. The log book will be a record of the progress of the Internship and the time spent on the work, and it will be useful in writing the final report. It may contain experimental conditions and results, ideas, mathematical expressions, rough

work and calculation, computer file names etc. All entries should be dated. The Internship supervisor should periodically examine and countersign the log book.

6. The log book and the typed report must be submitted at the end of the Internship.
7. The institution at which the Internship will be carried out should be prior-approved by the Department Council of the college where the student has enrolled for the UG Honours programme.

2.2. EVALUATION OF INTERNSHIP

- The evaluation of Internship shall be done internally through continuous assessment mode by a committee internally constituted by the Department Council of the college where the student has enrolled for the UG Honours programme.
- The credits and marks for the Internship will be awarded only at the end of semester 6.
- The scheme of continuous evaluation and the end-semester viva-voce examination based on the submitted report shall be as given below:

<table>
<tr><th>Sl. No.</th><th colspan="2">Components of Evaluation of Internship</th><th>Marks for Internship 2 Credits</th><th>Weightage</th></tr>
<tr><td>1</td><td rowspan="3">Continuous evaluation of internship through interim presentations and reports by the committee internally constituted by the Department Council</td><td>Acquisition of skill set</td><td>10</td><td rowspan="3">40%</td></tr>
<tr><td>2</td><td>Interim Presentation and Viva-voce</td><td>5</td></tr>
<tr><td>3</td><td>Punctuality and Log Book</td><td>5</td></tr>
<tr><td>4</td><td colspan="2">Report of Institute Visit/ Study Tour</td><td>5</td><td>10%</td></tr>
<tr><td>5</td><td rowspan="3">End-semester viva-voce examination to be conducted by the committee internally constituted by the Department Council</td><td>Quality of the work</td><td>6</td><td rowspan="3">35%</td></tr>
<tr><td>6</td><td>Presentation of the work</td><td>5</td></tr>
<tr><td>7</td><td>Viva-voce</td><td>6</td></tr>
<tr><td>8</td><td colspan="2">Evaluation of the day-to-day records, the report of internship supervisor, and final report submitted for the end semester viva–voce examination before the committee internally constituted by the Department Council</td><td>8</td><td>15%</td></tr>
<tr><td></td><td colspan="2">Total Marks</td><td>50</td><td></td></tr>
</table>

3. PROJECT

3.1. PROJECT IN HONOURS PROGRAMME

- In Honours programme, the student has the option to do a Project of 12-credits instead of three Core Courses in Major in semester 8.
- The Project can be done in the same institution/ any other higher educational institution (HEI)/ research centre/ training centre.
- The Project in Honours programme can be a short research work or an extended internship or a skill-based training programme.
- A faculty member of the respective institution, where the student does the Project, should be the supervisor of the Project.

3.2. PROJECT IN HONOURS WITH RESEARCH PROGRAMME

- Students who secure 75% marks and above (equivalently, CGPA 7.5 and above) cumulatively in the first six semesters are eligible to get selected to Honours with Research stream in the fourth year.
- A relaxation of 5% in marks (equivalently, a relaxation of 0.5 grade in CGPA) is allowed for those belonging to SC/ ST/ OBC (non-creamy layer)/ Differently-Abled/ Economically Weaker Section (EWS)/ other categories of candidates as per the decision of the UGC from time to time.
- In Honours with Research programme, the student has to do a mandatory Research Project of 12-credits instead of three Core Courses in Major in semester 8.
- The approved research centres of University of Calicut or any other university/ HEI can offer the Honours with Research programme. The departments in the affiliated colleges under University of Calicut, which are not the approved research centres of the University, should get prior approval from the University to offer the Honours with Research programme. Such departments should have minimum two faculty members with Ph.D., and they should also have the necessary infrastructure to offer Honours with Research programme.
- A faculty member of the University/ College with a Ph.D. degree can supervise the research project of the students who have enrolled for Honours with Research. One such faculty member can supervise maximum five students in Honours with Research stream.

- The maximum intake of the department for Honours with Research programme is fixed by the department based on the number of faculty members eligible for project supervision, and other academic, research, and infrastructural facilities available.
- If a greater number of eligible students are opting for the Honours with Research programme than the number of available seats, then the allotment shall be based on the existing rules of reservations and merits.

3.3. GUIDELINES FOR THE PROJECT IN HONOURS PROGRAMME AND HONOURS WITH RESEARCH PROGRAMME

1. Project can be in Electronics or allied disciplines.
2. Project should be done individually.
3. Project work can be of experimental/ theoretical/ computational in nature.
4. There should be minimum 360 hrs. of engagement from the student in the Project work in Honours programme as well as in Honours with Research programme.
5. There should be minimum 13 hrs./week of engagement (the hours corresponding to the three core courses in Major in semester 8) from the teacher in the guidance of the Project(s) in Honours programme and Honours with Research programme.
6. The various steps in project works are the following:
    - Wide review of a topic.
    - Investigation on a problem in systematic way using appropriate techniques.
    - Systematic recording of the work.
    - Reporting the results with interpretation in a standard documented form.
    - Presenting the results before the examiners.
7. During the Project the students should make regular and detailed entries in to a personal log book through the period of investigation. The log book will be a record of the progress of the Project and the time spent on the work, and it will be useful in writing the final report. It may contain experimental conditions and results, ideas, mathematical expressions, rough work and calculation, computer file names etc. All entries should be dated. The Project supervisor should periodically examine and countersign the log book.
8. The log book and the typed report must be submitted at the end of the Project. A copy of the report should be kept for reference at the department. A soft copy of the report too should be submitted, to be sent to the external examiner in advance.

9. It is desirable, but not mandatory, to publish the results of the Project in a peer reviewed journal.
10. The project report shall have an undertaking from the student and a certificate from the research supervisor for originality of the work, stating that there is no plagiarism, and that the work has not been submitted for the award of any other degree/ diploma in the same institution or any other institution.
11. The project proposal, institution at which the project is being carried out, and the project supervisor should be prior-approved by the Department Council of the college where the student has enrolled for the UG Honours programme.

3.4. EVALUATION OF PROJECT

- The evaluation of Project will be conducted at the end of the eighth semester by both internal and external modes.
- The Project in Honours programme as well as that in Honours with Research programme will be evaluated for 300 marks. Out of this, 90 marks is from internal evaluation and 210 marks, from external evaluation.
- The internal evaluation of the Project work shall be done through continuous assessment mode by a committee internally constituted by the Department Council of the college where the student has enrolled for the UG Honours programme. 30% of the weightage shall be given through this mode.
- The remaining 70% shall be awarded by the external examiner appointed by the University.
- The scheme of continuous evaluation and the end-semester viva-voce of the Project shall be as given below:

Components of Evaluation of Project	Marks for the Project (Honours/ Honours with Research)	Weightage
Continuous evaluation of project work through interim presentations and reports by the committee internally constituted by the Department Council	90	30%
End-semester viva-voce examination to be conducted by the external examiner appointed by the university	150	50%

Evaluation of the day-to-day records and project report submitted for the end-semester viva–voce examination conducted by the external examiner	60	20%
Total Marks	300	

INTERNAL EVALUATION OF PROJECT

Sl. No	Components of Evaluation of Project	Marks for the Project (Honours/ Honours with Research)
1	Skill in doing project work	30
2	Interim Presentation and Viva-Voce	20
3	Punctuality and Log book	20
4	Scheme/ Organization of Project Report	20
	Total Marks	90

EXTERNAL EVALUATION OF PROJECT

Sl. No	Components of Evaluation of Project	Marks for the Project (Honours/ Honours with Research) 12 credits
1	Content and relevance of the Project, Methodology, Quality of analysis, and Innovations of Research	50
2	Presentation of the Project	50
3	Project Report (typed copy), Log Book and References	60
4	Viva-Voce	50
	Total Marks	210

4. GENERAL FOUNDATION COURSES

- All the General Foundation Courses (3-credits) in Electronics are with only theory component.

4.1. INTERNAL EVALUATION

Sl. No.	Components of Internal Evaluation of a General Foundation Course in Electronics	Internal Marks of a General Foundation Course of 3-credits in Electronics	
		4 Theory Modules	Open-ended Module
1	Test paper/ Mid-semester Exam	10	2

2	Seminar/ Viva/ Quiz	6	2
3	Assignment	4	1
		20	5
	Total	25	

4.2. EXTERNAL EVALUATION

External evaluation carries about 70% marks. Examinations will be conducted at the end of each semester. Individual questions are evaluated in marks and the total marks are converted into grades by the University based on 10-point grading system (refer section 5).

PATTERN OF QUESTION PAPER FOR GENERAL FOUNDATION COURSES

Duration	Type	Total No. of Questions	No. of Questions to be Answered	Marks for Each Question	Ceiling of Marks
1.5 Hours	Short Answer	10	8 – 10	2	16
	Paragraph/ Problem	5	4 – 5	6	24
	Essay	2	1	10	10
				Total Marks	50

5. LETTER GRADES AND GRADE POINTS

- Mark system is followed for evaluating each question.
- For each course in the semester letter grade and grade point are introduced in 10-point indirect grading system as per guidelines given below.
- The Semester Grade Point Average (SGPA) is computed from the grades as a measure of the student’s performance in a given semester.
- The Cumulative GPA (CGPA) is based on the grades in all courses taken after joining the programme of study.
- Only the weighted grade point based on marks obtained shall be displayed on the grade card issued to the students.

LETTER GRADES AND GRADE POINTS

Sl. No.	Percentage of Marks (Internal & External Put Together)	Description	Letter Grade	Grade Point	Range of Grade Points	Class
1	95% and above	Outstanding	O	10	9.50 – 10	
2	Above 85% and below 95%	Excellent	A+	9	8.50 – 9. 49	

3	75% to below 85%	Very Good	A	8	7.50 – 8.49	First Class with Distinction
4	65% to below 75%	Good	B+	7	6.50 – 7.49	First Class
5	55% to below 65%	Above Average	B	6	5.50 – 6.49	
6	45% to below 55%	Average	C	5	4.50 – 5.49	Second Class
7	35% to below 45% aggregate (internal and external put together) with a minimum of 30% in external valuation	Pass	P	4	3.50 – 4.49	Third Class
8	Below an aggregate of 35% or below 30% in external evaluation	Fail	F	0	0 – 3.49	Fail
9	Not attending the examination	Absent	Ab	0	0	Fail

- When students take audit courses, they will be given Pass (P) or Fail (F) grade without any credits.
- The successful completion of all the courses and capstone components prescribed for the three-year or four-year programme with 'P' grade shall be the minimum requirement for the award of UG Degree or UG Degree Honours or UG Degree Honours with Research, as the case may be.

5.1. COMPUTATION OF SGPA AND CGPA

- The following method shall be used to compute the Semester Grade Point Average (SGPA):

  The SGPA equals the product of the number of credits (Ci) with the grade points (Gi) scored by a student in each course in a semester, summed over all the courses taken by a student in the semester, and then divided by the total number of credits of all the courses taken by the student in the semester,

  $$\text{i.e. SGPA (Si)} = \Sigma i\,(Ci \times Gi) / \Sigma i\,(Ci)$$

  where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course in the given semester. Credit Point of a course is the value obtained by multiplying the credit (Ci) of the course by the grade point (Gi) of the course.

$$SGPA = \frac{\text{Sum of the credit points of all the courses in a semester}}{\text{Total credits in that semester}}$$

ILLUSTRATION – COMPUTATION OF SGPA

Semester	**Course**	**Credit**	**Letter Grade**	**Grade point**	**Credit Point** (Credit x Grade)
I	Course 1	3	A	8	3 x 8 = 24
I	Course 2	4	B+	7	4 x 7 = 28
I	Course 3	3	B	6	3 x 6 = 18
I	Course 4	3	O	10	3 x 10 = 30
I	Course 5	3	C	5	3 x 5 = 15
I	Course 6	4	B	6	4 x 6 = 24
	Total	20			139
	SGPA				139/20 = 6.950

- The Cumulative Grade Point Average (CGPA) of the student shall be calculated at the end of a programme. The CGPA of a student determines the overall academic level of the student in a programme and is the criterion for ranking the students.

  CGPA for the three-year programme in CUFYUGP shall be calculated by the following formula.

$$CGPA = \frac{\text{Sum of the credit points of all the courses in six semesters}}{\text{Total credits in six semesters (133)}}$$

  CGPA for the four-year programme in CUFYUGP shall be calculated by the following formula.

$$CGPA = \frac{\text{Sum of the credit points of all the courses in eight semesters}}{\text{Total credits in eight semesters (177)}}$$

- The SGPA and CGPA shall be rounded off to three decimal points and reported in the transcripts.
- Based on the above letter grades, grade points, SGPA and CGPA, the University shall issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

Programme	B. Sc. Electronics				
Course Code	ELE1CJ101/ELEMN100				
Course Title	ELECTRICAL AND ELECTRONIC FUNDAMENTALS				
Type of Course	**Major**				
Semester	I				
Academic Level	100- 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic Knowledge in Physics.				
Course Summary	This course covers the fundamentals of electrical and electronic circuits includir DC circuits, AC circuits, semiconductor theory and PN junctions with practica applications explored through laboratory experiments.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Infer and define key electrical terms, concepts and to identify different types of passive circuit elements and their symbols.	U	C	Instructor-created exams / Quiz
CO2	Interpret a foundational understanding of semiconductor materials and acquire the ability to analyze and interpret the characteristics of diodes.	U	P	Assignment / Observation of Practical Skills
CO3	Outline the fundamentals of AC circuits and DC circuits.	U	C	Practical / Assignment
CO4	Identify communication abilities in ideas and designs effectively through reports, presentations etc.	Ap	C	Seminar Presentation /Assignments
CO5	Identify and solve specific problems or applications based on the skill acquired.	Ap	P	Instructor-created exams / Practical
CO6	Illstrate circuit diagrams and schematics to identify components and connections.	U	C	Practical/ Viva Voce/ Discussion

* - Remember (R), Understand (U), Apply (Ap), Analyze (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hours (45)	Mark (98)
I		**Basic Circuit Concepts**	**14**	15
	1	Electric Charge, Electric Potential and Field, voltage, Current, Work, Power and Energy.	2	
	2	Passive Circuit Elements: Resistor, Capacitor and Inductor, Fixed and Variable Types, Color coding.	2	
	3	Charging and Discharging of Capacitors.	3	
	4	Power Supply: AC and DC, Voltage Source and Current source, Battery.	2	
	5	Series and Parallel Connection of Resistors, Capacitors and Inductors, Voltage division rule and Current division rule.	3	
	6	Basic Laws: Ohm's Law and Kirchhoff's current and voltage Laws, Analysis of simple circuits with dc excitation	2	
		1. Circuits and Networks- Sudhakar and Shyam Mohan 2. Networks and Systems- D Roy Choudhary		
II		**A.C Fundamentals**	**10**	15
	7	Characteristics of Sine Wave	1	
	8	Sinusoidal voltage and current, instantaneous, peak, average and RMS values.	3	
	9	Phasor representation of AC quantities.	1	
	10	Inductive and Capacitive Reactances, Impedance, Self inductance, Mutual inductance, Construction and working principle of Transformer.	1	
	11	V-I Relationship in Resistor, Capacitor and Inductor.	2	
	12	Comparison of Single- phase and Three- phase systems.	2	
		Circuits and Networks- Sudhakar and Shyam Mohan Networks and Systems- D Roy Choudhary		
III		**Semiconductor Theory and PN junction.**	**11**	20
	13	Concept of Energy Bands in Solids, Insulators, Semiconductors and Conductors	1	
	14	Intrinsic and Extrinsic semiconductors, n-type and p-type semiconductors, Fermi Level	2	
	15	Drift and Diffusion current, Mobility, Conductivity, Hall Effect (No derivation)	2	
	16	PN Junction diode: Forward and Reverse biased PN junction	2	
	17	Depletion layer, Diode Equation, V-I characteristics, Knee Voltage, Static and Dynamic resistance, Ideal diode	2	
	18	Zener diode: Breakdown Mechanisms, V-I Characteristics, LED-construction and working, multicolor LED.	2	
		Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky		
IV		**Diode Applications**	**10**	20
	19	Rectifiers: Half wave and Full wave rectifiers, PIV, Capacitor filter, calculation and comparison of ripple factors.	4	
	20	Zener diode as Voltage regulator. Fixed voltage regulator ICs 78XX and 79XX series.	2	
	21	Clippers and Clampers: Positive, Negative and Biased.	3	
	22	Block diagram of Regulated DC Power supply.	1	

	Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky			
V	**Hands-on: Electrical and Electronic Fundamentals**		**30**	
	1	Safety precautions for electrical installations		
	2	Familiarization of measuring instruments		
	3	Application of Kirchoff's laws.		
	4	Characteristics of PN junction Diode.		
	5	Zener diode characteristics		
	6	Voltage regulator using zener		
	7	Rectifiers with Capacitor Filter		
	8	Build a 5 V dc Power supply using 7805		
		Mini Projects based on the above Experiments. Simulation of simple circuits.		

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

Textbook:	Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky, Pearson Education Publications. 2. Networks and Systems- D Roy Choudhary.
Reference:	Basic Electronics: Solid State, B.L Theraja, S.Chand Publications. Basic Electrical Engineering - Nagsarkar and Sukhija, Oxford University Press Circuits and Networks- A Sudhakar and Shyam Mohan S Palli 4. A Textbook of Applied Electronics by R.S. Sedha, S Chand Publication.
Web Resources:	1. https://www.khanacademy.org/science/physics/magnetic-forces-and-magnetic-fields 2. ~~https://www.learnabout-electronics.org~~ 3. Dr. Mahesh B Patil, Department of Electrical Engineering, IIT Bombay: https://youtu.be/IoDoW5kykkw?si=20su7DXd3gMoGNt3

Resources:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	2	1	-	2		-	-	2	-
CO 2	-	2	-	2	-	1	1	1	-	2	1	-
CO 3	1	-	-	2	1	1	1	1	-	2	1	-
CO 4	-	-	2	1	-	2	2	1	-	2	-	-
CO 5	2	2	-	1	-	-	2	-	-	3	2	-
CO 6	2	-	-	2	-	-	2	-	-	3	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5	✓	✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	ELE2CJ101/ELE2MN100				
Course Title	SEMICONDUCTOR DEVICES AND CIRCUITS (P)				
Type of Course	**Major**				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic Knowledge in Physics, Mathematics and semiconductor theory.				
Course Summary	In this course, participants will explore the foundational concepts of semiconductor devices and electronic circuits, delving into topics such as transistors and amplifiers, equipping them with both theoretical knowledge and practical skills essential for designing and analyzing electronic systems in a professional context.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Interpret the construction and operation of Bipolar Junction Transistors, Field-Effect Transistors and its configurations.	U	C	Instructor-created exams / Quiz/ Assignment
CO2	Identify and design single-stage RC-coupled amplifiers.	Ap	P	Practical/ Viva Voce / Seminar
CO3	Summarize and analyze the characteristics and parameters of JFET and MOSFET.	U	C	Observation of Practical Skills / assignments
CO4	Examine the frequency response characteristics of the single-stage RC-coupled amplifier.	An	P	Practical / Instructor-created exams / Asignments
CO5	Infer the principles of feedback in oscillators.	U	C	Instructor-created exams / Quiz/assignments
CO6	Illustrate circuit diagrams and schematics to identify components and connections	U	C	Viva Voce/Practical/Project

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs 45	Mark (98)
I		**BJT**	**13**	**20**
	1	Bipolar Junction Transistor: Types, Construction and Operation.	3	
	2	CB, CE and CC configurations and Current gains.	3	
	3	Input and Output Characteristics of CE Configuration.	2	
	4	Transistor Biasing, DC load line, Q- point, Bias Stabilization, Voltage Divider Bias.	4	
	5	Hybrid Equivalent Circuit for CE Configuration	1	
		Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky,		
II		**FET**	**11**	**20**
	6	JFET: Types, Construction, Operation and Parameters	3	
	7	Drain and Transfer Characteristics	2	
	8	Comparison of JFET and BJT	1	
	9	MOSFET: Types, Construction, Operation	3	
	10	Drain and Transfer Characteristics	1	
	11	Concept of CMOS	1	
		Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky		
III		**Amplifiers**	**10**	**15**
	12	Concept of Amplification, Small Signal and Large Signal Amplifiers	1	
	13	Single stage RC coupled Amplifier (CE), Design, Frequency response, voltage and current gain	3	
	14	Multistage Amplifiers: Block Diagram and Voltage Gain	1	
	15	Two Stage RC coupled Amplifier (Circuit diagram only)	1	
	16	Power Amplifiers: Class A, Class B, Class AB, Class C and Class D operation, Types of Distortions in Power Amplifiers, Comparison	4	
		Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky		
IV		**Oscillators**	**11**	**15**
	17	Feedback Concept: Positive and Negative feedback in amplifiers. Advantages of Negative Feedback	2	
	18	Types of Feedback Connections	1	
	19	Comparison Between Amplifiers and Oscillators	1	
	20	Principle of Sinusoidal oscillators and Barkhausen Criteria	2	
	21	Phase-shift Oscillator: Circuit, Working principle and Frequency of Oscillation (Derivation Not required)	3	
	22	Transistor as a Switch: Astable Multivibrator	2	
		Circuits and Networks- Sudhakar and Shyam Mohan		
V		**Hands-on semiconductor devices and circuits**	**30**	

	1	1. Reading and understanding transistor datasheets. 2.CE Transistor Characteristics 3.JFET Characteristics 4.Design a single stage RC coupled amplifier 5.RC Phase Shift Oscillator 6.Clipping Circuits 7.Clamping Circuits 8.Astable Multivibrator		
	2	Mini Project: Soldering and testing of simple circuits and Hobby circuits for beginners		

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

Text Books	1. Basic Electronics and Linear Circuits, N.N Bhargava, S.C Gupta, D.C Kulshreshthra McGraw-Hill Education (India) Pvt Limited. 2. Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky, Pearson Education Publications. 3. Basic Electronics: Solid State, B. L Theraja, S. Chand Publications. 4. A Textbook of Applied Electronics by R.S. Sedha, S Chand Publications
Web Resources	1. Dr. Mahesh B Patil, Department of Electrical Engineering, IIT Bombay: https://youtu.be/IoDoW5kykkw?si=20su7DXd3gMoGNt3 2. https://www.learnabout-electronics.org

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	2	2	2	1	3	2	-	2	2	-
CO 2	3	3	2	3	-	-	3	2	-	2	-	-
CO 3	3	3	2	3	-	-	3	2	-	2	-	-
CO 4	3	3	2	3	-	-	3	2	-	2	-	-
CO 5	3	2	2	2	2	1	3	2	-	2	2	-
CO 6	3	2	2	2	3	3	2	-	-	3	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project/Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	ELE3CJ201				
Course Title	FOUNDATIONAL MATHEMATICS				
Type of Course	**Major**				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Fundamental Mathematics Concepts: algebra, matrix, vector				
Course Summary	1. To provide the requisite and relevant background necessary to understand the other important engineering mathematics courses offered for Engineers and Scientists. 2. To introduce important topics of applied mathematics, namely Single and Multivariable Calculus and Vector Calculus etc. 3. To impart the knowledge of Laplace transform, an important transform technique for Engineers which requires knowledge of integration .				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Illustrate single variable differentiation and integration to solve applied problems in engineering and find the maxima and minima of functions	U	C	Instructor-created exams / Quiz
CO2	Identify basic concepts of Laplace Transforms and solve problems with periodic functions, step functions, impulse functions and convolution	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Develop partial derivatives, limits, total differentials	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Infer multiple integrals in Cartesian, Polar, Cylindrical and Spherical coordinates	U	C	Instructor-created exams / Home Assignments
CO5	Identify gradient, directional derivatives, divergence, curl and Stokes	Ap	P	One Minute Reflection
CO6	Experiment with discrete-time signals and systems, and find the transfer function of	Ap	P	Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Basic Mathematics and calculus**	**15**
	1	LCM and HCF	1
	2	Trigonometry-Sines, Cosines-Sinusoidal wave	1
	3	Solution of Quadratic Equation	3
	4	Calculus -Limits, differentiation,	3
	5	Integration	3
	6	Simple Problems	4
II		**Complex numbers and Matrix**	**11**
	7	Complex numbers, polar- rectangular conversion, Pol/Rec functions on Calculator	1
	8	Exponential and Euler’s Theorem	1
	9	Logarithm functions, concept of decibel, Sketch graph of logarithmic function	1
	10	Matrices and determinants, inverse, Rank, Crammer’s rule	8
III		**Vector Algebra**	**12**
	11	Fundamentals of vector operations	2
	12	Gradient, divergence and curl	2
	13	Line, surface and volume integrals	1
	14	Statement of Stoke’s and Gauss’s theorems	1
	15	Statement of Divergence theorems	1
	16	Cross product and Dot product	1
	17	Coordinate systems: differential length, differential area, differential volume	4
IV		**Laplace and Fourier transform**	**10**
	18	Concept of Fourier Series in sine wave	1
	19	Introduction to Laplace and its inverse	2
	20	Properties of Laplace transform	2
	21	Introduction to continuous Time Fourier transform and its inverse	3
	22	Properties of Fourier transform	2
V		**Open Ended Module: Applications of Mathematics in Electronics**	**12**
	1	**Case studies:** 1.Practical problems involving Quadratic equations 2.Plotting Frequency response of an Amplifier 3.Reduction of *n*th order differential equation to first order system - Solving nonhomogeneous system of first order differential equations 4.Prove any five Fourier series properties for discrete time signals	12
		5. Find the input output relationship of an RLC network 6. Find the solution of differential equation using LaPlace transform 7. Find the input output relation in difference equation 8. Find the Transfer function using Z transform **Group Assignment:** properties of Laplace Transform and Z transform	

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-	1	-	-	1	-	-
CO 2	2	3	-	-	-	-	-	-	-	3	-	-
CO 3	-	-	1	-	-	-	-	-	2	-	-	-
CO 4	-	-	2	3	-	-	-	-	-	-	-	1
CO 5	-	1	-	-	-	-	-	-	-	-	1	-
CO 6	-	-	-	3	-	-	1	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

References

Text Books:

1.Higher Engineering Mathematics B.S.Grewal, KHANNA PUBLISHERS

Programme	B. Sc. Electronics				
Course Code	ELE3CJ202/ELEMN200				
Course Title	DIGITAL ELECTRONICS				
Type of Course	**Major**				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Knowledge about basics of number system and basic logic gates				
Course Summary	This course explores about Binary and Hexa-decimal number systems, Boolean algebra, and various digital logic circuits.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize Binary, Hexa-decimal and Decimal Number systems and the ability to convert between them.	U	C	Instructor-created exams / Quiz and Home assignments
CO2	Solve Boolean Expressions Using Theorems and K Map	Ap	P	Practical Assignment / Observation of Practical Skills and Home assignments
CO3	Select techniques related to the design and analysis of various combinational logic circuits using Logic Gates	Ap	P	Practical Assignment / Observation of Practical Skills and Home assignments
CO4	Develop small scale combinational and sequential digital circuits	C	P	Practical Assignment / Observation of Practical Skills
CO5	Infer the principles, parameters and applications of various ADCs	U	C	Instructor-created exams / Quiz
CO6	Develop problem-solving skills by applying knowledge in Digital circuits	C	M	Practical skills/Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)				

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Mark (98)
I		**Number System and Boolean Algebra**	**12**	**20**
	1	Overview of Decimal, Binary and Hexa-decimal number system	2	
	2	Boolean Algebra and Theorems	2	
	3	SOP, POS, minterm and maxterm	1	
	4	K map and Simplification of Boolean Expressions using K Map	5	
	5	Basic logic gates and Universal property of NAND and NOR Gates	2	
Digital Principles and applications- Paul Malvino and P Leach Digital Fundamentals- Thomas L Floyd				
II		**Combinational Logic Circuits**	**12**	**15**
	6	Adder and Subtractor: Half and Full	2	
	7	Multiplexers (up to 4X1)	2	
	8	De-multiplexers (up to 1X4)	2	
	9	Decoders: 2-4 and 3-8	2	
	10	Encoders:4-2, 8-3 and decimal to BCD	2	
	11	Magnitude comparators - one and two bit	2	
Digital Principles and applications- Paul Malvino and P Leach Digital Fundamentals- Thomas L Floyd				
III		**Sequential Logic Circuits**	**9**	**15**
	12	Latch Vs Flip flop, SR Flip Flop	2	
	13	JK and Master-slave Flipflops	2	
	14	D & T Flipflop, Applications of flip flops	2	
	15	Shift Registers and Applications	2	
	16	Ring and Johnson Counter	1	
Digital Principles and applications- Paul Malvino and P Leach Digital Fundamentals- Thomas L Floyd				
IV		**Counters and Converter**	**12**	**20**
	17	Synchronous UP Counter (Up to 4 bit) - Logic diagram, timing diagram	2	
	18	Asynchronous UP Counter (Up to 4 bit) - Logic diagram, timing diagram	2	
	19	Mod Counters	2	
	20	Decade counter using flip flop and 7490 IC	2	
	21	ADC - Flash Type, Counter type	2	
	22	Successive Approximation ADC, Parameters of ADC	2	
Digital Principles and applications- Paul Malvino and P Leach Digital Fundamentals- Thomas L Floyd				
V		**Hands-on Digital Electronics:** **Practical Applications and Course Project**	**30**	

	1	Implement the following: 1. Verification of De Morgan's Theorem for 2 variables 2. Universal Property of NAND and NOR Gate 3. Adders: Half and Full 4. Subtractors: Half and Full 5. 8:1 MUX using 74151/Gates 6. 1:8 DMUX using 74138/Gates 7. SR and JK flip flop using NAND 8. Ring and Johnson Counters using D flip flop	20	
	2	Mini project: Build a practical application using Digital ICs	10	

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

Text Books:

1. Digital Principles and applications- Paul Malvino and P Leach
2. Digital Design M Morris Mano
3. Digital Fundamentals- Thomas L Floyd
4. Digital Principles- R L Tokheim

Web resources:

1. https://archive.nptel.ac.in/courses/108/105/108105132
2. https://www.youtube.com/playlist?list=PLBlnK6fEyqRjMH3mWf6kwqiTbT798eAOm
3. https://pages.uoregon.edu/rayfrey/DigitalNotes.pdf

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	-	1	2	2	1	3	2	-	-	-	-
CO 2	3	3	2	2	-	1	3	3	-	-	2	-
CO 3	3	3	2	2	1	2	3	3	-	2	2	-
CO 4	3	3	2	2	1	2	3	3	-	2	2	-
CO 5	3	2	2	1	2	-	3	3	-	2	-	-
CO 6	-	-	3	-	3	3	-	3	-	3	-	-

Correlation Levels:

Level	Correlation

-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project/ Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓		✓	✓
CO 4	✓		✓	✓
CO 5	✓	✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	ELE4CJ203				
Course Title	NETWORK ANALYSIS				
Type of Course	**Major**				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Knowledge about basic mathematics and basics of voltage and current				
Course Summary	This course explores about various theorems used for analysing an electrical network.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Infer various circuit components of an electrical networks and theorems governing them	U	C	Instructor-created exams / Quiz
CO2	Categorize various electrical networks using theorems	An	P	Practical Assignment / Observation of Practical Skills/assignments
CO3	Examine networks during the transient state	An	P	Practical Assignment / Observation of Practical Skills/assignments
CO4	Analyse networks excited by an AC source and to calculate power in AC circuits	An	P	Practical Assignment / Observation of Practical Skills/assignments
CO5	Identify the concept of Resonance and BW	U	C	Instructor-created exams / Quiz/assignments
CO6	Synthesize higher order networks using simulation tools	C	M	Viva Voce/Practical/Project

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Mark (98)
I		**Various Sources and Network Theorems**	**16**	**25**
	1	Voltage and Current sources-Ideal and Practical	1	
	2	Dependent and Independent Sources	1	
	3	Source transformation	1	
	4	KCL and KVL	1	
	5	Mesh and Nodal analysis	4	
	6	Super position theorem	2	
	7	Thevenin's Theorem	2	
	8	Norton's Theorem	2	
	9	Maximum power transfer theorem	1	
	10	Reciprocity theorem	1	
		Circuits and Networks- Sudhakar and Shyam Mohan		
II		**DC Transient Analysis**	**8**	**15**
	11	Transient analysis of RL Circuit using differential equations	2	
	12	Transient analysis of RC Circuit using differential equations	2	
	13	Transient analysis of RLC Circuit using differential equations	2	
	14	Transient analysis of RLC Circuit using Laplace transform	2	
		Circuits and Networks- Sudhakar and Shyam Mohan		
III		**AC Analysis**	**11**	**15**
	15	V I Relationship in R, L and C	1	
	16	AC Response of RL Circuit using differential equations	2	
	17	AC Response of RC Circuit using differential equations	2	
	18	AC Response of RLC Circuit using differential equations	2	
	19	Complex impedance, Phasor	2	
	20	Power in AC circuit and Power triangle	2	
		Circuits and Networks- Sudhakar and Shyam Mohan		
IV		**Resonance**	**10**	**15**
	21	Series Resonance-Frequency bandwidth and Q Factor	5	
	22	Parallel Resonance-Frequency bandwidth and Q Factor	5	
		Circuits and Networks- Sudhakar and Shyam Mohan		
V		**Hands-on Network Analysis: Practical Applications and Course Project**	**30**	
	1	Implement the following: 1. Verification of KCL and KVL 2. DC Response of RC and RL circuit using Simulation Tool 3. Frequency Response of High Pass and Low Pass RC circuit 4. Sinusoidal Response of RL and RLC using simulation tool 5. Series resonance-Measurement of resonant frequency, BW and Q 6. Parallel resonance using simulation tool.	20	
	2	Mini Project: Applications of networks and theorems in higher order filters	10	

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References:

Text Books

1. Networks and Systems- D Roy Choudhary
2. Circuits and Networks- Sudhakar and Shyam Mohan
3. Network Analysis- Van Valkenberg
4. Essentials of circuit analysis-Robert L Boylestad

Web Recourses

1. https://archive.nptel.ac.in/courses/108/105/108105159/
2. https://www.youtube.com/watch?v=duYOtrPE_hg
3. https://www.youtube.com/watch?v=1Uvom_Ci8Yg

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	2	2	2	1	3	2	-	2	2	-
CO 2	3	3	2	3	-	-	3	2	-	2	-	-
CO 3	3	3	2	3	-	-	3	2	-	2	-	-
CO 4	3	3	2	3	-	-	3	2	-	2	-	-
CO 5	3	2	2	2	2	1	3	2	-	2	2	-
CO 6	3	2	2	2	3	3	2	-	-	3	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project/Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	ELE4CJ204				
Course Title	MICROPROCESSORS AND MICROCONTROLLERS				
Type of Course	**Major**				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge of digital electronics and logic circuits is recommended.				
Course Summary	This course provides an introduction to microprocessors and microcontrollers, focusing on the 8085 and 8051 architectures. Students will gain an understanding of microprocessor/microcontroller architecture, instruction sets, programming, and interfacing with peripheral devices. The course includes both theoretical and practical components.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Compare the architectures of microprocessor, microcontroller	U	F	Instructor-created exams / Quiz
CO2	Identify the memory organization of 8051 microcontroller	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Showcase the skill, knowledge and ability of programming using instruction set	C	P	Seminar Presentation / Group Tutorial Work
CO4	Illustrate with microcontroller and interfaces including general purpose input/ output and timers	U	C	Instructor-created exams / Home Assignments
CO5	Interface 8051 microcontroller with the input and output devices such as LEDs, and keypad	Ap	P	One Minute Reflection Writing assignments
CO6	Combine and use peripheral serial communication and the concepts of interrupts in 8051 microcontrollers	C	P	Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P)
Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Introduction to 8085 Microprocessors**	**10**	**20**
	1	Introduction to 8085	2	
	2	Microprocessor bus organizations, data bus, address bus, control bus	2	
	3	Architecture of 8085	4	
	4	8086 microprocessor series (Data bus and address bus only)	2	
	Micro Processors architecture, Programming, and Applications with the 8085: Ramesh Gaonkar			
II		**8051 Microcontroller**	**10**	
	5	Architecture of 8051 microcontroller	2	20
	6	Internal memory RAM organization, Register banks	2	
	7	Byte and bit addressable area, scratch pad	1	
	8	Accumulator, Flags and flag register (PSW)	1	
	9	Program counter and data pointer. Stack and Stack pointer	1	
	10	Special Function Registers (Detailed analysis not required)	1	
	11	8051 Ports and I/O pins, control signals	2	
	Micro Processors and Controllers: Krishnakanth			
III		**8051 Instruction Set:**	**10**	15
	12	Data transfer (internal and external, Arithmetic and Logic, Shifting and Rotating)	2	
	13	Branching/Jump. Bit related instructions and operations	2	
	14	Addressing modes	1	
	15	Stack-Push and POP instruction	1	
	16	Subroutine -Call and return instructions. (A call-Lcall)	2	
	17	Software delay generation, calculation and programs	2	
	The 8051 microcontroller and embedded systems using assembly and C – Kenneth. J. Ayala -CENGAGE Learning			
IV		**8051 Peripherals: Timer and Interrupt**	**15**	15
	16	Interrupt concept - 8051 Interrupts:	3	
	17	interrupt priority -interrupt destination, ISR-IE and IP registers		
	18	software generated interrupts	2	
	19	I/O Ports: Timers - Counters	2	
	20	Serial port interrupt - External interrupt - Reset	2	
	21	Peripheral Interfacing: LED, KEY (Input and Output mode)	3	
	22	Keyboard :2 x 2 Matrix	2	

	The 8051 microcontroller and embedded systems using assembly and C – Kenneth. J. Ayala -CENGAGE Learning The 8051 microcontroller and applications: Ali Mazidi			
V	**Hands-on : Practical Applications, Case Study and Course Project**		**30**	
	1	1. Keil-c Simulator/proteus simulator tool Introduction /8051 kit 2. Addition – 8-bit, 16-bits 3. Subtraction – 8-bit, 16 bits 4. Block data transfer 5. Array addition (multibyte) 6. Logical operators – AND, OR NOT 7. Multiplication & Division 8. I/O ports programming.	20	
	2	Case study: Mini project	3	
	3	Capstone (/Course) Project: Traffic light controller Water level Indicator alarm Remote Room Temperature Monitoring Digital countdown timer-7 segment display)	7	

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	-	1	-	-	1	3	-	-	-	-	-
CO 2	2	-	-	1	-	1	2	-	-	-	-	-
CO 3	1	-	2	-	-	-	3	-	-	1	3	3
CO 4	1	-	1	-	-	1	1	-	-	-	2	-

CO 5	2	2	1	-	1	-	1	3	-	-	-	-
CO 6	1	3	2	-	-	-	2	3	-	-	1	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

References:

Text Books

1. Microprocessor Architecture Programming and Application with 8085, Ramesh S. Gaonkar, Prentice Hall
2. The 8051 microcontroller and embedded systems using assembly and C, Kenneth. J. Ayala – CENGAGE Learning
3. The 8051 microcontroller and applications, Ali Mazidi

Programme	B. Sc. Electronics				
Course Code	ELE4CJ205				
Course Title	ANALOG ELECTRONICS				
Type of Course	**Major**				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic Electronics and Electronic Circuits				
Course Summary	This course explores basics of Op-amp and different applications such as wave form generators, wave shaping circuits, Instrumentation amplifiers etc. Also give the awareness of IC555 and its applications				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize Basic Circuit Components. An introduction to electrical circuit components including ideal operational amplifiers	U	C	Instructor-created exams / Quiz
CO2	Analyze ideal operational amplifier circuits and design basic functions	An	P	Practical Assignment / Observation of Practical Skills
CO3	Assume and analyze circuits that use op-amps to generate various waveforms	An	P	Practical Assignment / Observation of Practical Skills
CO4	Analyze and synthesize wave shaping circuits and active filters using operational amplifiers.	An	P	Instructor-created exams / Home Assignments
CO5	Identify the role of op-amps in active filters and wave shaping circuits, including the configurations and characteristics of op-amps that make them suitable for these applications.	Ap	P	Seminar Presentation / Observation of Practical Skills
CO6	Demonstrate the functional characteristics and applications of different analog ICs .	U	C	Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Introduction to Op-amp and basic circuits**	**12**
	1	Block Diagram of operational Amplifier	1
	2	Ideal Op-amp, open loop and closed loop, CMRR and Slew rate	3
	3	Inverting and Non-Inverting Amplifier, virtual ground, Gain	2
	4	Voltage Follower	1
	5	Summing and Difference Amplifiers	2
	6	Instrumentation Amplifier	1
	7	Integrator and Differentiator	2
II		**Waveform Generators**	**10**
	8	Basic comparator and its Characteristics	1
	9	Typical comparator circuits using op amp	2
	10	Zero crossing detector and Schmitt trigger	3
	11	Square wave and Triangular wave generators	2
	12	Sinusoidal Oscillators, Phase shift Oscillators	2
III		**Wave shaping circuits and Active Filters**	**8**
	13	Clippers and Clampers	2
	14	First order Butter worth Low pass and High pass Filters	1
	15	Band pass and Band Reject Filters	1
	16	Notch and All pass Filters	1
	17	Digital to Analog Converters	3
IV		**Other Analog ICs**	**15**
	18	Functional block diagram of IC 555 and Pin Diagram	2
	19	Astable and Monostable Multivibrator using IC555and its applications	5
	20	Voltage controlled oscillator (VCO)	2
	21	PLL – Block diagram and Operating principle	2
	22	Parameters and pin out function	2
	23	Variable voltage Regulators (IC 723)	2
V		**Hands-on Analog Electronics:**	**30**
	1	Inverting and Non-Inverting Amplifier	4
	2	Summing and Difference Amplifiers	4
	3	Zero crossing detector and Schmitt trigger	2
	4	Phase shift Oscillator	2
	5	First order Butter worth Low pass and High pass Filters	2
	6	Astable and Monostable Multivibrator using IC555	4
	8	Low Voltage Regulators using IC 723	2
	9	Mini Project based on Op-Amp	10

Reference:

1. Ramakant A. Gayakwad,” Op-amp and Linear ICs”, Prentice-Hall of India Private LTD.

2. Botkar,” Integrated Circuits” Mottershed,” Electronic Devices and circuits”,

3. Millman & Halkias,” Integrated Electronic”, Tata McGraw-Hill Publishing LTD.

4. Tobey & Buelsman," Op-amp Design and Application".

5. Integrated Electronics- Milman&Halkias, Mc Graw Hill- Kogakusha (2003)

6. Electronics Fundamental and Applications- J. D. Ryder, Prentice Hall, India, 5th edition (2009)

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	3	-	-						
CO 2	3	2	3	3	-	-						
CO 3	3	2	3	3	-	-						
CO 4	3	2	3	3	-	-						
CO 5	-	1	3	3	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project/Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4		✓	✓	✓
CO 5		✓	✓	✓
CO 6	✓			✓

Programme	B. Sc. Electronics				
Course Code	ELE5CJ301				
Course Title	FIELD THEORY				
Type of Course	**Major**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Knowledge about foundational mathematics				
Course Summary	This course explores about various laws theorems that governs electromagnetic fields and wave propagation				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Illustrate basic concepts of Static electric field and Laws Governing them.	U	C	Instructor-created exams / Quiz
CO2	Relate Fundamentals of Magneto statics with the Laws Governing static magnetic fields	U	C	Instructor-created exams / Quiz
CO3	Summarize Maxwell's Equations with the physical significance of each	U	C	Instructor-created exams / Quiz
CO4	Analyse electromagnetic phenomena using Maxwell's equation and to understand the characteristics of uniform plane wave.	An	C	Instructor-created exams / Home Assignments
CO5	Infer various transmission lines, parameters and propagation modes	U	C	Instructor-created exams / Quiz
CO6	Apply basic concept of EM theory in electronics and communication	Ap	P	Assignment/Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Mark (98)
I		**Electrostatics**	**10**	**15**
	1	Coulomb's Law	1	
	2	Gauss's Law and Applications	1	
	3	Electric Potential and Field	2	
	4	Capacitance and capacitors and Electrostatic energy	3	
	5	Poisson's and Laplace's Equations	2	
	6	Boundary Conditions	1	
		Engineering Electromagnetics- Haytt Elements of Electromagnetics- Mathew O, O. Sadiku		
II		**Magnetostatics**	**12**	**15**
	7	Ohms law, Current and Current density	2	
	8	Kirchhoff's Law and equation of continuity	2	
	9	Biot-Savart's Law	1	
	10	Magnetic Vector potential	1	
	11	Ampere Circuital theorem	1	
	12	Magnetostatic energy	2	
	13	Boundary Condition	3	
		Engineering Electromagnetics- Haytt Elements of Electromagnetics- Mathew O, O. Sadiku		
III		**Electromagnetic Field Theory**	**14**	**20**
	14	Faraday's Law	2	
	15	Inconsistency of Ampere Circuital theorem, Conduction and displacement current	3	
	16	Maxwell's Equation, Integral and Differential form and for time varying fields	6	
	17	Poynting Theorem	3	
		Electromagnetic Field theory and transmission lines- G S N Raju Elements of Electromagnetics- Mathew O, O. Sadiku		
IV		**Transmission Line Theory**	**12**	**20**
	18	Transmission Line-Twisted, Parallel and coaxial	2	
	19	Modes of transmission and Transmission line equations	6	
	20	Group and phase velocity	1	
	21	Characteristic Impedance,	1	
	22	Reflection co efficient and VSWR	2	
		Electromagnetic Field theory and transmission lines- G S N Raju Elements of Electromagnetics- Mathew O, O. Sadiku		
V		**Open Ended Module**	**12**	
		Solutions for Maxwell's equations in free space Group and phase velocity in free space		

		Advanced and planar transmission lines Waveguides Microwave sources amplifiers devices, circuits and applications		

References:

Text Books

1. Engineering Electromagnetics- Haytt
2. Electromagnetic Field theory and transmission lines- G S N Raju
3. Elements of Electromagnetics- Mathew O, O. Sadiku
4. Electronic Communication systems- Kennedy

Web Recourses

1. https://archive.nptel.ac.in/courses/108/104/108104087/
2. https://freevideolectures.com/course/3288/electromagnetic-theory

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	2	2	2	1	3	2	-	2	2	-
CO 2	3	2	2	2	2	1	3	2	-	2	2	-
CO 3	3	2	2	2	2	1	3	2	-	2	2	-
CO 4	3	1	2	3	1	1	3	2	-	2	2	-
CO 5	3	1	1	2	-	-	2	2	-	2	2	-
CO 6	2	3	2	2	3	3	2	-	-	3	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam

- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5	✓	✓		✓
CO 6		✓		

Programme	B. Sc. Electronics				
Course Code	ELE5CJ302				
Course Title	PYTHON PROGRAMMING				
Type of Course	**Major**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamental Mathematics Concepts 2. basic computer skills				
Course Summary	This course covers the fundamental aspects of Python programming, ensuring students gain a solid understanding and practical experiences in various application domains.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Outline the concepts of variables, operators, and control flow statements.	U	F	Instructor-created exams / Quiz
CO2	Interpret the purpose and usage of functions and modules Develop Python programming concepts by explaining how loops, conditional statements, and data structures work.	U	C	Instructor-created exams / Quiz
CO3	Apply their knowledge to solve problems by writing Python scripts that use standard programming constructs like functions, loops, and conditional statements	Ap	C	Practical Assignment / Observation of Practical Skills

CO4	Dissect complex problems into smaller, more manageable parts and use Python to solve these sub-problems	An	p	Practical Assignment / Observation of Practical Skills
CO5	Examine Python code by identifying and correcting errors.	An	P	Practical Assignment / Observation of Practical Skills
CO6	Inspect the effectiveness of different programming approaches, and make decisions on which algorithms or data structures to use in various scenarios.	An	P	Group project Work

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Fundamentals of Python**	**10**	
	1	Python features, comparison with C & Execution of a python program	2	**15**
	2	comments, identifiers, keywords, variables	2	
	3	Datatypes in python- built-in datatypes and user-defined datatypes	3	
	4	Different operators in python, operator precedence and associativity	2	
	5	input & output Statements	1	
E. Balaguruswamy, Introduction to Computing and Problem-Solving Using Python Richard L. Halterman, Learning to Program with Python				
II		**Control statements, arrays and strings**	**10**	**20**
	6	If, if…else, if…else if…. else statements	2	
	7	Loops-while, for, infinite, nested	2	
	8	Break, continue, pass, assert and return statements	3	
	9	Arrays-creating, importing an array module, indexing and slicing on arrays	3	
E. Balaguruswamy, Introduction to Computing and Problem-Solving Using Python Richard L. Halterman, Learning to Program with Python				
III		**Sequences, dictionaries and Functions**	**13**	20
	10	string operations-length, indexing, slicing, repeating, concatenation, checking, basic string operations	2	
	11	List- creating list, accessing, updating and deleting elements from a list, basic list operations.	2	
	12	Tuple- creating and accessing tuples in python, basic tuple operations	2	
	13	Operations on dictionary, dictionary methods, using for loop with dictionaries	3	
	14	Function-built-in functions, composition of functions, user defined functions	2	
	15	Parameter and arguments, python recursive and anonymous function	2	

<table>
<tr><td colspan="5">E. Balaguruswamy, Introduction to Computing and Problem-Solving Using Python
Richard L. Halterman, Learning to Program with Python</td></tr>
<tr><td rowspan="4">IV</td><td colspan="2">Introduction to OOPs</td><td>12</td><td rowspan="4">15</td></tr>
<tr><td>16</td><td>Procedure orient approach and object orient approach</td><td>1</td></tr>
<tr><td>17</td><td>Problems in procedure orient approach and speciality of python approach</td><td>1</td></tr>
<tr><td>18</td><td>Features related to OOPS</td><td>3</td></tr>
<tr><td rowspan="4"></td><td>19</td><td>Classes, creating a python class</td><td>2</td><td rowspan="4"></td></tr>
<tr><td>20</td><td>objects-creating a class, declaring class objects</td><td>2</td></tr>
<tr><td>21</td><td>self-variable, constructor, types of variables and methods</td><td>2</td></tr>
<tr><td>22</td><td>Types of files in python</td><td>1</td></tr>
<tr><td colspan="5">E. Balaguruswamy, Introduction to Computing and Problem-Solving Using Python
Richard L. Halterman, Learning to Program with Python</td></tr>
<tr><td rowspan="10">V</td><td colspan="2">Hands-on Python</td><td>30</td><td></td></tr>
<tr><td>1</td><td>program to generate random numbers</td><td></td><td></td></tr>
<tr><td>2</td><td>program to accept 2 complex numbers and find their sum</td><td></td><td></td></tr>
<tr><td>3</td><td>program to simulate a simple calculator for performing basic arithmetic operations</td><td></td><td></td></tr>
<tr><td>4</td><td>program to generate Fibonacci series</td><td></td><td></td></tr>
<tr><td>5</td><td>Program to sort a group of strings in to alphabetical order</td><td></td><td></td></tr>
<tr><td>6</td><td>Program to find maximum and minimum elements in a list of elements</td><td></td><td></td></tr>
<tr><td>7</td><td>Program that uses a simple structure for storing students’ details</td><td></td><td></td></tr>
<tr><td>8</td><td>program to check whether a given number is palindrome or not and also count the number of occurrences of each digit in the input number.</td><td></td><td></td></tr>
<tr><td>9</td><td>Simple project like number guessing game, word guessing game etc.</td><td></td><td></td></tr>
</table>

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References:

Textbooks:

1. E. Balaguruswamy, Introduction to Computing and Problem-Solving Using Python
2. Richard L. Halterman, Learning to Program with Python
3. Martin C. Brown, Python: The Complete Reference

Web resources:

1. https://www.youtube.com/watch?v=eWRfhZUzrAc
2. https://nptel.ac.in/courses/106106145

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	1	-	1	-	1	-	-	-	-	-
CO 2	1	-	1	-	2	-	2	-	-	1	-	-
CO 3	-	-	2	-	2	-	2	-	-	2	-	-
CO 4	-	-	1	-	1	-	1	-	-	1	-	1
CO 5	-	-	1	-	-	-	1	-	-	2	-	-
CO 6	-	-	1	-	3	-	1	-	-	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar /project
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓

CO 3	✓	✓		✓
CO 4		✓	✓	
CO 5		✓	✓	
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	ELE5CJ303				
Course Title	SIGNALS AND SYSTEMS				
Type of Course	**Major**				
Semester	V				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Knowledge about basic mathematics and knowledge about various signals				
Course Summary	This course explores about various operations on signals that is useful for real time world applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize the basic properties and classifications of Signals	U	C	Instructor-created exams / Quiz
CO2	Evaluate various Signal properties by performing various operations and to understand their practical implications	Ap	P	Practical/ Assignment / Observation of Practical Skills
CO3	Apply the knowledge to classify systems based on their properties and behaviour	Ap	P	Practical/ Seminar Presentation / Group Tutorial Work
CO4	Identify Z transform and its properties to practical problems in digital signal processing	Ap	P	Practical/ Instructor-created exams / Home Assignments
CO5	Apply the DFT and FFT to complex signals and understand the significance of phase and magnitude spectra	Ap	P	Practical/ Instructor-created exams / Home Assignments
CO6	Develop various signals and systems using simulation tools	C	M	Practical/Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Mark (98)
\I		**Signals**	**15**	**20**
	1	Signals-Analog, Discrete and Digital	1	
	2	Uni-dimensional and multi-dimensional signals	1	
	3	Energy and power signals	1	
	4	Periodic and aperiodic signal	1	
	5	Causal and non causal signals	1	
	6	Even and odd signals, asymmetric signals	1	
	7	Representation methods-Functional, Graphical, Tabular and Sequential	2	
	8	Standard test signals-Unit impulse, Unit Step and Unit ramp	2	
	9	Basic operations on signals-Vector addition, multiplication, time shifting, folding, scaling (Both amplitude and time) and Convolution	5	
		Signals & Systems – A Nagoor Kani		
II		**Systems**	**7**	**15**
	10	Systems Definition	1	
	11	Classification: Static-Dynamic, Linear-Nonlinear, Time Varying-Time in varying, Stable-Astable, Causal-Noncausal, IIR-FIR, Recursive-non recursive	3	
	12	Excitation, Response and Impulse Response	1	
	13	Transfer Function	1	
	14	Characteristic equation and order of system	1	
		Signals & Systems – A Nagoor Kani		
III		**Z transform**	**9**	**15**
	15	Definition and ROC	1	
	16	Properties (Linearity, Time shifting, Time reversal, Conjugation, Convolution, Initial Value theorem, Final value theorem)	4	
	17	Z and Inverse Z transform of signals-Problems	4	
		Signals & Systems – A Nagoor Kani		
IV		**DFT**	**14**	**20**
	18	DTFT definition properties	2	
	19	DFT and IDFT-Definition and important properties	4	
	20	Circular convolution	2	
	21	FFT Radix-2 Decimation in time	3	
	22	FFT Radix-2 Decimation in Frequency	3	
		Signals & Systems – A Nagoor Kani		
V		**Hands-on Signals and Systems** **Practical Applications and Course Project**	**30**	
	1	Implement the following: 1. Generation of standard test signals 2. Basic operations on signals 3. Linear Convolution 4. Circular Convolution 5. DFT and IDFT 6. FFT.	20	
	2	Mini Project: Applications such as Filter design and systems designing.	10	

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References:

Text Books

1. Signals & Systems – A Nagoor Kani
2. Digital Signal Processing – A Nagoor Kani
3. Digital Signal Processing – S Salivahan
4. Digital Signal Processing – Ramesh Babu

Web Link

1. https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/videogalleries/video-lectures/
2. https://www.youtube.com/playlist?list=PLOunECWxELQRYwsuj4BL4Hu1nvj9dxRQ6

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	2	2	2	1	3	2	-	2	2	-
CO 2	3	-	-	3	-	-	3	2	-	3	-	-
CO 3	3	3	-	-	-	-	3	2	-	2	-	-
CO 4	3	3	-	-	-	-	3	2	-	2	-	-
CO 5	3	3	-	-	-	-	3	2	-	2	-	-
CO 6	3	3	2	3	2	3	2	-	-	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	ELE6CJ304/ELE8MN304				
Course Title	OPTO ELECTRONICS				
Type of Course	**Major**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Basic Electronic Devices				
Course Summary	This course explores the optical properties of semiconductors, junction theory, Opto electronic detectors and display devices				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize the principles and operation of key optoelectronic devices, such as light-emitting diodes (LEDs), lasers, photodetectors, and optical modulators	U	C	Instructor-created exams / Quiz
CO2	Infer the semiconductor physics underlying optoelectronic devices, including the behavior of carriers, bandgap engineering, and semiconductor material properties	U	C	Assignment / Seminar Presentation
CO3	Illustrate the principles behind various display technologies, including liquid crystal displays (LCDs), organic light-emitting diodes	U	C	Seminar Presentation / Group Tutorial Work

	(OLEDs), and other emerging technologies.			
CO4	Compare and evaluate different device designs of LEDs and Laser diodes	An	P	Instructor-created exams / Home Assignments
CO5	Utilize the knowledge about photodiodes to design a simple photodetector circuit	Ap	P	Group Tutorial Work
CO6	Classify operational modes and luminescence mechanisms involved in various display devices	U	C	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Optical properties of semiconductors**	**11**
	1	Radiative and non-radiative recombination, band to band recombination	2
	2	Exciton absorption, donor- acceptor and impurity band absorption	2
	3	Relation between absorption and emission	1
	4	Stokes shift in optical transitions	2
	5	LASER principle and characteristics	3
	6	Spontaneous and stimulated emission, examples of LASERs	1
II		**Junction Theory**	**12**
	7	PN junction and Current density across junctions	3
	8	Graded junctions	1
	9	Heterojunction, Double heterojunction	3
	10	Quantum well and Quantum dots	2
	11	LED structures- SH, DH, SQW, MQ	2
	12	Generation of white light and applications	1
III		**Opto-electronic detectors and Display devices**	**14**
	13	Thermal detectors and Photoconductive detectors	4
	14	P-I-N photodetector	1
	15	Silicon photodiodes and performance characteristics	2
	16	Phototransistors and Metal Semiconductor photodetectors	3
	17	PL, EL, CL displays	2
	18	Displays based on LED, Plasma panel and LCD	2
IV		**Introduction to Fiber Optics**	**11**
	19	Introduction to Fiber optics, structure	2
	20	light propagation in fibers and characteristics	2
	21	Critical angle, Total internal reflection, Acceptance angle, Numerical Aperture	5
	22	Advantages of optical Communication	2
V		**Open Ended Module: Virtual lab experiments**	**12**
	1	Design and set up photo detector circuit experiments other photonics experiments Open-Ended Exploration and Assessment: Student-led research on finding the importance of Opto electronics in the present and future, make a report	12

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References:

Text Books

1. Semiconductor optoelectronic devices- Pallab Bhattacharya, PHI, ISBN-978-

81203-2047-5(2009)
2. Semiconductor optoelectronics- Jasprit Singh, Tata Mc Graw Hill (1995)
3. Semiconductor physics and optoelectronics- V Rajendran, J. Hemaletha, M Stalin Maccolin, Vikas Publishers Delhi (2004), ISBN,81-259-1448-X
4. An introduction to Optoelectronics- Wilson and Hawkes, PHI, (1996)
5. Light Emitting Diodes- E Fred Scheubert, Cambridge University Press, (2003)
6. Solid State Lighting- Zukaszukasu, John Wiley Sons, NY (2002)
7. Optoelectronic devices and systems – S C Gupta, PHI, (2005)
8. Solid State Electronic devices- Ben G Streetmann and Sanjay Banerjee, PHI (2003)5 th Edition, ISBN-81-203-1840-4
9. Introduction to Semiconductor Materials and Devices- M S Thyagi, John Wiley Sons, NY, (2003)
10. Physics of semiconductor devices- S M Sze John Wiley Eastern 2 nd Edition, (2002) ISBN- 9971-51-266-1

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	-	3	-	-						
CO 2	-	-	-	2	-	-						
CO 3	-	-	-	3	-	-						
CO 4	3	1	-	-	-	-						
CO 5	3	1	1	-	-	-						
CO 6	-	-	-	2	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Project/Practical (20%)

- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4	✓	✓		✓
CO 5	✓		✓	✓
CO 6	✓	✓		✓

Programme	B. Sc. Electronics				
Course Code	ELE6CJ305/ELE8MN305				
Course Title	ANALOG AND DIGITAL COMMUNICATION				
Type of Course	**Major**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	• Basic understanding of electronics concepts such as circuits, signals, and components. • Familiarity with mathematical concepts like calculus and probability.				
Course Summary	This course provides a foundation in the principles and techniques of analog and digital communication systems. Students will learn about the basic concepts of amplitude modulation (AM) and frequency modulation (FM) for analog signal transmission, design and function of transmitters and receivers for AM and FM, fundamentals of pulse modulation including sampling, quantization, and coding techniques like PCM, digital pulse modulation techniques like ASK and FSK, and basic communication system. Through this understanding, students will be able to analyze the characteristics of analog signals and their limitations in transmission.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Compare the working principles of amplitude modulation (AM) and frequency modulation (FM) for analog signal transmission	U	F	Instructor-created exams / Quiz
CO2	Develop the design and function of basic transmitter and receiver blocks for AM and FM transmission	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Summarize the fundamentals of pulse modulation, including sampling, quantization, and coding techniques like Pulse Code Modulation (PCM)	U	F	Seminar Presentation / Group Tutorial Work
CO4	Categorize between analog and digital pulse modulation techniques like Amplitude Shift Keying (ASK) and Frequency Shift Keying	An	C	Instructor-created exams / Home Assignments
CO5	Construct basic communication system components (modulators, demodulators, filters) using hardware or software tools	C	P	Project reports, presentations demonstrating successful implementation of communication system components.
CO6	Analyze the characteristics of analog signals (bandwidth, power spectrum) and understand their limitations in transmission	An	C	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Amplitude Modulation and Angle Modulation,**	**10**	**15**
	1	Block diagram of communication system, Electro magnetic spectrum and history of communication systems	2	
	2	Need for modulation, Amplitude Modulation power relations in AM waves	2	
	3	Basic concepts of Frequency Modulation and Phase Modulation	1	
	4	Types of FM -Narrow band FM, Wide band FM, and comparison	2	

	5	Transmission bandwidth of FM Wave	1	
	6	Comparison of FM and AM, Concept of Pre-emphasis and de-emphasis.	2	
		Electronic Communication Systems: George Kennedy		
II		**Transmitters and Receiver**	**13**	**20**
	7	Block Diagram of AM Transmitter and FM Transmitter	2	
	8	Radio Receiver - Receiver types, TRF	1	
	9	Superheterodyne receiver	2	
	10	Sensitivity, Selectivity, Image frequency and its rejection	2	
	11	IF amplifiers, AGC, Amplitude limiting	1	
	12	Block diagram of FM Receiver,	2	
	13	Stereo-phonic FM multiplex system	2	
	14	Comparison of AM and FM Receivers	1	
		Electronic Communication Systems: George Kennedy		
III		**Pulse Modulation**	**13**	**20**
	15	Sampling - reconstruction - aliasing	2	
	16	Types of Pulse modulation- PAM, PWM and PPM generation	5	
	17	Pulse Code Modulation: PCM Generation and Reconstruction	3	
	18	Quantization, Companding	1	
	19	Multiplexing Techniques - FDM and TDM	2	
		Electronic Communication Systems: George Kennedy		
IV		**Digital Modulation Techniques**	**9**	**15**
	20	ASK- Modulator, Coherent ASK Detector,	3	
	21	FSK- Modulator, Non-Coherent FSK Detector	3	
	22	BPSK- Modulator, Coherent BPSK Detection.	3	
		Taub s Principles of Communication Systems: Herbert Taub		
V		**Hands-on:** **Practical Applications, Case Study and Course Project**	**30**	
	1	List of Experiments: 1. Amplitude modulation 2. AM demodulation 3. Frequency modulation 4. Frequency Division Multiplexing & De multiplexing 5. Pulse Amplitude Modulation 6. PAM Demodulation 7. Pulse Width Modulation 8. Pulse Position Modulation 9. Frequency Shift Keying: Generation and Detection	30	

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	1	2	-	-	3	-	-	-	1	-
CO 2	1	-	1	2	-	-	2	-	-	-	2	1
CO3	1	-	1	2	-	1	2	-	-	2	1	-
CO 4		1	-	1	2	-	1	2	-	1	-	1
CO 5		1	-	1	-	-	1	1	-	1	-	-
CO 6		1	-	1	-	-	-	1	1	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

References:

Text Books

1. Analog and Digital Communications, Simon Haykin, John Wiley, 2005
2. Electronics Communication Systems- Fundamentals through Advanced, Wayne Tomasi,5th Edition, 2009, PHI
3. Principles of Communication Systems, Herbert Taub, Donald L Schilling, Goutam Saha, 3rd Edition, McGraw- Hill, 2008.
4. Electronic Communications, Dennis Roddy and John Coolen, 4th Edition, Pearson Education India
5. Electronics & Communication System, George Kennedy and Bernard DavisTMH 2004

Programme	B. Sc. Electronics				
Course Code	ELE6CJ306/ELE8MN306				
Course Title	EMBEDDDED SYSTEM DESISGN WITH IOT				
Type of Course	**Major**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	2	75
Pre-requisites	Knowledge in Electronics Computer architecture Basic programming skills				
Course Summary	This course provides a comprehensive introduction to embedded systems and the Internet of Things (IoT), covering fundamental concepts, hardware, programming, and practical applications. Students will gain hands-on experience with popular development boards like Arduino and Node MCU, learn basic embedded C programming, and explore various sensors and actuators interfacing techniques.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize embedded systems, covering their definition, application areas, categories, and architecture	U	C	Instructor-created exams / Quiz
CO2	Develop programming embedded systems using the C language.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Identify Arduino boards and their applications in embedded systems development.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Outline Internet of Things (IoT) concepts and practical skills in developing IoT	U	C	Instructor-created exams / Home Assignments

	solutions using Node MCU development boards.			
CO5	Develop IoT applications using Arduino boards and Node MCU.	Ap	P	One Minute Reflection Writing assignments
CO6	Develop critical thinking and problem-solving skills in IoT and embedded programming.	Ap	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)	Marks (98)
I		**Embedded Concepts**	**6**	**10**
	1	Introduction to embedded systems	1	
	2	Application Areas	1	
	3	Categories of embedded systems	2	
	4	Architecture of embedded systems: Hardware architecture and Software architecture	2	
II		**Basics Embedded C Programming**	**10**	**20**
	5	Data types (int, char and float) , Variables and variable declaration	2	
	6	Operators in Embedded C (Relational, Equality, Arithmetic and Logical)	2	
	7	Control flow statements :(if, if- else, if- elseif -else and for statement)	2	
	8	The while, do-while and switch statement	2	
	9	Arrays and Pointers	2	
III		**Introduction to Arduino Board**	**10**	**15**
	10	An overview of Arduino boards	2	
	11	Pin configuration of Arduino Uno (R3)	2	
	12	Arduino Serial Monitor	2	
	13	Interfacing button, switch, LED and OLED with Arduino Uno board	2	
	14	Basics of PWM and ADC in Arduino programming	2	
IV		**IoT and IoT Development Boards**	**19**	**25**
	15	Overview of IoT.	2	
	16	IoT Layering concepts and MQTT	2	

	17	IoT Development Boards: Introduction to Node MCU development board	3	
	18	Node MCU hardware components	2	
	19	Controlling Digital and Analog Pins: Understanding GPIO pins on Node MCU, Digital input and output operations and Analog input using Node MCU's ADC	2	
	20	Connecting Node MCU to Wi-Fi: Configuring Wi-Fi settings on Node MCU, Sending and receiving data over Wi-Fi.	3	
	21	Interfacing Sensors with Node MCU	2	
	22	Understanding the basics of IoT and its applications	3	
V	**Hands-on Embedded System Design with IoT: Practical Applications, Case Study and Course Project**		**30**	
	1	Implement the following: 1. Write an Arduino program to turn ON an LED using button switch. 2. Write an Arduino program to interface OLED. 3. Write an Arduino program to display room temperature and humidity in LCD display. 4. Write an Arduino program to detect an obstacle using IR sensor. 5. DC Motor Speed Control: Connecting a DC motor to an Arduino for speed control. 6. Relay Applications: Integrating relays with Arduino for switching applications. 7. Smart Home Automation Simulation: Designing a simulation for home automation, Controlling lights, appliances, and security systems. 8. Agricultural IoT Implementation: Designing a simulation for precision farming and monitoring crop conditions, Integrating sensors for soil moisture, temperature, etc.	20	
	2	Case study	3	
	3	Capstone (/Course) Project: Build a practical application in IoT using Node MCU or Raspberry pi board	7	

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References:
Text Books

1. The 8051 Microcontroller and Embedded Systems" by Muhammad Ali Mazidi, Janice Gillispie Mazidi, and Rolin D. McKinlay
2. Computers as Components: Principles of Embedded Computer System Design" by Wayne Wolf

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-						
CO 2	2	3	-	-	-	-						
CO 3	-	-	1	-	-	-						
CO 4	-	-	2	3	-	-						
CO 5	-	1	-	-	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

Quiz / Assignment/ Quiz/ Discussion / Seminar
Midterm Exam
Programming Assignments (20%)
Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics
Course Code	ELE7CJ401
Course Title	DIGITAL SYSTEM DESIGN
Type of Course	**Major**
Semester	**VII**

Academic Level	**400 - 499**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamentals of Digital Electronics				
Course Summary	This course introduces students to the fundamentals of digital system design, focusing on combinational and sequential logic circuit design, hardware description languages (HDLs)				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Infer the fundamental concepts of digital system design, including Boolean algebra and Simplification methods	U	C	Instructor-created exams / Quiz
CO2	Demonstrate the principles behind multi level gate circuits and combinational circuit design.	U	C	Instructor-created exams / Quiz
CO3	Apply the concepts of Boolean algebra and combinational circuit design to solve problems in digital system design.	Ap	P	Seminar Presentation
CO4	Analyse state graphs and tables to derive and reduce sequential circuits for specific applications.	An	C	Instructor-created exams / Assignments
CO5	Summarize the Fundamentals of VHDL	U	C	Assignments
CO6	Identify the Digital design concepts and successfully simulate the design using VHDL	Ap	P	Assignments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hours (45)	Marks (98)
I		**Concepts of Digital System Design**	**12**	**15**
	1	Boolean Algebra - Basic Operations, Expressions and Truth Tables	2	
	2	Applications of Boolean Algebra, Minterm and Maxterm expansions	3	
	3	K-Map Simplifications *(upto Five Variable)*	4	
	4	Quine-McCluskey Method / Tabular Method	3	
		Sections from References: 1. Fundamentals of Logic Design Charles Roth Jr. 2. Digital Design M Morris Mano, Michel D Ciletti		
II		**Multilevel Gate Circuits and Combinational Circuit Design**	**12**	**20**
	5	Design of Two level and Multilevel Gate Circuits	3	
	6	Combinational Circuit Design using Gates, Gate Delays and Timing Diagrams, Hazards.	3	
	7	Multiplexers, Three state buffers, Decoders and Encoders	2	
	8	Programmable Logic Devices: PLA, PAL	2	
	9	CPLD, FPGA	2	
		Sections from References: 1. Fundamentals of Logic Design, Charles Roth Jr. 2. Digital Design, M Morris Mano, Michel D Ciletti		
III		**Sequential Circuits Design**	**15**	**25**
	10	Latches and Flip Flops	1	
	11	Registers and counters	2	
	12	Analysis of clocked Sequential Circuits	3	
	13	Derivation of State graphs and Tables	3	
	14	Reduction of State tables and State Assignment	3	
	15	Sequential Circuit Design, Mealy and Moore model of FSM	3	
		Sections from References: 1. Fundamentals of Logic Design, Charles Roth Jr. 2. Digital Design, M Morris Mano, Michel D Ciletti		
IV		**Introduction to VHDL**	**6**	**10**
	18	VHDL description of Combinational Circuits	1	
	19	VHDL Models for multiplexers and VHDL Modules	2	
	20	Signals and constants, Arrays, Operators	1	
	21	Packages and Libraries, IEEE Standard logic	1	
	22	Compilation and simulation of VHDL Code	1	

	Sections from References: 1. Fundamentals of Logic Design, Charles Roth Jr.			
V	**Hands-on: Practical Applications**		**30**	**20**
	1	Design a seven segment display driver.		
	2	Design 8 X 1 Multiplexer using gates.		
	3	To build a Flip- Flop Circuits using elementary gates. *(RS, Clocked RS, D-type).*		
	4	Design a counter using D/T/JK Flip-Flop.		
	5	Write VHDL code to realise basic and derived logic gates.		
	6	Write VHDL code to Half adder, Full Adder using basic and derived gates.		
	7	Write VHDL code to Half subtractor and Full Subtractor using basic and derived gates.		
	8	Write VHDL code to Clocked D FF, T FF and JK FF (with Reset inputs).		
		Case study: Traffic light controller /Stepper motor sequence generator / Rolling display.		

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

Resources:

Textbooks	1. Fundamentals of Logic Design, Charles Roth Jr., Cengage Learning, India Edition, 5th Edition. 2. Digital Design, M Morris Mano, Michel D Ciletti, Pearson, 5th Edition. 3. Digital System Design using VHDL, Charles H Roth, Jr. and Lizy Kurian John, Cengage Learning
References:	1. Digital System Design with VHDL, Mark Zwoli nski, Pearson Education Limited. 2. A VHDL Primer, Jayaram Bhasker, Prentice Hall. 3. Digital Systems Design, A Nagoor Kani, CBS Publishers and Distributors Pvt Ltd.
Online Resources	1. Electronics – Digital circuits and systems, Prof. S Srinivasan, Dept. of Electrical engineering IIT Madras: https://youtube.com/playlist?list=PL803563859BF7ED8C&si=h0rYD WcmJKgWdhZ2

	2. Digital System Design, Prof. Neeraj Goel, Assistant Professor, Dept. of Computer Science and Engineering, IIT Ropar: https://youtu.be/BoIOLczVulQ?si=b6KUQ1t6d4KOZhZL

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	-	2	-	-	3	-	-	-	-	-
CO 2	2	2	-	2	-	-	3	3	-	-	-	-
CO 3	-	-	2	-	-	-	2	3	1	-	-	-
CO 4	-	-	2	-	-	-	2	-	2	3	-	-
CO 5	-	2	2	-	-	2	3	2	-	-	-	-
CO 6	2	-	2	-	-	2	3	2	-	3	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment / Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

It	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6				

<table>
<tr><td>Programme</td><td colspan="5">B. Sc. Electronics</td></tr>
<tr><td>Course Code</td><td colspan="5">ELE7CJ402</td></tr>
<tr><td>Course Title</td><td colspan="5">ANTENNAS AND RF TECHNOLOGY</td></tr>
<tr><td>Type of Course</td><td colspan="5">Major</td></tr>
<tr><td>Semester</td><td colspan="5">VII</td></tr>
<tr><td>Academic Level</td><td colspan="5">400 - 499</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours</td></tr>
<tr><td>4</td><td>3</td><td>-</td><td>2</td><td>75</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Basic Knowledge about Electromagnetic field theory and wave propagation</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course explores about the basic operational parameters of an antenna, various types of antennas, microwave devices and components and modern RF technologies.</td></tr>
</table>

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Illustrate the fundamentals of antenna design gaining the knowledge of radiation mechanisms and antenna parameters	U	C	Instructor-created exams / Quiz
CO2	Summarize the basic characteristics of microstrip antennas, feeding methods and dipole antenna design considerations	U	C	Practical Assignment / Observation of Practical Skills
CO3	Infer the working principles of microwave devices and components	U	C	Instructor-created exams/ Seminar Presentation
CO4	Outline the principles of transmission line theory, including characteristic impedance, reflection coefficient and standing wave ratio and to use Smith chart to solve problems involving impedance matching	U	C	Instructor-created exams / Group Tutorial Work /Home Assignments
CO5	Analyze planar transmission lines such as strip line, slot line and coplanar waveguides	An	P	Practical Assignment /One Minute Reflection Writing assignments
CO6	Develop and simulate various types of microstrip antennas and understand the radiation	Ap	P	Practical Assignment/Viva Voce

	mechanism			
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Basic Antenna Theory**	**15**	**20**
	1	Antenna Definition	1	
	2	Radiation mechanism and polarization	3	
	3	Antenna parameters-Gain Directivity, radiation efficiency, effective aperture, EIRP	3	
	4	Antenna array of two isotropic point sources-Broad side and End-fire	2	
	5	Half wave dipole antenna design	2	
	6	Microstrip antennas-Rectangular and circular patch	4	
Antenna Theory Design and Analysis, Constantine A. Balanis Microstrip Antennas, Bahl I. J. and Bhartia				
II		**Microwave devices and components**	**10**	**20**
	7	Rectangular waveguide-cut off frequency, TE and TM modes	2	
	8	Basic principle of two cavity klystron	1	
	9	Reflex klystron	1	
	10	Principle of operation of Magnetron	2	
	11	Passive microwave components- Isolator, circulator, phase shifter and directional coupler	4	
Microwave Engineering, David M. Pozar Microwave devices and circuits, Samuel Y. Liao Microwave K C Gupta				
III		**Planar Transmission lines**	**10**	**15**
	12	Types of RF transmission lines, Substrate, Effective Permittivity	3	
	13	Microstrip Line	2	
	14	Slot Line	1	
	15	Coplanar Waveguide	1	
	16	Smith Chart	3	
Antenna Theory Design and Analysis, Constantine A. Balanis Microstrip Antennas, Bahl I. J. and Bhartia Microwave Integrated circuits, Gupta K. C., and Amarjit Singh				
IV		**Modern RF Technologies (Basic Concepts only)**	**10**	**15**
	17	Scattering parameters	2	
	18	Vector Network analyser	1	
	19	Concept of EMI/EMC	2	
	20	RFiD Technology	2	
	21	Wireless power transfer	1	
	22	Concept of Specific Absorption Ratio (SAR)	2	
Antenna Theory Design and Analysis, Constantine A. Balanis Microstrip Antennas, Bahl I. J. and Bhartia				

		Microwave Integrated circuits, Gupta K. C., and Amarjit Singh		
V		**Hands-on Antenna and RF Technology Practical Applications and Course Project**	**30**	
	1	Implement the following using simulation tool: 1. VSWR measurement using Smith Chart 2. Microstrip, Slotline and CPW transmission line of Characteristic impedance 50 Ohm 3. Rectangular and Circular patch antenna-Reflection, radiation and surface current 4. Effective permittivity calculation of a substrate.	20	
	2	Mini Project: Designing and modelling of an RF device such as Antenna/Filter/waveguide/transmission line etc using simulation tool.	10	

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

Text

Books:

1. Antenna Theory Design and Analysis, Constantine A. Balanis
2. Microstrip Antennas, Bahl I. J. and Bhartia
3. Microwave Engineering, David M. Pozar
4. Microwave devices and circuits, Samuel Y. Liao
5. Microwave, K C Gupta
6. Foundations for Microwave engineering, Robert E. Collin
7. Microwave Integrated circuits, Gupta K. C., and Amarjit Singh.
8. Stripline-like transmission lines for microwave integrated circuits, Bharathi Bhat and S. K. Koul.
9. Foundation for Microstrip Circuit Design, T. C. Edwards

Web Resources:

1. https://archive.nptel.ac.in/courses/108/101/108101092/
2. https://www.coursera.org/lecture/microwave-antenna/weblecture-3-1-antenna-introduction-iXKQP
3. https://ocw.mit.edu/courses/6-661-receivers-antennas-and-signals-spring-2003/pages/lecture-notes/

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	2	2	2	1	3	2	-	2	2	-

CO 2	3	2	2	2	2	1	3	2	-	2	2	-
CO 3	2	2	1	2	1	2	2	3	-	3	1	-
CO 4	3	2	2	2	2	1	3	2	-	2	2	-
CO 5	3	1	1	2	-	-	2	2	-	2	2	-
CO 6	2	3	2	2	3	3	2	-	3	3	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical/ Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	ELE7CJ403				
Course Title	ADVANCED DIGITAL SIGNAL PROCESSING				
Type of Course	**Major**				
Semester	VII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Knowledge of Signals and Systems 2. Foundational Mathematics				
Course Summary	This course introduces various spectrum estimation methods, concept of multirate digital signal processing. A study of Discrete random signal processing and simulation using Matlab is discussed.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize Signal Processing Systems. Comprehend multirate signal processing and demonstrate its applications.	U	C	Instructor-created exams / Quiz
CO2	Demonstrate an understanding of the power spectral density and apply it to discrete random signals and systems.	U	C	Practical Assignment / Observation of Practical Skills
CO3	Develop proficiency in programming languages commonly used for signal processing, such as MATLAB	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Analyze the characteristics of digital filters and understand their design parameters.	An	P	Instructor-created exams / Home Assignments
CO5	Examine and optimize digital filters for specific applications. Analyze adaptive filtering problems and demonstrate its application.	An	P	One Minute Reflection Writing assignments
CO6	Apply linear prediction and filtering techniques to discrete random signals for signal detection and estimation. Apply power spectrum estimation techniques to random signals.	Ap	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**INTRODUCTION TO DSP**	**10**
	1	Signals and system Operations, Convolution, Correlation	2
	2	Sampling, Aliasing, Fourier series, Fourier transforms	3
	3	DFT –FFT, Z transforms	2
	4	Concept of discrete time systems, Concept of filters, IIR and FIR filters	3
II		**INTRODUCTION TO MATLAB**	**10**
	5	Introduction to MATLAB	3
	6	MATLAB Characteristics – MATLAB Preliminaries	3
	7	Rules on Variable and Function, Names Special Characters	2
	8	Basic Arithmetic Operators Elementary math Intrinsic Functions File Types.	2
III		**SPECTRUM ESTIMATION**	**15**
	9	Non-parametric methods-correlation method	2
	10	Co-variance estimator- performance analysis of estimators	2
	11	Unbiased, consistent estimators	1
	12	Windows- periodogram estimator	2
	13	Barlett spectrum estimation	2
	14	Welch estimation	2
	15	Model based approach - ar, ma, arma signal modelling- p	2
	16	parameter estimation using Yule – walker method	2
IV		**MULTIRATE DIGITAL SIGNAL PROCESSING**	**10**
	17	Mathematical description of change of sampling rate	
	18	Interpolation and decimation, Continuous time model	2
	19	Direct digital domain approach, decimation by an integer factor	2
	20	Interpolation by an integer factor single and multistage realization	2
	21	Poly phase realization, application to sub band coding	2
	22	Wavelet transform and filter bank implementation of wavelet expansion of signals	2
V		**Hands-on Data Structures:** **Practical Applications, Case Study and Course Project**	**30**
	1	**1. Familiarization to MATLAB** **2. Matrix Operations:** Matrix Addition, Matrix Subtraction, Inverse Of The Matrix **3. Convolution:** Linear Convolution, Circular Convolution **4. Time domain :** Discrete Time Signals And Systems, DTFT, DFT **5. Frequency domain :** Impulse Response, FFT Operation, IFFT Operation **6. Sampling Theorem :** Verification Of Sampling Theorem **7. Filter Design :** Design Of FIR Filters and IIR Fileters **8. Transforms :** Z Transforms **9. DSP Trainers :** Familiarization of Texas Instrument DSP Kit TMS320 Series	20
	2	Case study	3
	3	Capstone (/Course) Project: Implement filter applications, low pass , high pass filters	7

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

Text Books:

1. Monson H. Hayes, Statistical Digital Signal Processing And Modeling, John Wiley And Sons, Inc.,New York,1996.

2. Hunt, Lipsman, Rosenberg, A Guide To Matlab,Cambridge

3. JohnG.Proakis, DimitrisG.Manolakis, Digital Signal Processing Prentice Hall Of India,1995

4. SanjaySharma,Signals And Systems,KatsonBooks,

5.SopoclesJ.Orfanidis, Optimum Signal Processing,Mcgraw Hill,

1990 **Mapping of COs with PSOs and POs :**

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	-	1	-	-						
CO 2	-	-	-	3	3	-						
CO 3	-	-	1	-	-	-						
CO 4	-	1	2	3	-	-						
CO 5	-	1	-	2	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		✓		✓
CO 2		✓		✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

<table>
<tr><td>Programme</td><td colspan="5">B. Sc. Electronics</td></tr>
<tr><td>Course Code</td><td colspan="5">ELE7CJ404</td></tr>
<tr><td>Course Title</td><td colspan="5">CONTROL SYSTEM ENGINEERING</td></tr>
<tr><td>Type of Course</td><td colspan="5">Major</td></tr>
<tr><td>Semester</td><td colspan="5">VII</td></tr>
<tr><td>Academic Level</td><td colspan="5">400-499</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours</td></tr>
<tr><td>4</td><td>3</td><td>-</td><td>2</td><td>75</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">1. Fundamental Mathematics Concepts: Laplace transform</td></tr>
<tr><td>Course Summary</td><td colspan="5">A course combining these topics equips students with valuable skills in analyzing, modeling, and designing feedback control systems with an emphasis on servo motor applications.</td></tr>
</table>

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Relate and explain the key concepts of open-loop and closed-loop control systems and block diagrams.	U	C	Instructor-created exams / Quiz
CO2	Identify and build signal flow graphs to represent control systems and analyse their signal flow characteristics.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Develop mathematical models of physical systems (mechanical, electrical) using differential equations and convert them to transfer functions	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Illustrate the operating principles of various types of servo motors (DC, AC, stepper) and their characteristics relevant to control system design.	U	C	Instructor-created exams / Home Assignments
CO5	Analyse the stability and performance of linear time-invariant (LTI) systems using time and frequency domain analysis techniques (Bode plots, Nyquist plots, root locus plots)	Ap	P	One Minute Reflection Writing assignments
CO6	Build and test basic servo motor control systems using hardware platforms, sensors, and actuators.	Ap	P	Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

<table>
<tr><th>Module</th><th>Unit</th><th>Content</th><th>Hrs</th></tr>
<tr><td rowspan="5">I</td><td colspan="2">Basic Concepts</td><td>4</td></tr>
<tr><td>1</td><td>Historical review</td><td>1</td></tr>
<tr><td>2</td><td>Deinitions</td><td>1</td></tr>
<tr><td>3</td><td>Classifications</td><td>1</td></tr>
<tr><td>4</td><td>Comparison between open loop and closed loop control systems</td><td>1</td></tr>
<tr><td rowspan="9">II</td><td colspan="2">Mathematical Models & Components</td><td>16</td></tr>
<tr><td>5</td><td>Linear and nonlinear systems</td><td>1</td></tr>
<tr><td>6</td><td>Transfer function</td><td>1</td></tr>
<tr><td>7</td><td>Mathematical modelling of Electrical and Mechanical systems</td><td>4</td></tr>
<tr><td>8</td><td>Analogies: Force- Current and Force-Voltage</td><td>1</td></tr>
<tr><td>9</td><td>Block diagram and Signal flow graphs</td><td>5</td></tr>
<tr><td>10</td><td>Servo Motors : AC and DC</td><td>2</td></tr>
<tr><td>11</td><td>Potentiometers</td><td>1</td></tr>
<tr><td>12</td><td>Stepper motor</td><td>1</td></tr>
<tr><td rowspan="5">III</td><td colspan="2">Time & Frequency Domain Analysis</td><td>12</td></tr>
<tr><td>13</td><td>Time and frequency response of first and second order systems</td><td>4</td></tr>
<tr><td>14</td><td>Relationship between time and frequency domain specifications</td><td>2</td></tr>
<tr><td>15</td><td>Steady state errors and error constants</td><td>2</td></tr>
<tr><td>16</td><td>Concepts and applications of P,PD,PI and PID controllers</td><td>4</td></tr>
<tr><td rowspan="6">IV</td><td colspan="2">Stability Analysis</td><td>13</td></tr>
<tr><td>17</td><td>Definition</td><td>1</td></tr>
<tr><td>19</td><td>Routh-Hurwitz Criterion</td><td>3</td></tr>
<tr><td>20</td><td>Root Locus technique</td><td>3</td></tr>
<tr><td>21</td><td>Nyquist criterion</td><td>1</td></tr>
<tr><td>22</td><td>Bode plot</td><td>3</td></tr>
<tr><td></td><td>23</td><td>Relative stability : Phase margin and gain margin</td><td>2</td></tr>
<tr><td rowspan="2">V</td><td colspan="2">Hands-on Data Structures:
Practical Applications, Case Study and Course Project</td><td>30</td></tr>
<tr><td>1</td><td>1. Characteristics of DC servo motor
Aim: To find speed torque characteristics of DC servo motor
Apparatus: DC servo motor set up, multi meter, connecting wires
2. DC position control system
Linear Search: Basic sequential search on an unordered list.
Binary Search: Search on a sorted list using the divide-and-conquer approach.
3. ON/OFF Temperature control system
Selection Sort and Insertion Sort (In-place comparison sort).
Quicksort (Divide-and-conquer approach)
4. Characteristics of AC servo motor Binary Trees,Binary Search Trees, AVL trees, Heap Trees,Tries, B-Trees:
5. Time domain analysis of second order system
6. Temperature control system using PID Application domains include dictionaries, caches, and symbol tables.
7. Level control system Dijkstra's Algorithm (non-negative edge weights) and Bellman-Ford Algorithm (negative edge weights)
8. Open loop and closed loop control system Prim's and Kruskal's Algorithm</td><td>20</td></tr>
</table>

	2	Case study	3
	3	Capstone (/Course) Project:Build a practical application using hash tables (e.g., custom web cache, password manager)	7

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-						
CO 2	2	3	-	-	-	-						
CO 3	-	-	1	-	-	-						
CO 4	-	-	2	3	-	-						
CO 5	-	1	-	-	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
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Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
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- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

References

Text Books:

1. Modern Control Engineering, Ogata K.,Prentice-Hall of India Pvt Ltd., New Delhi, 3rd edition, 2000.
2. Feedback Control of Dynamic Systems,Franklin G.F., Powell J.D., Emami-Naeini A. Pearson, 5th edition, 2006
3. Control Systems Engineering by Nagrath and Gopal New Age Publication
4. Automatic Control Systems Benjamin C.Kuo 8th Edition, Farid Golnaraghi, John Wiley &Sons.
5. Feedback and Control Systems, Joseph J Distefano 2nd Edition TMH

Programme	B. Sc. Electronics				
Course Code	ELE7CJ405				
Course Title	DIGITAL IMAGE PROCESSING				
Type of Course	**Major**				
Semester	VII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Knowledge of Signals, Systems, Image concepts 2. Foundational Mathematics				
Course Summary	The course provides a comprehensive overview of the fundamentals and applications of digital image processing. The course also includes practical sessions where students work with software tools such as MATLAB, Python with libraries like OpenCV, or dedicated image processing software packages.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Outline the fundamental concepts underlying digital image processing systems	U	C	Instructor-created exams / Quiz
CO2	Develop the ability to analyse images in the frequency domain using various transformation techniques, enabling the enhancement and restoration of images.	Ap	C	Practical Assignment / Observation of Practical Skills
CO3	Analyze, design, and implement digital image processing algorithms using software	An	P	Practical Assignment / Observation of Practical Skills
CO4	Apply various techniques for enhancing the quality of digital images, including contrast stretching, histogram equalization, and spatial & frequency domain methods.	An	P	Instructor-created exams / Home Assignments
CO5	Identify and remove noise from images using different restoration techniques, such as filtering and deconvolution	Ap	P	One Minute Reflection Writing assignments
CO6	Apply and extract information from images for pattern recognition tasks, including image classification, object detection, and image	Ap	P	Viva Voce

	understanding.			
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)	Marks (98)
I		**DIGITAL IMAGE FUNDAMENTALS**	**10**	**15**
	1	Elements of digital image processing systems, Vidicon and Digital Camera working principles	2	
	2	Elements of visual perception, brightness, contrast, hue, saturation	3	
	3	Image sampling, Quantization, dither	3	
	4	Two-dimensional mathematical preliminaries	2	
II		**IMAGE TRANSFORMS**	**10**	**15**
	5	1D DFT, D transforms DFT	3	
	6	DCT, Discrete Sine, Walsh, Hadamard,	3	
	7	Slant, Haar, KLT	2	
	8	SVD, Wavelet transform	2	
III		**IMAGE ENHANCEMENT AND RESTORATION**	**15**	**25**
	9	Histogram modification, Noise distributions, Spatial averaging	2	
	10	Directional Smoothing, Median, Geometric mean, Harmonic mean	2	
	11	Contra harmonic and Yp mean filters	1	
	12	Image restoration – degradation model, Unconstrained and Constrained restoration	2	
	13	Inverse filtering removal of blur caused by uniform linear motion,	2	
	14	Wiener filtering,	2	
	15	Geometric transformations-spatial transformations	1	
	16	Gray-Level interpolation.	1	
	17	Edge detection, Edge linking and boundary detection,	2	
IV		**IMAGE SEGMENTATION AND RECOGNITION**	**10**	
	18	Image segmentation, Region growing	2	
	19	Region splitting and merging, Patterns and pattern classes,	2	
	20	Matching by minimum distance classifier, Matching by correlation.	2	
	21	Neural networks-Back propagation network and training,	2	
	22	Neural network to recognize shapes.	2	
V		**Hands-on:** **Practical Applications, Case Study and Course Project**	**30**	
	1	1 Display of an Image. Negative of an Image(Binary & Gray Scale) 2. Transformations of an Image 3. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization 4. Display of FFT(1-D & 2-D) of an image 5. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image 6. Implementation of Image Smoothening Filters (Mean and Median filtering of an Image) 7. Implementation of image sharpening filters and Edge Detection using Gradient Filters 8. Implementation of image restoring techniques 9. Implementation of Image Intensity slicing technique for image	20	

		enhancement		
	2	Case study: Image Compression by DCT, DPCM, HUFFMAN coding	3	
	3	Capstone Mini Project: Pattern recognition tasks, image classification, object detection, neural network architectures commonly used for shape recognition: convolutional neural networks (CNNs), recurrent neural networks (RNNs), and deep neural networks (DNNs)	7	

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, ‘ Digital Image Processing’, Pearson Education, Inc., Second Edition, 2004

2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,‘ Digital Image Processing using MATLAB’, Pearson Education, Inc., 2004.

3. Anil K. Jain, ‘ Fundamentals of Digital Image Processing’, Pearson Education, Inc., 2002.

4. "Digital Image Processing" by R. Castleman, Prentice-Hall, 1996. A foundational text covering the basics of digital image processing.

5. D.E. Dudgeon and R.M. Mersereau, ‘Multidimensional Digital Signal Processing’, Prentice Hall Professional Technical Reference, 1990.

6. William K. Pratt, ‘ Digital Image Processing’, John Wiley, NewYork, 2002.

7. Milan Sonka et al, ‘IMAGE PROCESSING, ANALYSIS AND MACHINE VISION’, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999,

6. "Handbook of image and video processing" edited by Al Bovik, Academic Press,

2000. 7."Computer Vision" by Linda Shapiro and George Stockman, Prentice Hall,

2001.

Web resources:

1. **OpenCV.org** - The official site for OpenCV, a library of programming functions for real-time computer vision. OpenCVOfficialWebsite

2. **Scikit-image.org** - Offers documentation and tutorials for scikit-image, a collection of algorithms for image processing in Python. Scikit-imageOfficialWebsite

3. **ImageProcessingPlace.com** - Companion site to the "Digital Image Processing" books by Gonzalez & Woods, offering resources and MATLAB examples. Image Processing Place

4. **LearnOpenCV.com** - Provides tutorials, courses, and articles on OpenCV, deep learning, and computer vision. LearnOpenCV

5. **Algorithmia.com** - A marketplace for algorithms, including many for image processing and computer vision. AlgorithmiaOfficialWebsite

6. **PyImageSearch.com** - A blog dedicated to teaching computer vision and deep learning, with a focus on image processing. PyImageSearch

7. **Stack Overflow** - A community website where you can find answers or ask questions about image processing among other topics. StackOverflow

8. **GitHub** - Hosts numerous projects and libraries related to image processing. Searching for "image processing" on GitHub can lead to many relevant projects. GitHub

9. **Coursera** & **edX** - Both platforms offer online courses in image processing from universities and colleges around the world. Coursera edX

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	-	-	-	-						
CO 2	1	3	-	-	3	-						
CO 3	-	-	1	-	-	-						
CO 4	-	1	2	3	-	-						
CO 5	-	1	-	2	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		✓		✓
CO 2		✓		✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	ELE8CJ406/ELE8MN406				
Course Title	OPTICAL FIBER COMMUNICATION				
Type of Course	**Major**				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Basic Electronic devices 2. Basic principles of light transmission through a fiber				
Course Summary	This course explores the Light propagation characteristics in Optical Fibers, Signal degradation in optical fibers, Optic fiber couplers, optical sources and detectors				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Relate the concept of fiber optic communication and how it pertains to information transmission.	U	C	Instructor-created exams / Quiz
CO2	Illustrate the structure, performance, and signal analysis of optical sources and detectors, including LEDs and semiconductor lasers.	U	C	Assignment / Group Tutorial Work
CO3	Identify the elements of an optical fiber transmission link, including fibers, cables, connectors, and splices	Ap	C	Seminar Presentation / Group Tutorial Work
CO4	Infer the fundamental principles of light propagation in optical fibers, including total internal reflection, modal dispersion, and waveguiding.	U	C	Instructor-created exams / Home Assignments
CO5	Relate the causes of signal loss in optical fibers, including absorption, scattering, and bending losses, and learn how to minimize these losses.	U	C	One Minute Reflection Writing assignments
CO6	Identify the different types of dispersion—modal, chromatic, and polarization mode dispersion—that can affect signal integrity and how to manage them in fiber optic	Ap	C	Instructor-created exams/Viva Voce
	communication systems.			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create ©
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Total mark(98)
I		**Light propagation characteristics in Optical Fibers**	**11**	**15**
	1	Recollection of basic principles of optics transmitting light on a	2	
	2	Light propagation in fibers and characteristics-Critical angle - Total internal reflection.	2	
	3	Classification of Fibers: Single mode and multimode Fibers, Step index and Graded index Fibers, comparison	3	
	4	Refractive Index profile - Effect of index profile on propagation	1	
	5	Acceptance angle, Acceptance cone	1	
	6	Numerical aperture	1	
	7	Mode field diameter, Cut off wavelength	1	
II		**Signal degradation in optical fibers**	**12**	
	8	Attenuation in single mode and multimode fibers	2	**20**
	9	Absorption loss, scattering loss and bending loss	3	
	10	Dispersion – Material dispersion, Waveguide dispersion	3	
	11	Modal dispersion, Polarization mode dispersion	3	
	12	Band Width limitation	1	
III		**Optic fiber**	**13**	**15**
	13	Types of couplers	3	
	14	Fiber to fiber joints	2	
	15	Splicing techniques- Fusion splice, V groove splice, Elastic tube	4	
	16	Optical fiber connectors -Structure of a connector	2	
	17	Optical Communication System, point to point transmission systems and	2	
IV		**Optical sources and detectors**	**12**	**20**
	18	Light production, LEDs and characteristics,	2	
	19	DFB lasers, tunable DBR lasers	3	
	20	Photoconductors, photodiodes, and phototransistors,	3	
	21	Optical receiver	2	
	22	Optical amplifiers- SOAs and EDFAs	2	
V		**Open Ended**	**12**	
		Study Fiber optic communication kit/ Virtual lab experiments Characterization of Fiber/Study and submit an assignment on different	12	

References

1. Optical Fibre communication - J. M. Senior. Prentice Hall India (1994)
2. Optical Fibre communication systems - J. Gowar, Prentice Hall India (1995)

3. Fibre optic communication - J. Palais, Prentice Hall India (1988)

4. Fundamentals of Fibre Optic Telecommunication -B. P. Pal., Wiley Eastern (1994)

5. Integrated Optics - R. G. Huspcrger. Springer Verlag, (1998)

6. Fundamentals of Fibre Optics-B. P. Pal, Wiley Eastern, (1994)

7. Understanding Fiber optics- J. Hecht, Pearson Edu. Inc (2006)

8. An introduction to Fiber Optics, Ghatak and Thyagarajan, Cambridge University Press 1998

9. Fibre optic sensors - principles and applications - B.D.Gupta, New India Publishing, (2006)

10. Fibre Optic Communication Systems, 3rd Edition - G.P. Agrawal, John Wiley andSons, (2002)

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	2	-	-						
CO 2	2	1	-	3	-	-						
CO 3	-	-	-	2	-	-						
CO 4	-	-	-	3	-	-						
CO 5	2	1	1	2	-	-						
CO 6	1	1	1	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Project/Practical (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project/Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓		✓	✓

Programme	B. Sc. Electronics				
Course Code	ELE8CJ407/ELE8MN407				
Course Title	SATELLITE AND RADAR SYSTEMS				
Type of Course	**Major**				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Basic concepts of microwave electronics and Antenna Theory				
Course Summary	This course explores about Satellite communications and RADAR systems				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate different types of satellite orbits and its applications	U	C	Instructor-created exams / Quiz Home Assignments
CO2	Analyse the power requirements for satellite	An	P	Instructor-created exams / Quiz

	links and communication payloads			Home Assignments
CO3	Summarize the fundamental principles of RF propagation and the impact of atmospheric conditions on RF signal propagation	U	C	Instructor-created exams / Quiz Home Assignments
CO4	Infer satellite access techniques and operation principle of GPS	U	C	Instructor-created exams / Quiz Home Assignments
CO5	Summarize principle of RADAR operations and factors that affects RADAR signals	U	C	Instructor-created exams / Quiz Home Assignments
CO6	Identify and compare the performance of various RADAR and LIDAR	Ap	P	Instructor-created exams / Quiz Home Assignments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Satellite Communication**	**13**	**20**
	1	Types of Communication Satellites	1	
	2	Uplink, Downlink and Satellite link design	2	
	3	Keplers law, Orbital parameters and perturbations	2	
	4	Subsystems of satellite-propulsion system, telemetry, tracking and control Transponder	1	
	5	Earth stations-Antenna, feed and tracking system	2	
	6	Solar and sidereal days	1	
	7	Satellite access-FDMA, TDMA and CDMA	2	
	8	GPS-Principle of operation	2	
		Satellite Communications systems engineering, Louis J. Ippolito Jr. Satellite Communications, Dennis Roddy Satellite Communication Systems: Design Principles, M. Richharia GPS Theory and Practice, B. Hofmann Wollenhof, H. Lichtenegger and J. Collins		
II		**Propagation Effects**	**13**	**15**
	9	Atmospheric effect on propagation and Loss in free space	4	
	10	Path analysis-Unfaded signal level and thermal noise	3	
	11	Threshold and frequency deviation	2	
	12	Antenna gain and Friis Transmission formula	3	
	13	Sources of noise and Noise power ratio	1	
		Satellite Communications systems engineering, Louis J. Ippolito Jr. Satellite Communications, Dennis Roddy Satellite Communication Systems: Design Principles, M. Richharia		
III		**RADAR Fundamentals**	**14**	**20**
	14	Block diagram	2	
	15	RADAR Frequencies, Range equation and ambiguities	6	
	16	RADAR Displays and duplexers	4	
	17	RADAR cross sections	2	
		Radar Principles for the Non-Specialist, J. C. Toomay, Paul Hannen Radar systems, MerrilI Skolnik		
IV		**Special Purpose RADARs**	**10**	**15**
	18	Pulsed RADAR, FM CW RADAR and Doppler RADAR	3	
	19	MTI and Pulse Compression RADAR	2	
	20	Air surveillance RADAR	3	
	21	RADAR Jamming	1	
	22	LIDAR	1	
		Radar Principles for the Non-Specialist, J. C. Toomay, Paul Hannen Radar systems, MerrilI Skolnik		
V		**Open Ended Module**	**10**	
		Satellite link performance and mobile satellite channel Atmospheric effects of RADAR Antennas used in RADAR and Satellite Communication Tracking techniques of RADAR RCS Reduction		

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

References

Text

Books:

1. Satellite Communications systems engineering, Louis J. Ippolito Jr.
2. Satellite Communications, Dennis Roddy
3. Satellite Communication Systems: Design Principles, M. Richharia
4. Radar Principles for the Non-Specialist, J. C. Toomay, Paul Hannen
5. Radar systems, MerrilI Skolnik
6. GPS Theory and Practice, B. Hofmann Wollenhof, H. Lichtenegger and J. Collins

Web resources:

1. https://www.youtube.com/watch?v=MEtgoFjNCEw&ab_channel=Dr.SapnaKatiyar
2. https://archive.nptel.ac.in/courses/108/105/108105154/
3. https://www.ll.mit.edu/outreach/radar-introduction-radar-systems-online-course
4. https://www.jpl.nasa.gov/edu/teach/activity/build-a-satellite/

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	2	2	2	1	3	2	-	2	2	-
CO 2	3	3	2	2	2	1	3	1	-	2	2	-
CO 3	3	2	2	2	2	1	3	2	-	2	2	-
CO 4	3	1	3	2	1	2	3	2	-	2	2	-
CO 5	3	1	1	2	-	-	2	2	-	2	2	-
CO 6	2	3	2	2	3	3	2	-	-	3	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2		✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

Programme	B. Sc. ELECTRONICS				
Course Code	ELE8CJ408/ELE8MN408				
Course Title	OPTIMISATION ALGORITHMS				
Type of Course	**Major**				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Foundational Mathematics and Set Theory 2. Genetic Fundamentals and Evolution				
Course Summary	This course is on various evolutionary optimization techniques. It provides basic exposition to the goals and methods of soft computing. It applies to intelligent techniques for problem solving.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize and solve problems using optimization techniques	U	C	Instructor-created exams / Quiz
CO2	Solve real-world problems into mathematical optimization models.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Apply various optimization algorithms	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Demonstrate a solid understanding of fundamental optimization concepts and principles.	U	C	Instructor-created exams / Home Assignments
CO5	Identify optimization techniques to linear and nonlinear programming problems.	Ap	P	Instructor-created exams / Home Assignments
CO6	Determine critical thinking skills in identifying optimization problems, selecting appropriate algorithms, and interpreting results	E	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)				

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	TotalMark (98)
I		**Neura**	**10**	**20**
	1	Machine Learning using Neural Network	2	
	2	Learning algorithms, Supervised Learning Neural Networks	3	
	3	Feed Forward Network	3	
	4	Unsupervised Learning Neural Networks	2	
II		**Conventional Optimization Techniques**	**10**	**15**
	5	Introduction to optimization techniques	3	
	6	Statement of an optimization problem	3	
	7	Classification	2	
	8	Unconstrained optimization	2	
III		**Optimisation**	**20**	**20**
	9	Gradient search method	2	
	10	Gradient of a function,	3	
	11	Steepest gradient conjugate gradient	1	
	12	Newton's Method	3	
	13	Marquardt Method	3	
	14	Constrained optimization	3	
	15	Sequential linear programming	1	
	16	Interior penalty function method	1	
	17	External penalty function method	3	
IV		**Evolutionary Optimization Techniques**	**8**	**15**
	18	Genetic algorithm	2	
	19	Working principle, Basic operators and Terminologies	2	
	20	Building block hypothesis	2	
	21	Travelling Salesman Problem	1	
	22	Particle swam optimization, Ant colony optimization	1	
V		**Open Ended Module: Understanding Group Behaviour**	**12**	
	1	**Case studies:** 1. Managing a large crowd in a social gathering 2. Direct marketing and other business models **Real-World Applications and Trade-offs:** Applications of Evolutionary Algorithms to solve Real World Problems **Open-Ended Exploration and Assessment:** Student-led research on Evolutionary Algorithms	12	

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

References

Text Books:

1. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison wesley, 2009.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic-Theory and Applications,Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Edn., 2003.
4. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2003.
5. Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall, 1998.
6. Simon Haykins, Neural Networks: A Comprehensive Foundation, Prentice Hall International Inc, 1999.
7. Singiresu S. Rao, Engineering optimization Theory and practice, John Wiley & sons, inc,Fourth Edition, 2009
8. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 1997.
9. VenkataRao, Vimal J. Savsani, Mechanical Design Optimization Using Advanced Optimization Techniques, springer 2012

Web resources:

1. https://archive.nptel.ac.in/courses/108/105/108105132
2. https://www.youtube.com/playlist?list=PLBlnK6fEyqRjMH3mWf6kwqiTbT798eAOm
3. https://pages.uoregon.edu/rayfrey/DigitalNotes.pdf

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	-	-	-	-						
CO 2	2	1	-	-	-	-						
CO 3	-	-	2	-	-	-						
CO 4	-	-	1	3	-	-						
CO 5	-	1	-	-	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		✓		✓
CO 2	✓			✓
CO 3			✓	✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	**B. Sc. Electronics**				
Course Code	**ELE5EJ304**				
Course Title	**SEMICONDUCTOR FABRICATION TECHNOLOGY**				
Type of Course	**ELECTIVE**				
Semester	**5**				
Academic Level	**300- 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Basic Knowledge in Physics and basics of semiconductor theory.				
Course Summary	This course provides an overview of the foundational concepts of semiconductor fabrication technology delving into topics such as Hybrid and Monolithic IC fabrication techniques.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize the basic concepts of semiconductor physics and material science relevant to IC fabrication.	U	C	Instructor-created exams / Quiz
CO2	Demonstrate the different stages of the IC fabrication process in detail, including photolithography, etching,	U	C	Assignment /Seminar
CO3	Infer the challenges and opportunities in miniaturization and scaling of transistors.	U	C	Quiz / Assignment
CO4	Summarize critical thinking and problem-solving skills through case studies and discussions.	U	C	Instructor-created exams
CO5	Compare the CMOS and BJT process sequence.	U	C	Seminar Presentation
CO6	Relate the challenges and limitations of present technology and emerging trends in IC fabrication.	U	C	Discussion
*** Cognitive Level:** **R** - Remember, **U** - Understand, **Ap** - Apply, **An** - Analyze, **E** - Evaluate, **C** - Create				
# Knowledge Level: F - Factual, **C** - Conceptual, **P** - Procedural, **M** - Metacognitive				

Detailed Syllabus:

Module	**Unit**	**Topics**	**Hours 60**	**Marks 98**
I		**Introduction to Integrated Circuits**	**11**	**15**
	1	History of semiconductor devices.	1	
	2	Moore's law, feature size and minimum feature size trend.	1	
	3	Advantages of ICs over Discrete Components.	2	
	4	Features of Hybrid IC Technology.	3	
	5	Features of Monolithic IC Technology.	3	
	6	Classification of Integrated Circuits based on Chip size	1	
		Integrated Circuits by K R Botkar, Khanna Publishers.		
		Crystal Growth And Wafer Preparation	**9**	

II	7	Understanding the Silicon crystal structure	2	**15**
	8	Clean room technology	2	
	9	Crystal Growth and Silicon Wafer Preparation.	3	
	10	Crystalline defects and their effects.	2	
		G. S. May and S. M. Sze, *Fundamentals of Semiconductor Fabrication*, Wiley India		
III		**Unit Fabrication Steps in IC**	**19**	
	11	Epitaxial growth processes	2	**20**
	12	Oxidation: Thermal Oxidation and PECVD	3	
	13	Photolithography: Electron beam and X- ray lithography	3	
	14	Etching: Wet Chemical Etching and Dry Etching.	3	
	15	Doping : Diffusion and ion implantation	3	
	16	Deposition: Physical vapor deposition and chemical vapor deposition	3	
	17	Planarization: chemical–mechanical polishing (CMP)	2	
		G. S. May and S. M. Sze, *Fundamentals of Semiconductor Fabrication*, Wiley India, 2004.		

IV		**Process Integration**	**9**	
	18	Schematic representation of IC fabrication	1	**20**
	19	Bipolar Technology: n–p–n bipolar transistor fabrication sequence.	3	
	20	MOS Technology: Basics of NMOS, PMOS and CMOS fabrication sequence.	3	
	21	Automated Test Equipment (ATE)	1	
	22	Die Separation and Package Types	1	
	G. S. May and S. M. Sze, *Fundamentals of Semiconductor Fabrication*, Wiley India, 2004.			
V		**Open Ended Module**	**12**	
	1. Challenges for Integration. (Seminar,Discussion) 2. System on Chip. (Case study) 3. Future Trends in IC Technology (Seminar,Discussion)			

Textbook:	1. G. S. May and S. M. Sze, *Fundamentals of Semiconductor Fabrication*, Wiley India, 2004. 2. Integrated Circuits by K R Botkar, Khanna Publishers.
Reference:	1. Richard C. Jaeger, "Introduction to Microelectronic Fabrication" 2. S. M. Sze, *Semiconductor Devices: Physics and Technology*, 2nd Edn., Wiley India, 2011. 3. Introduction to Semiconductor Manufacturing Technology – Second Edition, Hong Xiao, SPIE Press, 2012.
Online Resources:	1. Prof. Naresh Kumar Emani, IIT Hyderabad: https://youtu.be/mRkONceq2Bk?sib09VKEhVTF5SjzI- 2. https://www.learnabout-electronics.org

Note: The course is divided into five modules, with four modules together having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules. The 70 marks shown in the last column, distributed over the first four modules, is only for the external examination.

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	-	2	-	-	2	-	-	2	-	-
CO 2	3	3	3	-	-	-	3	3	3	-	-	2
CO 3	2	-	-	2	-	-	2	-	-	2	-	-
CO 4	2	-	3	-	-	-	2	3	-	2	1	-
CO 5	2	-	-	-	2	-	2	-	-	2	-	-
CO 6	2	-	2	-	-	-	2	2	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

```` **Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)
````

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓	✓	✓
CO 5		✓		✓
CO 6	✓		✓	

Programme	**B.Sc. Electronics**				
Course Code	**ELE5EJ306**				
Course Title	SMART MATERIALS				
Type of Course	**Major**				
Semester	**V**				
Academic Level	**300 - 399**				
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours**
	4	4			60
Pre-requisites	1. Fundamentals of Materials 2. Classification of Materials				
Course Summary	This course offers a comprehensive introduction to smart materials, their definitions, needs, classifications, and applications. It is designed to provide students with an understanding of how smart materials respond to changes in their environment and how they can be used in various technological applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize and describe smart materials and understand their importance in	U	C	Instructor-created exams / Quiz
CO2	Classify smart materials based on their properties and identify suitable applications for each class	U	C	Practical Assignment / Observation of Practical Skills
CO3	Identify the principles behind nanomaterials and shape memory alloys, and discuss their roles in modern electronics and devices.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Infer the operation and applications of rheological fluids, including magneto-rheological and electro-rheological fluids.	U	C	Instructor-created exams / Home Assignments
CO5	Analyze and evaluate the advantages and limitations of various smart	An	P	One Minute Reflection

	materials and their impact on design and functionality.			Writing assignments
CO6	Develop research on recent developments in smart materials, synthesize information from academic journals, and present findings effectively.	C	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**	**Marks (98)**
I		**Introduction to Smart Materials**	**8**	**16**
	1	Definition of Smart Materials	1	
	2	Need for Smart Materials	1	
	3	Classification and Applications of Smart Materials	2	
	4	Piezo electric and Magneto strictive Materials	2	
	5	Ultra-Light Materials	2	
II		**Nano Materials**	**10**	
	6	Definitions and Classification of Nano Materials	3	**16**
	7	Graphene, Carbynes and Nano composites	2	
	8	Fabrication Techniques of Nano-Materials	2	
	9	Characterisation Techniques of Nano-Materials: Microscopic and Diffraction Techniques	3	
III		**Shape Memory Alloys**	**10**	
	10	Definition of Shape Memory Alloys	2	**18**
	11	Working of Shape Memory Alloys	2	
	12	Characteristics of Shape Memory Alloys	3	
	13	Applications of Shape Memory Alloys	3	
IV		**Rheological Fluid**	**20**	
	14	Definition of Magneto-Rheological Fluid	1	**20**
	15	Parts of Magneto-Rheological Fluid	2	
	15	Mode of Magneto-Rheological Fluid (MRF)	2	
	16	Advantages and Disadvantages of MRF	2	
	17	Applications of MRF:	2	
	18	Linear MR devices and Rotary MR devices	2	
	19	Electro-Rheological Fluid: Definition and Parts	3	
	20	Mode of Electro -Rheological Fluid (ERF)	2	
	21	Advantages and Disadvantages of ERF	2	
	22	Applications of ERF	2	
V		**Open Ended Module: Recent Developments in Smart Materials**	**12**	
		Recent Research Developments Real Time Applications Review Writing Based on Research Journal Presentation	10	

		Open-Ended Exploration and Assessment: Student-led research on Smart Materials. Presentation and discussion of findings **Group Assignment:** Write a Review Report based on Recent Journal Publications		

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	1	-	2	-	-	-
CO 2	2	-	1	2	-	-
CO 3	1	1	-	-	-	-
CO 4	2	-	-	-	-	-
CO 5	-	-	2	1	-	-
CO 6	2	-	1	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations

CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			
CO 4	✓			
CO 5		✓	✓	
CO 6			✓	

Suggested Learning Resources:

Text Books:

1.“Smart Structures –Analysis and Design”, A.V.Srin ivasan, Cambridge University Press, New York, 2001, (ISBN:0521650267).

2. “Smart Materials and Structures”, M.V.Gandhi and B.S.Thompson Chapmen & Hall, London, 1992 (ISBN:0412370107)

Website Links

1. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.tce.edu/sites/default/files/PDF/RV4-Smart-Materials.pdf
2. https://civil.poriyaan.in/topic/shape-memory-alloys--sma--40134/chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://srict.in/UploadedFiles/133039117797739107.pdf
3. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.tce.edu/sites/default/files/PDF/RV8-ER-Fluid.pdf

Programme	B. Sc. Electronics				
Course Code	**ELE6EJ307**				
Course Title	VLSI TECHNOLOGY				
Type of Course	Elective				
Semester	6				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	• Strong foundation in digital logic design (Boolean algebra, logic gates) • Basic understanding of electronics and semiconductor devices • Programming experience (familiarity with C++ or similar languages)				
Course Summary	This course introduces students to the fundamental concepts, design principles, and implementation techniques of Very Large-Scale Integration (VLSI) circuits. Through a combination of theory and practical classes, students will learn to analyze, design, and simulate digital circuits using hardware description languages (HDLs) and programmable logic devices (FPGAs). The course covers topics such as combinational and sequential circuits, FSMs, FPGAs, and HDL design.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Illustrate the working mechanism and design guidelines of combinational and sequential circuits	R & U	F & C	Instructor-created exams / Quiz
CO2	Demonstrate the concept of physical design process like partitioning , floor planning, optimization algorithm	R & U	F & C	Practical Assignment / Observation of Practical Skills
CO3	Summarize the architecture and key features of Field-Programmable Gate Arrays (FPGAs	R & U	F & C	Seminar Presentation / Group Tutorial Work
CO4	Infer the design flow and programming technology in digital system design	U	F & C	Instructor- created exams / Home Assignments
CO5	Develop hardware description languages (HDLs) for digital circuit design	Ap & C	P	Seminar presentations

CO6	Develop hardware description languages (HDLs) such as Verilog or VHDL for digital circuit design and simulation in VLSI projects.	Ap	C	Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Combinational and Sequential circuit elements**	**8**	**12**
	1	Classification of ICs, features of ICs: monolithic and hybrid ICs	1	
	2	Historical evolution and future trends of VLSI technology	1	
	3	Digital logic design flow. Review of combinational circuits.	2	
	4	Combinational building blocks: multiplexers, demultiplexers	2	
	5	Decoders, encoders and adder circuits.	2	
		VLSI Fabrication Principles: S.K. Gandhi: John Wiley Inc.		
II		**Introduction to VLSI Physical Design Automation**	**16**	**23**
	7	Design Representation, VLSI Design Styles	2	
	8	VLSI Physical Design automation.	2	
	9	Partitioning, Floor planning	2	
	10	Pin Assignment, Standard cell	2	
	11	Performance issues in circuit layout, delay models, Layout styles.	2	
	12	Placement: Problem formulation, classification,	2	
	13	Simulation based placement algorithms, Partitioning based placement algorithms	2	
	14	Time driven and performance driven placement.	2	
		Algorithms for VLSI Physical Design Automation – Naveed Sherwani, 3rd Ed., 2005		
III		**Logic design and FPGA**	**12**	**15**
	14	Evolution of Programmable logic devices. PAL, PLA , CPLD and FPGA	2	
	15	FPGA Technology: FPGA resources - Logic Blocks and Interconnection Resources; Economics and applications of FPGAs	2	
	16	Implementation Process for FPGAs Programming Technologies - Static RAM Programming,. Anti Fuse Programming	2	
	17	EPROM and EEPROM Programming Technology	2	
	18	Commercially available FPGAs - Xilinx FPGAs, Altera FPGAs	2	
	19	FPGA Design Flow Example - Initial Design Entry, Translation to XNF Format, Partitioning, Place and Route,	2	
		1.FPGA-Based System Design Wayne Wolf, Verlag: Prentice Hall **2. Modern VLSI Design: System-on-Chip Design (3rd Edition) Wayne Wolf, Verlag**		
IV		**Verilog HDL:**	**12**	**20**
	20	Introduction to HDL. Verilog primitive operators and structural Verilog Behavioral Verilog.	6	
	21	Design verification. Modelling of combinational and sequential circuits	3	
	22	(including FSM and FSMD) with Verilog Design examples in Verilog.	3	
		Verilog HDL Synthesis A practical primer : J.Bhasker VHDL primer : J Bhasker		
		Open Ended Module	**12**	

<table>
<tr><td rowspan="2">V</td><td>1</td><td>Case studies:
Design and implementation of a real-world application using an FPGA (e.g., simple audio filtering, data acquisition system)
Comparison of different VLSI design methodologies for a specific application
Analysis of the impact of VLSI technology on various industries
Real-World Applications and Trade-offs:
Discuss ethical considerations and environmental impact of FPGA technology
Explore emerging trends and applications of FPGAs in areas like artificial intelligence, machine learning, and edge computing.
Open-Ended Assessment:
Develop teamwork and communication skills through collaborative projects involving FPGA design and implementation
Group Assignment: Evolution of IC technologies</td><td>12</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-	1	-	-	1	-	-
CO 2	2	3	-	-	-	-	-	-	-	3	-	-
CO 3	-	-	1	-	-	-	-	-	2	-	-	-
CO 4	-	-	2	3	-	-	-	-	-	-	-	1

CO 5	-	1	-	-	-	-	-	-	-	-	1	-
CO 6	-	-	-	3	-	-	1	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

REFERENCES

R1.	"VLSI Fabrication Principles"	S.K. Gandhi	John Wiley Inc.
R2.	. "VLSI Technology"	S.M. Sze	McGraw Hill
R3.	"Silicon VLSI Technology: Fundamentals, Practice and Modeling"	James D. Plummer	Pearson Education
R4.	Principles of Digital Systems Design and VHDL.	LizyKurien and Charles Roth.	Cengage Publishing. ISBN-13: 978-8131505748
R5.	Verilog HDL	Palnitkar, Samir	Pearson Education; Second edition (2003)
Case studies for analysis would be provided from time to time in advance by the faculty.			

Programme	B. Sc. Electronics				
Course Code	**ELE6EJ309**				
Course Title	INTRODUCTION TO ARTIFICIAL INTELLIGENCE				
Type of Course	**Major**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Fundamental Mathematics Concepts 2. Basic programming knowledge				
Course Summary	This course aims to provide students with a comprehensive understanding of the intersection between artificial intelligence and writing. It covers fundamental concepts, techniques, and applications of AI in the field of writing, including natural language processing, machine learning, and language generation				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Recall the history and foundational concepts of Artificial Intelligence.	R	F	Instructor-created exams / Quiz
CO2	Infer different types of AI agents and their applications.	U	C	Instructor-created exams / Quiz
CO3	Illustrate the ethical implications of AI development and deployment	U	F	Seminar Presentation / Group Tutorial Work
CO4	Develop AI domain knowledge with logic systems and interface techniques for reasoning in AI systems	Ap	P	Seminar Presentation / Group Tutorial Work
CO5	Illustrate different types of learning techniques used in intelligent systems	U	C	Instructor-created exams / Quiz
CO6	Evaluate the societal and economic impact of AI advancements critically	E	F	Seminar Presentation / Group Tutorial Work
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)				

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks(98)
I		**Introduction**	**10**	
	1	What is Artificial Intelligence(AI)?	1	16
	2	The Foundations of AI, History of AI, Applications of AI.	2	
	3	Intelligent Agents – Agents and Environments	2	
	4	Good behaviour: The concept of rationality, nature of Environments, Structure of Agents	2	
	5	Solving Problems by searching-Problem solving Agents	2	
	6	Example problems	1	
1.Gerhard Welss, - Multi Agents Systems, Second Edition, 2013 2. David L. Poole and Alan K. Mackworth, - Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010				
II		**Solution Searching**	**14**	**20**
	7	Searching for solutions	2	
	8	Uninformed search strategies, Informed search strategies	2	
	9	Heuristic functions	2	
	10	Adversarial search - Games, Optimal decisions in games	2	
	11	The Minimax algorithm, Alpha-Beta pruning.	2	
	12	Constraint Satisfaction Problems – Defining CSP	1	
	13	Constraint Propagation- inference in CSPs, Backtracking search for CSPs, Structure of CSP problems	3	
1.Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill,2017 2. M. Tim Jones, - Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers Inc.; First Edition, 2008.				
III		**Knowledge Representation**	**13**	**20**
	14	Logical Agents – Knowledge based agents, Logic,	3	
	15	Knowledge Representation First Order Predicate Logic – Prolog Programming	2	
	16	Unification – Forward Chaining-Backward Chaining – Resolution –	3	
	17	Knowledge Representation – Ontological Engineering-Categories and Objects –	2	
	18	Events – Mental Events and Mental Objects – Reasoning Systems for Categories -Reasoning with Default Information	3	
1.I. Bratko, —Prolog: Programming for Artificial Intelligence, Fourth Edition, Addison-Wesley Educational Publishers Inc., 2011. 2. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill,2017				
IV		**AI applications**	**11**	**14**
	19	Language Models	2	
	20	Information Retrieval, Information Extraction	3	
	21	Natural Language Processing , Machine Translation , Speech Recognition	3	
	22	Robot – Hardware –Perception – Planning – Moving	3	

<table>
<tr><td colspan="5">1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2009.
2. Artificial Intelligence: A Modern Approach, 4th Edition, Stuart Russell, peter Norvig University of California at Berkeley, Pearson education, 2020.</td></tr>
<tr><td rowspan="2">V</td><td colspan="2">Open Ended Module: current contours & sub-disciplines</td><td>12</td><td></td></tr>
<tr><td>1</td><td>Contemporary Developments Related to the Course during the Semester
Concerned
Exploring sub-discipline of AI</td><td>12</td><td></td></tr>
</table>

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

References

Text

books:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2009.

2. Artificial Intelligence: A Modern Approach, 4th Edition, Stuart Russell, peter Norvig University of California at Berkeley, Pearson education, 2020.

3. I. Bratko, ―Prolog: Programming for Artificial Intelligence, Fourth Edition, Addison- Wesley Educational Publishers Inc., 2011.
4. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2017
5. M. Tim Jones, - Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers Inc.; First Edition, 2008.
6. Nils J. Nilsson, - The Quest for Artificial Intelligence, Cambridge University Press, 2009.
7. Gerhard Welss, - Multi Agents Systems, Second Edition, 2013
8. David L. Poole and Alan K. Mackworth, - Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
9. Dan W. Patterson, “Introduction to AI and ES”, PearsonEducation,2007

Web resourse:
1. https://nptel.ac.in/courses/106105077
2. http://www.digimat.in/nptel/courses/video/106102220/L01.html

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	-	-	-	-	2	1	-	-	-	-
CO 2	1	-	-	-	-	-	2	1	-	-	-	-
CO 3	-	-	1	-	-	-	-	-	1	-	-	2
CO 4	2	3	1	-	2	1	-	2	-	2	-	-
CO 5	2	2	-	-	-	1	2	2	-	1	-	-
CO 6	-	-	1	-	-	-	-	-	1	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Presentation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓

CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE8EJ409**				
Course Title	INTRODUCTION TO MACHINE LEARNING				
Type of Course	**Major**				
Semester	VIII				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Fundamental AI Concepts 2. Basic programming knowledge				
Course Summary	This course enables the learners to understand the advanced concepts and algorithms in machine learning. The course covers the standard and most popular supervised learning algorithms and helps the students to provide machine learning based solutions to real world problems.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Define and recall key concepts in machine learning, such as supervised learning, semi-supervised, unsupervised learning, and reinforcement learning	R	C	Instructor-created exams / Quiz
CO2	Explain the working principles of various ML algorithms and their strengths and weaknesses	U	C	Instructor-created exams / Quiz

CO3	Apply machine learning algorithms to real-world datasets	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Solve practical problems using supervised and unsupervised learning techniques.	Ap	P	Seminar Presentation / Group Tutorial Work
CO5	Evaluate the performance of machine learning models through metrics like accuracy, precision, recall, and F1 score	An	C	Instructor-created exams / Quiz
CO6	Compare the ethical considerations and potential biases in machine learning application	U	F	Seminar Presentation / Group Tutorial Work
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	marks(98)
I		**Introduction**	**10**	**15**
	1	Introduction, easy for human hard for machines, a simple predicting machine	2	
	2	Machine learning paradigms-supervised, semi-supervised, unsupervised, reinforcement learning	2	
	3	Basics of parameter estimation - maximum likelihood estimation(MLE) and maximum a posteriori estimation(MAP).	2	
	4	Introduction to Bayesian formulation.	2	
	5	Gaussian Mixture Models, Hidden Markov models	2	
1. Ethem Alpaydin, Introduction to Machine Learning, 2nd edition, MIT Press 2010. 2. Mohammed J. Zaki and Wagner Meira, Data Mining and Analysis: Fundamental Concepts and Algorithms, Cambridge University Press, First South Asia edition, 2016				
II		**Supervised Learning**	**17**	**20**
	6	Regression - Linear regression with one variable, Linear regression with multiple variables	2	
	7	solution using gradient descent algorithm and matrix method, basic idea of overfitting in regression.	2	
	8	Linear Methods for Classification- Logistic regression, Naive Bayes,	2	
	9	Decision tree algorithm ID3.	2	
	10	SVM - Introduction, Maximum Margin Classification, Mathematics behind Maximum Margin Classification, Maximum Margin linear separators, soft margin SVM classifier	3	
	11	Random Forest	2	
	12	Artificial Neural Network: Introduction	2	
	13	Perceptrons, multi-layer networks and back propagation	2	
1. Ethem Alpaydin, Introduction to Machine Learning, 2nd edition, MIT Press 2010. 2. Mohammed J. Zaki and Wagner Meira, Data Mining and Analysis: Fundamental Concepts and Algorithms, Cambridge University Press, First South Asia edition, 2016				
III		**Unsupervised Learning**	**11**	**20**
	14	Clustering - Similarity measures, Supervised vs Unsupervised Clustering Analysis	2	
	15	Hierarchical Agglomerative Clustering,	2	
	16	K-means partitional clustering	2	
	17	Expectation maximization (EM) for soft clustering	2	
	18	Dimensionality reduction – Principal Component Analysis.	3	
1. Tom Mitchell, Machine Learning, McGraw-Hill, 1997 2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective, MIT Press 2012.				
IV		**Modelling and evaluation**	**10**	**15**
	19	Building the model, Training a model	2	

	20	Evaluating a model, improving a model	2	
	21	Classification Performance measures - Precision, Recall, Accuracy, F-Measure, Receiver Operating Characteristic Curve(ROC)	3	
	22	- Area Under Curve(AUC. Bootstrapping, Cross Validation, Ensemble methods, Bias-Variance decomposition	3	
1. Tom Mitchell, Machine Learning, McGraw-Hill, 1997 2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective, MIT Press 2012.				
V	**Open Ended Module: real world problems using ML methods**		**12**	
	1	Exercises to solve the real-world problems using the following machine learning methods: Linear Regression Logistic Regression Neural Networks Support Vector Machines K-Means Clustering & PCA	12	

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

References

1. Ethem Alpaydin, Introduction to Machine Learning, 2nd edition, MIT Press 2010.
2. Mohammed J. Zaki and Wagner Meira, Data Mining and Analysis: Fundamental Concepts and Algorithms, Cambridge University Press, First South Asia edition, 2016.
3. Jake VanderPlas, Python Data Science Handbook, O'Reilly Media, 2016
4. Tom Mitchell, Machine Learning, McGraw-Hill, 1997.
5. Christopher Bishop. Neural Networks for Pattern Recognition,Oxford University Press, 1995.
6. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective, MIT Press 2012.
7. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements Of Statistical Learning, Second edition Springer 2007.
8. P. Langley, Elements of Machine Learning, Morgan Kaufmann, 1995.
9. Richert and Coelho, Building Machine Learning Systems with Python.
10. Davy Cielen, Arno DB Meysman and Mohamed Ali.Introducing Data Science.

Web resourses:

1. https://nptel.ac.in/courses/106106139
2. www.digimat.in/nptel/courses/video/106106198/L01.html

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	1	-	-	-	-	2	1	1	-	1	-
CO 2	-	1	1	-	2	2	2	2	-	1	-	-
CO 3	-	2	1	-	3	1	-	1	-	1	-	-
CO 4	-	1	2	-	2	2	-	2	-	2	-	-
CO 5	1	1	-	-	-	-	2	1	-	1	-	-
CO 6	-	-	-	-	-	1	-	-	-	-	1	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Presentation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓

CO 3	✓	✓		✓
CO 4		✓	✓	✓
CO 5		✓	✓	✓
CO 6	✓	✓	✓	✓

Programme	B. Sc. Electronics				
Course Code	**ELE8EJ411**				
Course Title	DRONE TECHNOLOGY				
Type of Course	**Elective**				
Semester	VIII				
Academic Level	400-499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic knowledge of electronics, including understanding circuits, microcontrollers, and interfacing with sensors and actuators. Proficiency in at least one programming language (e.g., Python, C++, Java) is essential. Knowledge of matrices, vectors, and linear transformations is essential for understanding robot kinematics, dynamics, and computer vision.				
Course Summary	Learn about the fundamental principles of robotics and drones. Understand the components and systems that make up drones. Explore the applications and impact of drone technology across various industries. Discuss the ethical, legal, and social implications of drone technology.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Gain a solid foundation in the principles of robotics and drone technology, including mechanics and electronics	U	C	Instructor-created exams / Quiz
CO2	Relate and select appropriate sensors, actuators, and controllers for different types of robotic and drone projects.	U	C	Practical Assignment / Observation of Practical Skills
CO3	Examine software tools for simulation, design, and testing of robotic systems and drones.	An	P	Practical Assignment / Observation of Practical Skills
CO4	Experiment with machine learning and artificial intelligence to enhance the capabilities of robotic systems and drones.	Ap	P	Instructor-created exams / Home Assignments
CO5	Relate the ethical, legal, and societal implications of robotics and drone technology, including privacy, safety, and regulatory considerations.	U	P	One Minute Reflection Writing assignments
CO6	Summarize the current research	U	P	Viva Voce

	trends and challenges in robotics and drone technology, setting a foundation for further education and innovation.			
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (48 +12)	Marks (98)
I		**Introduction to Robotics and Drones**	**10**	**15**
	1	Overview of robotics and drone technology	2	
	2	History and evolution of drones	3	
	3	Types of drones	3	
	4	Applications of drones	2	
II		**Fundamentals of Flight**	**10**	**15**
	5	Principles of flight and aerodynamics	3	
	6	Drone components and systems	3	
	7	Introduction to Unmanned Aerial Vehicle	2	
	8	UAV design and engineering	2	
III		**Sensors and Navigation**	**15**	**25**
	9	Sensors used in drones (GPS, IMU, LiDAR, cameras)	2	
	10	Basics of navigation and control systems	3	
	11	Introduction to remote sensing and data collection	1	
	12	Understanding flight controllers	3	
	13	Basics of drone piloting and manual control	3	
	14	Introduction to autopilot systems and software	3	
	15	Principles of autonomous flight	1	
	16	Path planning and obstacle avoidance	1	
	17	Machine learning and AI in drones	3	
IV		**Drone Applications and Safety**	**10**	**15**
	18	Surveying and mapping	2	
	19	Agriculture and environmental monitoring	2	
	20	Search and rescue, surveillance, and delivery services	2	
	21	Privacy concerns and surveillance, Regulatory and safety considerations	1	
	22	Future of drone technology and societal impact	1	
V		**Open Ended Module: Understand the different types of actuators in arm**	**30**	
	1	**Case studies:** 1. Medical Robotics: Explore the use of robotic arms in surgery and rehabilitation, focusing on the requirements for precision and safety. **Real-World Applications and Trade-offs:** Learn about agriculture and environmental monitoring with practical examples. **Open-Ended Exploration and Assessment:**	12	

		Study how robotic arms are used in manufacturing for tasks like assembly, welding, and painting. **Group Assignment:** Study any one industrial Automation.		

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

References

Text Books:

1. Internet of Things: Robotic and Drone Technology, Edited ByNitin Goyal, Sharad Sharma, Arun Kumar Rana, Suman Lata Tripathi, CRC Press

2. Drone Technology: Future Trends and Practical Applications Editor(s):Sachi Nandan Mohanty, J.V.R. Ravindra, G. Surya Narayana, Chinmaya Ranjan Pattnaik, Y. Mohamed Sirajudeen, Wiley Publ.

3."Drone Technologies and Applications" authored by Koç Mehmet Tuğrul, edited by Dragan Cvetković https://www.intechopen.com/books/1002775

4 "Drones - Applications" edited by George Dekoulis https://www.intechopen.com/books/6465

5. "Introduction to Robotics: Mechanics and Control" by John J. Craig, Pearson Publ.

6. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education, 2009.

7. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, Special Edition, (2012).

8. Ganesh S Hegde, “A textbook on Industrial Robotics”, University science press, 3rdedition, 2017.

Web resources:

1. https://robotsguide.com
2. https://roboticscasual.com/best-online-resources-to-learn-robotics/
3. https://www.coursera.org/specializations/robotics
4. https://ocw.mit.edu/courses/2-12-introduction-to-robotics-fall-2005/
5. https://ardupilot.org/

6. https://px4.io/
7. https://dronecode.org/

8. https://diydrones.com/
9. https://www.edx.org/
10. https://www.youtube.com/user/sparkfun

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	-	3	-	-						
CO 2	1	3	-	-	3	-						
CO 3	-	-	-	-	2	-						
CO 4	-	1	2	3	-	-						
CO 5	-	1	-	2	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		✓		✓
CO 2		✓		✓
CO 3	✓			✓
CO 4		✓		✓

CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE8EJ413**				
Course Title	INTEGRATING AI WITH FLUTTER				
Type of Course	**Elective**				
Semester	VIII				
Academic Level	400- 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Fundamentals of AI, Basic knowledge of programming				
Course Summary	This course provides a comprehensive introduction to Flutter development and the integration of AI, covering fundamental concepts and practical implementation within mobile applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate AI fundamentals and Flutter framework features, facilitating their ability to integrate AI functionalities effectively into Flutter apps.	U	P	Instructor-created exams / Quiz
CO2	Summarize Flutter app development concepts such as widgets, UI components, state management, user input handling, navigation, and routing.	U	P	Seminar Presentation / Group Tutorial Work
CO3	Extend knowledge in machine learning concepts, explore ML's role in mobile app development, and provide an overview of popular AI frameworks and libraries compatible with Flutter.	U	P	Practical Assignment / Observation of Practical Skills
CO4	Identify AI functionalities proficiently into Flutter apps, leveraging their understanding of AI concepts and Flutter framework features to develop innovative and intelligent mobile applications.	Ap	P	Practical Assignment / Observation of Practical Skills s
CO5	Demonstrate a comprehensive	U	P	Viva Voce

	understanding of implementing text classification and language translation features within Flutter applications using ML Kit's natural language processing capabilities.			
CO6	Develop proficiency in designing and implementing advanced text classification and language translation features within Flutter applications, fostering their ability to create intelligent and dynamic user experiences.	Ap	P	Practical Assignment / Observation of Practical Skills s
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45+12)	Marks (98)
I		**Basic of AI and Flutter**	**5**	**10**
	1	Introduction to AI and its subsets	1	
	2	Introduction to Flutter	1	
	3	Overview of artificial intelligence and its applications.	1	
	4	Introduction to Flutter framework and its features.	1	
	5	Setting up the development environment for Flutter.	1	
II		**Intermediate Flutter Development**	**12**	**15**
	6	Basics of Flutter App Development	1	
	7	Flutter widgets	2	
	8	UI components	2	
	9	State management in Flutter apps	3	
	10	Handling user input and gestures	2	
	11	Handling navigation and routing	2	
III		**Machine Learning in Flutter**	**12**	**15**
	12	Introduction to AI in Mobile Apps	2	
	13	Concepts of machine learning.	3	
	14	Role of ML in mobile app development.	3	
	15	Overview of popular AI frameworks	2	
	16	AI libraries compatible with Flutter.	2	
IV		**AI Services in Flutter**	**16**	**30**
	17	Text Classification with Flutter	2	
	18	Text Classification with ML Kit	2	
	19	Introduction to ML Kit for Flutter.	3	
	20	Text classification using ML Kit's natural language processing capabilities.	3	

	21	Developing a text classification feature within a Flutter app.	3	
	22	Implementing language translation in Flutter	3	
V	**Open Ended Module: App Development with Flutter**		**12**	
		Case studies: 1. Setting up Flutter development environment. 2. Building UI components using Flutter widgets. **Real-World Applications and Trade-offs:** 1. Implementing state management in a Flutter app. 2. Handling user input and gestures within a Flutter app. Navigating between screens and handling routing in a Flutter app. 3. Exploring popular AI frameworks and libraries compatible with Flutter. **Open-Ended Exploration and Assessment:** Implementing text classification features in a Flutter app. Or ML Kit's natural language processing capabilities for text classification. **Group Assignment:** Integrating language translation functionalities into a Flutter app.	**12**	

REFERENCES

1. Beginning App Development with Flutter, Rap Payne
2. Beginning Flutter: A Hands On Guide to App Development, Marco L. Napoli
3. Flutter for Beginners, Thomas Bailey, and Alessandro Biessek
4. https://www.tutorialspoint.com/flutter/flutter_tutorial.pdf
5. https://www.classcentral.com/report/best-flutter-and-dart-courses/
6. https://www.youtube.com/watch?v=VPvVD8t02U8

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 45 instructional hours for the fixed modules and 30 hours for the open-ended one. Module Vis designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V.Internal assessments (30 marks) are split between the practical module (20 marks) and the first four modules (10 marks).The end-semester examination for the theory part will be based on the 22 units in the first four modules. The 70 marks shown in the last column, distributed over the first four modules, is only for the external examination.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1		1	2	-	1	1						
CO 2	-	2	1	-	1	1						
CO 3	-	2	1	-	1	1						

CO 4	-	2	1	-	1	1						
CO 5	-	1	1	-	1	-						
CO 6	-	3	1	-	-	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓		✓	✓
CO 4			✓	✓
CO 5			✓	✓
CO 6			✓	✓

Programme	B. Sc. Electronics				
Course Code	**ELE5EJ305**				
Course Title	COMPUTER HARDWARE & NETWORK MAINTENANCE				
Type of Course	**ELECTIVE**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Basic knowledge of computer 2. Familiarity with operating systems				
Course Summary	This course provides a structured approach to learning computer hardware and network maintenance, ensuring that students are well-prepared for entry- level IT support roles or for further specialized studies.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Identify and describe the key components of a computer system	U	C	Instructor-created exams / Quiz
CO2	Organize a PC and install operating systems (Windows/Linux)	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Analyse and diagnose common hardware issues using diagnostic tools and software	An	P	Seminar Presentation / Group Tutorial Work
CO4	Design and implement a secure home or small office network, including the selection and configuration of network devices	C	P	Practical Assignment / Observation of Practical Skills
CO5	Evaluate and select appropriate PC components for upgrades, considering factors such as performance enhancement, compatibility, and cost	E	P	Practical Assignment / Observation of Practical Skills
CO6	Create a comprehensive maintenance and troubleshooting strategy for personal computers that includes preventive maintenance, troubleshooting workflows, and upgrade plans	C	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Computer System Architecture**	**11**	**15**
	1	Introduction to computer system components	2	
	2	Understanding system buses, connectors, and expansion slots	2	
	3	Overview of peripheral devices (Input/Output)	2	
	4	BIOS/UEFI settings	3	
	5	Boot processes	2	
		"Computer Organization and Design MIPS Edition: The Hardware/Software Interface" by David A. Patterson and John L. Hennessy "Computer Systems: A Programmer's Perspective" by Brent Bershad and Heath LeBlanc		
II		**Assembly and Configuration**	**13**	**20**
	6	Assembling a PC: Step-by-step guide and hands-on practice	3	
	7	Laptop and its internal structure	2	
	8	Installing and configuring operating systems (Windows/Linux)	3	
	9	Customize Operating System	2	
	10	Drivers and software installation	1	
	11	Device Driver, OS Update and Firewall Security	2	
		"Build Your Own PC Do-It-Yourself For Dummies" by Mark L. Chambers "Upgrading and Repairing PCs" by Scott Mueller		
III		**Hardware Troubleshooting and Maintenance**	**11**	**15**
	12	Diagnostic tools and software for troubleshooting	2	
	13	Common hardware issues and repair techniques	3	
	14	Preventive Maintenance and Troubleshooting of PC	2	
	15	Upgrading components for enhanced capabilities	2	
	16	PC tuning, overclocking, and cooling solutions	2	
		"Upgrading and Repairing PCs" by Scott Mueller "Troubleshooting and Maintaining Your PC All-in-One For Dummies" by Dan Gookin		
IV		**Network Setup, Management, and Security**	**13**	**20**
	17	Networking fundamentals (LAN/WAN, routers, switches, protocols)	3	
	18	Network Protocols	2	
	19	Wired and wireless network setup and configuration	2	
	20	Network troubleshooting and tools	3	
	21	Network security	2	
	22	Data backup and Data recovery	1	
		"Networking All-in-One For Dummies: Incorporating the Boundary Element Method" by Doug Lowe "Network Security Essentials: Applications and Standards" by William Stallings		
V		**Open Ended Module:**	**12**	
	1	• Demonstrate testing and troubleshooting for power supplies in I/O devices and trace circuit of PC SMPS • Assemble and repair Desktop Computer with all its hardware components. • Install different Operating System and all other application software. • Install Printer, Scanner and troubleshoot their faults. • Set up and configure Networking System using various network devices.	12	

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

References

1. "Upgrading and Repairing PCs" by Scott Mueller
2. "Computer Organization and Design MIPS Edition: The Hardware/Software Interface" by David A. Patterson and John L. Hennessy
3. “Computer Systems: A Programmer's Perspective” by Brent Bershad and Heath LeBlanc
4. "Build Your Own PC Do-It-Yourself For Dummies" by Mark L. Chambers
5. "Troubleshooting and Maintaining Your PC All-in-One For Dummies" by Dan Gookin
6. “Networking All-in-One For Dummies: Incorporating the Boundary Element Method” by Doug Lowe
7. "Network Security Essentials: Applications and Standards" by William Stallings

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-						
CO 2	2	3	-	-	-	-						
CO 3	-	-	1	-	-	-						
CO 4	-	-	2	3	-	-						
CO 5	-	1	-	-	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	**B.Sc. Electronics**				
Course Code	**ELE5EJ307**				
Course Title	**POWER ELECTRONICS**				
Type of Course	**Elective**				
Semester	**V**				
Academic Level	**300-399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Knowledge in Electronic Devices and Circuits				
Course Summary	This course introduces the principles of power electronics, power semiconductor devices, switching techniques, types of converters, control methods and its applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize power electronic semiconductor devices, its operation and application.	**U**	**C**	Instructor-created exams/ Quiz
CO2	Illustrate the turn on and power electronic devices.	**U**	**C**	Assignment
CO3	Demonstrate different firing, commutation and protection circuits for thyristors.	**U**	**C**	Seminar Presentation / Group Tutorial Work
CO4	Outline the principles and operation of various power electronics converters such as rectifiers, choppers, inverters, and AC voltage controllers	**U**	**C**	Internal exams

CO5	Classify and operation of switch mode regulators.	**U**	**C**	Group Discussion/ Quiz
CO6	Identify and discuss the applications of power electronics in various domains	**Ap**	**C**	Internal exams/ Quiz

*** Cognitive Level:**
R - Remember**, U -** Understand**, Ap -** Apply**, An -** Analyze**, E -** Evaluate**, C –** Create

 # Knowledge Level: F - Factual**, C -** Conceptual**, P -** Procedural**, M -** Metacognitive

Note: Course outcomes need not be envisioned as the outcomes for each module, they should be more generic such that they reflect the totality of the outcomes intended from a course as a whole. The additional explanation in some of the course outcomes is optional; it can serve to clarify the pedagogical objectives and strategies involved in the particular course.

Detailed Syllabus:

Module	Unit	Content	Hours (60)	Marks (98)
I		**Power Semiconductor Devices**	**9**	**15**
	1	Power Diode, DIAC , TRIAC	2	
	2	Characteristics of Power Transistors	1	
	3	Characteristics of Thyristor / SCR	2	
	4	Gate Turn Off Thyristor (GTO)	1	
	5	Two transistor model of Thyristor	1	
	6	SCR Specification and Ratings	2	
	Sections from References: 1. Power Electronic Drives and Advanced Applications, Vinod Kumar, Ranjan kumar Behra, Dheeraj Joshi, Umesh Bansal, CRC Press			
II		**Thyristor control and Protection circuits**	**13**	**20**
	7	SCR: Methods of Turn ON	2	
	8	SCR: Firing (triggering) Circuits	3	
	9	Series and Parallel operation of SCR	2	
	10	Thyristor commutation techniques *(Circuit operation only)*	4	
	11	Protection of SCR	2	
	Sections from References: 1. Power Electronic Drives and Advanced Applications, Vinod Kumar, Ranjan kumar Behra, Dheeraj Joshi, Umesh Bansal, CRC Press 2. Industrial and Power Electronics G K Mithal, Dr. Maneesha Gupta, Khanna Publishers.			
III		**Power Electronic Converters**	**12**	**20**
	12	AC-DC Converters (Rectifiers): Thyristor Circuits and their Control, Single-Phase Converters	2	
	13	DC-DC Converters (Choppers): Step down (Buck) converter, Step Up (Boost) converter	3	
	14	Step up/Step down (Buck-Boost) converter and Cuk converters.	2	
	15	DC-AC Converter (Inverters): Single-Phase Inverters	3	
	16	AC –AC Converter: Single Phase Half wave AC voltage Controller	2	

	Sections from References: 1. Industrial and Power Electronics G K Mithal, Dr. Maneesha Gupta, Khanna Publishers.			
IV		**Applications of Power Electronics**	**11**	**15**
	17	Switched Mode Power Supplies (SMPS)	3	
	18	Power conditioners, Uninterruptible power supplies (UPS)	2	
	19	Induction Heating..	2	
	20	Battery Charging Regulator.	1	
	21	Emergency Lighting System.	1	
	22	Electric vehicles battery chargers.	2	
	Sections from References: 1. Power Electronics M D Singh, K B Khanchandani, Tata Mc Graw Hill			
V	**Open Ended Module:**		**12**	
		Case studies: Wireless Power Transfer in electric vehicle Real-World Applications and Trade-offs ● Identify the operation of Fan Speed controller ● Construct an LED Emergency Lamp Open-Ended Exploration and Assessment: ● Study and analyse the operation of a SMPS adaptor		
	Sections from References: 1. Power Electronic Drives and Advanced Applications, Vinod Kumar, Ranjan kumar Behra, Dheeraj Joshi, Umesh Bansal, CRC Press			

Text Books:	
	Power Electronic Drives and Advanced Applications, Vinod Kumar, Ranjan kumar Behra, Dheeraj Joshi, Umesh Bansal, CRC Press
	Industrial and Power Electronics G K Mithal, Dr. Maneesha Gupta, Khanna Publishers.
	Power Electronics M D Singh, K B Khanchandani, Tata Mc Graw Hill
	Power Electronics and its Applications, Alok Jain, Penram International

References:	1. Power electronics: Circuits, Devices and Applications , M.H. Rashid third Edition (2004),Pearson Education 2. Power Electronics, Dr. P S Bimbhra, Khanna Publishers. 3. Power Electronics, Ned Mohan, Tore. M. Undeland, William P. Robbins, John Wiley & Sons Third Edition-2006
Online Resource	1. Prof. G. Bhuvaneshwari, Dept. of Electrical Engineering, IIT Delhi: https://youtube.com/playlist?list=PLp6ek2hDcoND7i5-DAD9mPmYF1Wg6ROdO&si=gC6uVfEgHN8WCMR1 2. Prof. Vivek Agarwal, Dept. of Electrical Engineering, IIT Bombay: https://youtube.com/playlist?list=PLOzRYVm0a65dVYOA7_3-N67Xu1NIrLnR0&si=u08y6yKY-HvtQgkr

Note: The course is divided into five modules, with four modules together having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules. The 70 marks shown in the last column, distributed over the first four modules, is only for the external examination.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	1	1	3	-	-	3	1	-	-	2	2
CO 2	2	-	1	3	-	-	3	-	-	-	2	-
CO 3	2	-	2	3	-	-	3	1	-	-	2	-
CO 4	3	2	2	3	-	-	3	1	-	1	2	-
CO 5	2	2	2	3	-	-	3	1	-	-	2	-
CO 6	2	2	2	2	-	-	3	1	2	-	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	**B.Sc. Electronics**				
Course Code	**ELE6EJ308**				
Course Title	**MEDICAL ELECTRONICS**				
Type of Course	**Elective**				
Semester	**V**				
Academic Level	**300 - 399**				
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours**
	4	4			60
Pre-requisites	Knowledge of Instrumentation and Measurement				
Course Summary	The course is designed to give the basic concepts of Instrumentation involved in medical field and human physiology. Biomedical Instrumentation is applicationof technology for medical field. During the course, students will explore Electro- physiological measurements, medical imaging etc. The course will make the students understand the devices used in diagnosing the diseases.				

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Illustrate transducers for biomedical applications, including piezoelectric and ultrasonic transducers, and understand the use of fiber optic sensors for temperature measurements.	U	C	Instructor-created exams / Quiz
CO2	Demonstrate the operation and application of various medical amplifiers, including preamplifiers, differential amplifiers, chopper amplifiers, and isolation amplifiers.	U	C	Practical Assignment / Observation of Practical Skills
CO3	Identify shock hazards and leakage currents.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Compare and differentiate between radiographic and fluoroscopic techniques, computer tomography, MRI, ultrasonography, endoscopy, and thermography.	U	P	Instructor-created exams / Home Assignments
CO5	Acquire knowledge about different types of biotelemetry systems and how they are used in patient monitoring.	Ap	P	Practical Assignment
CO6	Summarize the use of spirometers, photo plethysmography, body plethysmography, and blood gas analyzers for measuring blood pH, pCO2, pO2, as well as the use of fingertip oximeters, ESR, and GSR measurements.	U	P	Presentation and Tech Talk

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Total marks(98)
I		**Intr**	**8**	**20**
	1	Introduction to Transducers and its Selection Criteria, Factors in the	2	
	2	Piezo-Electric, Ultrasonic Transducers, Temperature, measurements - Fiber optic temperature sensors	2	
	3	Electrodes: Limb electrodes, floating electrodes, pre-gelled disposable electrodes, Micro, needle and surface electrodes.	4	
II		**Electro – Physiological measurements**	**16**	**15**
	4	Amplifiers: physiological signal amplifier, Preamplifiers,Instrumentation amplifiers, chopper amplifiers,	3	
	5	ECG, EEG, EMG, ERG	3	
	6	Sodium Pump	3	
	7	Typical waveforms	2	
	8	Electrical safety in medical environment: shock hazards, leakage current	3	
	9	Instruments for checking safety parameters of biomedical	2	
III		**Medical**	**14**	
	10	Radiographic and fluoroscopic techniques	2	**20**
	11	X-rays	2	
	12	Computer tomography	2	
	13	Mammography, MRI, fMRI	2	
	14	Ultrasonography, Endoscopy, Thermography	2	
	15	Different types of biotelemetry systems and patient monitoring	4	
IV		**Assisting and Therapeutic equipment**	**10**	**15**
	16	Pacemakers	1	
	17	Defibrillators and Ventilators	2	
	18	Nerve and muscle stimulators, Diathermy	2	
	19	Heart Lung machine	2	
	20	Audio meters	1	
	21	Dialyzers	1	
	22	Lithotripsy	1	
V		**Open**	**12**	
	1	**Non-electrical parameter measurements** Measurement of blood pressure, Cardiac output, Heart rate, Heart sound Pulmonaryfunction measurements, spirometer, Photo Plethysmography, Body Plethysmography, Blood Gas analyzers: pH of blood, measurement of blood pCO2, pO2, finger-tip oximeter, ESR, GSR, measurements, Standard HL7	12	

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 50 instructional hours for the fixed modules and 10 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	1	-	2	-	-	-
CO 2	2	-	1	2	-	-
CO 3	1	1	-	-	-	-
CO 4	2	-	-	-	-	-
CO 5	-	-	2	1	-	-
CO 6	2	-	1	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			
CO 4	✓			
CO 5		✓	✓	
CO 6			✓	

Suggested Learning Resources:

Text Books:

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing CoLtd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation andMeasurements', II edition, Pearson Education, 2002 / PHI.
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
4. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley &Sons, 1975.

Programme	**B.Sc. Electronics**				
Course Code	**ELE6EJ310**				
Course Title	**MOBILE COMMUNICATION**				
Type of Course	**Elective**				
Semester	**VI**				
Academic Level	**300 - 399**				
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours**
	4	3	-	-	60
Pre-requisites	Basic Knowledge in Principles of Communication				
Course Summary	This course introduces students to the Wireless Communication Principles, development and evolution of wireless communication, its underlying architecture and various technologies adopted in the present era of communication				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Recall of fundamental Wireless communication principles and practices.	**R**	**C**	Internal Exam
CO2	Summarize the basic concepts of basic Cellular System and the design requirements	**U**	**C**	Internal Exam
CO3	Relate knowledge and awareness of the technologies like GSM, GPRS, EDGE etc.	**R**	**C**	Discussion /Assignment
CO4	Show communication devices in terms of data transmission and losses.	**U**	**C**	Internal Exam
CO5	Infer the emerging trends in Wireless communication like WiFi, WiMAX	**U**	**C**	Discussion / Quiz
CO6	Identify the limitations and future developments of mobile communication technologies	**Ap**	**C**	Discussion /Assignment

*** Cognitive Level:**
R - Remember, **U** - Understand, **Ap** - Apply, **An** - Analyze, **E** - Evaluate, **C** - Create

 # Knowledge Level: F - Factual, **C** - Conceptual, **P** - Procedural, **M** - Metacognitive

Detailed Syllabus

Module	Unit	Content	Hours (60)	Marks (98)
I	**Overview of Wireless Communication System**		**9**	**15**
	1	Introduction, Advantages and Challenges	3	
	2	Wireless Communication Network Architecture	2	
	3	Functional Block, Spectrum Allocation Methods	2	
	4	Wireless communication system - *Cordless, Cellular, Paging, Bluetooth, Wireless data service system, Zigbee, WLL*	2	
	Sections from References: 1. Mainak Chowdhury, Arumita Biswas, 'Wireless Communication Theory and Practice' Cambridge University Press			
II	**Introduction to Cellular Systems**		**12**	**15**
	5	Introduction to Cellular Systems, Development trend in cellular system,	2	
	6	Cellular System Principles- System Components, Cell: Structure and type,	2	
	7	Channel assignment, Channel Reuse.	2	
	8	Source Interference, Interference Mitigation Technique	2	
	9	Handsoff: *Initiation, Protocol, prioritisation, classification*	2	
	10	Diffraction losses, Fading	2	
	Sections from References: 1. Mainak Chowdhury, Arumita Biswas, 'Wireless Communication Theory and Practice' Cambridge University Press			

III	**Global system for Mobile**		**15**	**15**
	11	GSM Architecture	3	
	12	GSM Interfaces: *Air Interface, Abis Interface, A interface*	2	
	13	Spectrum Allocation, Areas of GSM, Logical Channels	2	
	14	GSM Processes*: Security and data confidentiality*, *Location update, Call management, Handover management*	2	
	15	GPRS services, System architecture	4	
	16	Enhanced Data Rates for GSM Evolution (EDGE)	2	
	Sections from References: 1. Mainak Chowdhury, Arumita Biswas, 'Wireless Communication Theory and Practice' Cambridge University Press			
IV	**3G, HSDPA, HSUPA and LTE**		**12**	**15**
	17	WCDMA Based 3G Network,	3	
	18	HSDPA, HSUPA	2	
	19	LTE system architecture, Key technologies of LTE	2	
	20	Multi carrier technology, MIMO Technology	1	
	21	IEEE 802.11,Topologies of 802.11, IEEE 802.11 Variants	2	
	22	MAC techniques, Introduction to WiMAX	2	
	Sections from References: 1. Mainak Chowdhury, Arumita Biswas, 'Wireless Communication Theory and Practice' Cambridge University Press			
V	**Open Ended Module**		**12**	

	Case study: On any Advanced Mobile communication System Open-Ended Exploration and Assessment: ● Conduct a discussion on present communication devices. ● Invite industry experts or researchers to share their knowledge and experience with the class.	12	

Resources:

Text Book	1. Mainak Chowdhury, Arumita Biswas, 'Wireless Communication Theory and Practice' Cambridge University Press
Reference Books	1. 'Wireless Communication Principles and Practices',Rappaport T. S, Pearson Education, Asia, New Delhi, 3rd Ed.2003. 2. Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications 3. 'Mobile communication', JochenSchiller, Pearson Education,Asia. 4. 'Principles and Applications of GSM', Vijay K Garg, Joseph E Wilkes, Pearson Education. 5. Wireless digital communication, Kamilo Feher, PHI 6. Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI). 7. Wireless Communications-T.L.Singh-TMH 8. Adhoc Mobile Wireless network, C.K.Toh Pearson
Online Resource	1. Prof. David Koilpillai, Dept. of Electrical Engineering, IIT Madras: https://youtu.be/f2wlHL1Sok8?si=6L3imkxhpAstelQn

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	-	2	-	-	2	-	-	-	-	-
CO 2	2	2	-	-	-	-	2	-	-	-	-	-
CO 3	-	-	1	-	-	-	1	-	-	-	-	-
CO 4	-	-	2	-	-	-	2	2	-	-	-	-
CO 5	-	-	-	-	1	-	1	-	-	1	1	-
CO 6	-	-	-	-	-	2	-	-	2	-	2	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	
3	

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4	✓			✓
CO 5	✓	✓		
CO 6		✓		

Programme	B. Sc. Electronics				
Course Code	**ELE8EJ410**				
Course Title	LIGHT AND AUDIO SYSTEMS ENGINEERING				
Type of Course	**Elective**				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Fundamental Mathematics Concepts: Set, Functions, Logic 2. CSC2CJ101 – Fundamentals of Programming				
Course Summary	This course explores implementations of linked list and array-based data structures, delving into the inner workings of basic data structures including lists, stacks, queues, trees, and graphs.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate the basic properties of light and sound	U	C	Instructor-created exams / Quiz
CO2	Examine the functions and applications of various lighting fixtures and sound equipment	An	P	Practical Assignment / Observation of Practical Skills
CO3	Determine optimal illumination levels for various settings. They will also apply knowledge of loudspeaker specifications and power requirements to set up a sound system for live events.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Analyze and design advanced lighting and sound systems	An	P	Instructor-created exams / Home Assignments
CO5	Develop innovative	C	P	Practical Assignment /

	projection mappings and other projection technologies.			Observation of Practical Skills
CO6	Evaluate the advantages and disadvantages of different types of projectors and sound systems	E	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (48 +12)**	**Marks (98)**
I		**Fundamentals of Lighting**	**10**	**15**
	1	Basics of light-color,temperature, brightness, and intensity, Types of Lighting -Ambient, task and accent lighting	2	
	2	Different light sources (LED, fluorescent, halogen, etc.), Overview of lighting fixtures and their functions	3	
	3	Lighting Calculations and Measurements-Calculating illumination levels, understanding lumens, lux and foot-candles, using light meters.	3	
	4	Lighting Controls and Systems - Dimmers, motion sensors and smart lighting systems	2	
	"Lighting Design Basics" by Mark Karlen and James R. Benya. "IES Lighting Handbook" by Illuminating Engineering Society. "Lighting Control: Technology and Applications" by Robert S. Simpson.			
II		**Introduction to Projection Techniques**	**10**	**15**
	5	Understanding different types of projectors, Projection surfaces and aspect ratios.	3	
	6	Projection Mapping- techniques for mapping video content to irregular surfaces	3	
	7	Creating interactive displays using projectors and motion sensors.	2	
	8	3D holographic and cutting-edge projection technologies	2	
	"Projection Displays" by Edward H. Stupp and Matthew S. Brennesholtz. “Projection mapping A Complete Guide” by Gerardus Blokdyk			
III		**Introduction to Sound**	**20**	**25**
	9	Sound waves- amplitude, frequency and phase.	2	
	10	Room acoustics and soundproofing	3	
	11	Microphones- Types (based on Transduction and functional design)	1	
	12	Preamplifiers and mixers	3	
	13	Stage monitors and mixing consoles	3	
	14	Loudspeakers specifications and power requirements.	3	

	15	Placement strategies for optimal sound.	1	
	16	Use of SPL meters for speaker calibration.	1	

	17	Setting up a sound system for a live event.	3	
	"The Sound Reinforcement Handbook" by Gary Davis and Ralph Jones "Modern Recording Techniques" by David Miles Huber and Robert E. Runstein			
IV	**Introduction to Advanced Sound Systems**		**8**	**15**
	18	Principles of surround sound, 5.1 and 7.1 setups.	2	
	19	Concepts of Object-based audio	2	
	20	Basics of Dolby Atmos	2	
	21	Overview of DTS:X and other DTS sound systems	1	
	22	Comparison between DTS and Dolby Atmos.	1	
	"Surround Sound: Up and Running" by Tomlinson Holman. Dolby Atmos / DTS official documentation and guides.			
V	**Open Ended Module: Setting up of Projector and Sound**		**12**	
	1	**Case studies:** 1. Explore the functionality and benefits of dimmers, motion sensors, and smart lighting systems. 2. explore the technique of projection mapping by projecting video content onto irregular surfaces. [mapping software (e.g., MadMapper, VPT7), objects with irregular surfaces (e.g., mannequin, small architectural model)] **Real-World Applications and Trade-offs:** Set up a live sound system and experiment with microphone and speaker placement to control feedback. **Open-Ended Exploration and Assessment:** Create a simple sound system setup with microphones, mixers, amplifiers, and speakers **Group Assignment:** Compare and contrast the functionality and applications of various types of projectors, including DLP (Digital Light Processing), LCD (Liquid Crystal Display), and LED (Light Emitting Diode) projectors.	12	

Books and References:

1. "Lighting Design Basics" by Mark Karlen and James R. Benya.
2. "IES Lighting Handbook" by Illuminating Engineering Society.
3. "Lighting Control: Technology and Applications" by Robert S. Simpson.
4. "Projection Displays" by Edward H. Stupp and Matthew S. Brennesholtz.
5. “Projection mapping A Complete Guide” by Gerardus Blokdyk
6. "The Sound Reinforcement Handbook" by Gary Davis and Ralph Jones
7. "Modern Recording Techniques" by David Miles Huber and Robert E. Runstein
8. "Surround Sound: Up and Running" by Tomlinson Holman.
9. Dolby Atmos / DTS official documentation and guides.

Note: The course is divided into five modules, with four modules together having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

The 70 marks shown in the last column, distributed over the first four modules, is only for the external examination.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-						
CO 2	2	3	-	-	-	-						
CO 3	-	-	1	-	-	-						
CO 4	-	-	2	3	-	-						
CO 5	-	1	-	-	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓

CO 5		✓		✓
CO 6			✓	

Programme	**B.Sc. Electronics**				
Course Code	**ELE8EJ412**				
Course Title	**FUNDAMENTALS OF ROBOTICS AND APPLICATIONS**				
Type of Course	**Major**				
Semester	**VIII**				
Academic Level	**300 - 399**				
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours**
	4	4			60
Pre-requisites	Basic Knowledge in Robotics				
Course Summary	Robotics is an interdisciplinary branch of electronic engineering anc mechanical engineering. Robotics involves design, construction, operation, anc use of robots. The goal of robotics is to design machines that can help anc assist humans. Robotics integrates fields of mechanical engineering, electrica engineering, information engineering, Mechatronics, electronics bioengineering, computer engineering, control engineering, software engineering, mathematics, etc.				

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Interpret the significance, social impact and future prospects of robotics and automation in various engineering applications	U	C	Instructor-created exams
CO2	Identify and describe the components and anatomy of robotic system.	U	C	Practical Assignment / Observation of Practical Skills
CO3	Examine various path planning techniques and analyse different motions of robotics system	An	P	Group Tutorial Work

CO4	Develop suitable drives and end-effectors for a given robotics application	Ap	P	Home Assignments/seminar
CO5	Apply robotics concept to automate the monotonous and hazardous tasks and categorize various types	Ap	P	One Minute Reflection Writing assignments

	of robots based on the design and applications in real world scenarios			
CO6	Communicate effectively about complex robotic concepts through presentations and technical discussions.	Ap	P	Presentation and Tech Talk
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Total marks(98)
I		**Introduction to Introduction to Robotics**	**12**	**20**
	1	Introduction to Robotics	1	
	2	Laws of Robot	1	
	3	Brief History of Robotics & Basic Components of Robot	3	
	4	Robot Locomotion	3	
	5	AI in Robotics	2	
	6	Robotic Research Areas	2	
II		**Robot Anatomy and Motion Analysis**	**12**	**20**
	7	Anatomy of a Robot	1	
	8	Types of Robot Sensors	1	
	9	Hardware Designing Using Software	2	
	10	Power Supply in Robotics	1	
	11	Microcontroller in Robotics	1	
	12	Basics of Robot Configurations and its applications	2	
	13	Degrees of freedom(path)	2	
III		**Robot Drives and End Effectors**	**14**	**15**
	14	Robot Drive Systems: Hydraulic, Pneumatic and Electric	2	
	15	Classification Of End Effectors	2	
	16	Grippers: Mechanical Grippers, Vacuum Grippers, Magnetic Grippers, Adhesive Gripper, Gripper Force	4	
	17	Tools As End Effectors	3	
	18	Robot Control Types: Limited Sequence Control, Point-To-Point Control, Playback with Continuous Path Control, and Intelligent	3	
IV		**Path Planning and Robot Application**	**10**	**15**
	19	Material Handling: Pick and Place, Palletizing and Depalletizing,	2	
	20	Medical, Agricultural and Space Applications	2	
	21	Unmanned Vehicles: Ground, Ariel and Underwater	2	
	22	Types Of Robots: Manipulator, Legged Robot, Wheeled Robot, Aerial Robots, Industrial Robots, Humanoids, Robots, Autonomous Robots, and	2	
V		**Open**	**12**	

	1	Discussion of Recent developments in Robotic Field Presentation and Assignment submission by Students Tech Talk by Students	10

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 50 instructional hours for the fixed modules and 10 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

Mapping of COs with PSOs and POs :

Mapping of COs with PSOs and POs :												
	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO 1	1	-	2	-	-	-						
CO 2	2	-	1	2	-	-						
CO 3	1	1	-	-	-	-						
CO 4	2	-	-	-	-	-						
CO 5	-	-	2	1	-	-						
CO 6	2	-	1	-	-	-						

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam

- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			
CO 4	✓			
CO 5		✓	✓	
CO 6			✓	

Suggested Learning Resources:

Text Books:

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education, 2009.

2. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, Special Edition, (2012).

3. Ganesh S Hegde, “A textbook on Industrial Robotics”, University science press, 3rdedition, 2017.

Reference Books:

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.

2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics: Control, Sensing, Vision and Intelligence",McGraw Hill, 1987. https://www.robots.com/applications

Website Links

1. https://www.javatpoint.com/robotics-tutorial
2. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.theseus.fi/bitstream/handle/10024/37806/Shakhatreh_Fareed.pdf
3. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://srict.in/UploadedFiles/133039117797739107.pdf

Programme	B. Sc. Electronics				
Course Code	**ELE8EJ414**				
Course Title	INDUSTRIAL AUTOMATION				
Type of Course	Elective				
Semester	VIII				
Academic Level	300- 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Digital and Analog Electronics, Microprocessor Based Computer System 2. Basic Electrical Wiring and Control Logic.				
Course Summary	This course provides a comprehensive introduction to industrial automation, covering essential concepts, components, and programming techniques. Participants will gain a deep understanding of automation system using PLCs and, general concepts on SCADA (Supervisory Control and Data Acquisition) and Distributed Control Systems (DCS). Practical applications and hands-on experiences will enhance students' ability to design, implement, and troubleshoot industrial automation solutions.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Illustrate the basics and need for automation in industries.	U	C	Instructor-created exams / Quiz
CO2	Infer various automation components in the categories of sensors and actuators used in industry.	U	C	Seminar Presentation / Group Tutorial Work
CO3	Analyse the basic functions in PLC using input/output modules.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Design and analyze ladder logic PLC Programme, that includes Timer/Counter, relay logics and math functions, for an automation sequence.	An	P	Practical Assignment / Observation of Practical Skills s
CO5	Evaluate the automation process created in PLC logic program for a specific application in industry.	E	P	Practical Assignment / Observation of Practical Skills s
CO6	Summarize on data	U	C	Viva Voce

	acquisition system interface and SCADA system			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (45+12)**	**Marks (98)**
I		**Introduction to Industrial Automation**	**10**	**15**
	1	Automation overview, Requirement of automation systems	2	
	2	Architecture of Industrial Automation system	1	
	3	Introduction to PLC and SCADA	2	
	4	Fundamentals of Automatic Control	2	
	5	Advantages of using PLC for Industrial automation.	1	
	6	Introduction to P-I-D Control	2	
II		**Automation Components**	**12**	**15**
	7	Manually and mechanically operated switches.	1	
	8	Sensors for temperature, Pressure, Force, Displacement, Speed, Flow, Level, Humidity and Proximity	4	
	9	Actuators: Relay, Process Control Valves, Solid State Relay	3	
	10	Basics of speed control in DC and AC motors using drives.	4	
III		**PLC Programming**	**15**	**25**
	10	Programmable Logic Controllers	1	
	11	Analog And Digital Input And Output Modules	1	
	12	PLC Programming, Ladder Logic, Ladder Diagram,	2	
	13	Sequential Flow Chart	1	
	14	Basic Relay Instructions, Latching Relays	2	
	15	Input-Output Instructions	1	
	16	Arithmetic and Comparison Functions	1	
	17	Timer Instructions, On Delay Timer and Off Delay Timer	2	
	18	Counter Instructions - Up/Down Counters	1	
	19	Application of PLC to Process Control Industries.	3	
IV		**Distributed Control System**	**8**	**15**
	20	Overview of DCS, DCS software and communication	2	
	21	0-10V and 4-20mA wire communication. I to V and V to I converter.	2	
	22	Industrial bus systems: Modbus and Profibus,	2	
	23	DCS integration with PLC and Computers	2	
		Open Ended Module: PLC for Industrial Automation	**12**	

V		**Case studies:** 1. Converting relay schematics into PLC ladder programs 2. Ladder program execution with ON & OFF Timer and Relay. **Real-World Applications and Trade-offs:** 1. Implementing an Alarm based control scheme and run in a simulated environment. 2. Designing an entire PLC logic for filling and draining water tank automatically. **Open-Ended Exploration and Assessment:**	**12**	
		Speed control of Motors using PLC program. **Group Assignment:** Automatic Control of Warehouse Door or Automatic Packing Mechanism.		

REFERENCES

1. C D Johnson, "Process Control Instrumentation Technology", Prentice Hall India,8th Edition, 2006.
2. S.K.Singh, "Industrial Instrumentation", Tata Mcgraw Hill, 2nd edition companies,2003.
3. E.A.Parr, Newnes ,NewDelhi,"Industrial Control Handbook",3rd Edition, 2000.
3. Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw- Hill, New York, 2019.
4. John W. Webb, Ronald A. Reis, Programmable Logic Controllers Principles and Applications, PHI publication
5. Stuart Boyer A, "SCADA: Supervisory control and data Acquisition", Fourth Edition, ISA- The Instrumentation, Systems, and Automation Society,2010

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 45 instructional hours for the fixed modules and 30 hours for the open-ended one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V.Internal assessments (30 marks) are split between the practical module (20 marks) and the first four modules (10 marks).The end-semester examination for the theory part will be based on the 22 units in the first four modules. The 70 marks shown in the last column, distributed over the first four modules, is only for the external examination.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-						
CO 2	2	3	-	-	-	-						

CO 3	-	-	1	-	-	-						
CO 4	-	-	2	3	-	-						
CO 5	-	1	-	-	-	-						
CO 6												

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4				✓
CO 5		✓		✓
CO 6		✓		✓

Programme	B. Sc. Electronics				
Course Code	**ELE1MN101**				
Course Title	**ELECTRONIC FUNDAMENTALS**				
Type of Course	Minor				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge in science				
Course Summary	This course introduces some of the basic electronics devices like diode and different type of transistors and also basic applications using these devices.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Identify and differentiate basic electronic components.	U	C	Instructor-Demonstration
CO2	Illustrate fundamentals laws of electric circuits.	U	C	Instructor-created exams /
CO3	Differentiate voltage source and current source	Ap	C	Instructor-created exams / Quiz
CO4	Outline principle and behaviour of semiconductor devices.	U	P	Instructor-created exams / Quiz
CO5	Examine basics of testing and measuring instruments	Ap	P	Practical Work
CO6	Build simple electronic circuits	Ap	P	Practical work

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Electronic Components**	**10**	**15**
	1	Introduction to Electronics	1	
	2	Introduction Passive Components: Resistor, Capacitor, Inductor, Transformer, resistor colour coding.	3	
	3	Voltage, Current, Voltage source, Current source, Ohm's Law, Kirchhoff's laws	3	
	4	R, C, L series and parallel connections.	3	
II		**Semiconductor diode**	**10**	**15**
	5	Classification of solids- Conductor, Insulator and semiconductor	2	
	6	Intrinsic and extrinsic semiconductors. N type and P type semiconductors, Minority and majority carriers.	2	
	7	Basic principle of operation of PN junction diode, depletion layer, biased PN junction V-I characteristics of diode	3	
	8	PIV of diode, Knee voltage.static and dynamic resistance of Diode.		
	9	Basic principles of LED and Zener diode and its Applications	3	
III		**BJT and FET**	**13**	**20**
	10	BJT Pins, Structure of NPN and PNP transistor.	1	
	11	Biased transistor, active ,saturation and cut off modes	1	
	12	CE transistor configuration.	1	
	13	Current gain of transistor in CE configuration	1	
	14	CE transistor Characteristics,	2	
	15	Introduction to FET, Types of FET, Comparison between FET and BJT.	4	
IV		**Electronic circuits**	**12**	**20**
	16	Introduction to rectifier, Rectifier types.	3	
	17	Circuit diagram and working of Half wave rectifier.		
	18	DC output voltage, ripple factor and rectifier efficiency of half wave rectifier.(detailed analysis not required)		
	19	Full wave rectifier, Circuit diagram of centre tap and bridge rectifiers.	3	
	20	DC output voltage, ripple factor and rectifier efficiency of full wave rectifier. (detailed analysis not required), Capacitor filter		
	21	Block diagram of DC Power supply,	3	
	22	Circuit diagram of CE transistor amplifier and voltage gain of CE amplifier.(Detailed analysis not required)	2	
V		**Electronics Practical** **Hardware implementation or Simulation Lab**	**30**	
	1	1) Familiarisation of Passive and active components 2) Validating Ohm's law. 3)Application of KVL and KCL 4) Series and parallel connection of resistors. 5) VI characteristics of diode.	30	
		6) Reverse characteristics of zener diode. 7) Half wave rectifier.		

Note: The syllabus has five modules.There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

1.Electronic Devices and Circuit Theory by Robert L Boyleshad.
2.Principles of electronics- V.K Metha.

3.Basic electronics and linear circuits – N.N Bhargava, Kurukshetra and Gupta.

4. Electronics Engineering - B.L.Theraja
5. Textbook of Applied electronics – R.S Sedha.

Online resources

1. https://onlinecourses.swayam2.ac.in/nou23_ec06/preview (Swayam portal online course)

2. https://onlinecourses.nptel.ac.in/noc21_mm03/preview (Swayam portal online course)

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-	1	1			1	
CO 2	2	3	-	-	-	-	1	1			1	
CO 3	-	-	1	-	-	-	1	1			1	
CO 4	-	-	2	3	-	-	1	1			1	
CO 5	-	1	-	-	-	-	1	1			1	
CO 6	-	-	-	3	-	-	1	1			1	

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium

3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE2MN101**				
Course Title	**FUNDAMENTALS OF DIGITAL ELECTRONICS**				
Type of Course	Minor				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Nil				
Course Summary	This course covers different number systems, Boolean algebra theorems, combinational logic circuits, sequential logic circuits and overview of computer memories.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Illustrate different number systems and logic gates	U	C	Instructor-Demonstration
CO2	Analyse simple combinational logic circuits	An	C	Instructor-created exams /
CO3	Analyse simple sequential logic circuits	An	C	Instructor-created exams / Quiz
CO4	Summarize different type of computer memories	U	C	Instructor-created exams / Quiz
CO5	Design and implement simple combinational logic circuits.	An	P	Practical Work
CO6	Design and implement simple sequential logic circuits	An	P	Practical work

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Number system and codes**	**10**	**15**
	1	Decimal, Binary, Hexadecimal number systems conversion of one code to another. Binary Coded Decimal,	1	
	2	Logic Gates : Truth Tables, OR, AND, NOT, XOR, XNOR, Universal (NOR and NAND) Gates.	3	
	3	Boolean Algebra Theorems.	3	
	4	DeMorgan's Theorems.	3	
II		**Combinational Logic Analysis and Design**	**10**	**17**
	5	Standard representation of logic functions (SOP and POS).	2	
	6	Minimization of SOP expression using Karnaugh map.	2	
	7	Adder (half and full) and half subtractor and basic binary Decoder.	3	
	8	Multiplexers and Demultiplexers	3	
III		**Sequential logic circuit**	**15**	**22**
	9	Operation of S –R Latch and Gated D Latch	1	
	10	Flip flop (FF), S-R FF,	1	
	11	J-K FF and D type FFs.	1	
	12	Introduction to Counters (synchronous and asynchronous)	1	
	13	Logic circuit of 2 bit asynchronous and 2 bit synchronous counter	3	
	14	Introduction to shift registers different types of shift registers.	2	
	15	Logic circuit of serial in serial out shift register	2	
	16	Logic circuit of Johnson counter	2	
	17	Logic circuit of Ring counter	2	
IV		**Memories**	**10**	**16**
	18	Introduction to memory.	2	
	19	General memory operations. Read and write operation in a single bit memory device.	2	
	20	Basic concepts of RAM.	1	
	20	Types of RAM.	2	
	21	Basic concepts of ROM	1	
	22	Types of ROM	2	
V		**Digital Electronics Practical** **Hardware Implementation or Simulation Lab**	**30**	
	1	1. Familiarization of logic gates using ICs (NOT, OR, AND, XOR, NAND, NOR). 2. Implement a Half Adder using logic gates 3. Implement a Half subtractor logic gates.	30	

		4. Implement D flip flop using logic gates or IC 5. 4 bit adder using ICs 6. Multiplexer using ICs or logic gates. 7. Johnson counter 8. Ring counter		

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

1. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia .

2. Donald P. Leach, Albert Paul Malvino, Digital Principles
and Applications, Tata McGraw Hill.
3. M. Morris Mano, Michael D. Ciletti, Digital Design,
Pearson Education Asia, (2007) 30
4. R.L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill
5. https://onlinecourses.nptel.ac.in/noc24_ee52/preview

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	1	-	-	-	-	1					
CO 2	1	1	-	-	-	-	1					
CO 3	1	1	1	-	-	1	1	1			1	
CO 4	2	1	2	-	-	1	2	1			1	
CO 5	2	1	2	-	-	1	2	1			1	
CO 6	2	1	2	-	-	1	2	1			1	

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Electronics (Minor)

Programme	B. Sc. Electronics				
Course Code	**ELE3MN201**				
Course Title	**ARDUINO CODING WITH EMBEDDED C**				
Type of Course	Minor				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge in Science.				
Course Summary	This course covers introduction to microcontrollers, fundamentals arduino platform, fundamentals of Embedded C, arduino programming and interfacing of sensors and actuators to the arduino board.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize arduino platform	U	C	Instructor-Demonstration
CO2	Summarize fundamentals of embedded	U	C	Instructor-created exams /
CO3	Show codes for simple input and out functions using arduino	U	C	Instructor-created exams / Quiz
CO4	Develop and write codes to interface sensors to arduino.	Ap	P	Practical work
CO5	Develop and write codes to interface motors to arduino	Ap	P	Practical Work
CO6	Build simple projects using Arduino	Ap	P	Practical work

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit	Content	Hrs	Marks 98
I		**Introduction to arduino platform**	**8**	**15**
	1	Introduction to microcontroller, Features of AVR microcontroller.	2	
	2	Arduino overview, Key features of Arduino and Arduino board types	2	
	3	Various components on Arduino Board , Pin configuration arduino uno	2	
	4	Installation of arduino IDE	2	
II		**Embedded C**	**18**	**20**
	5	Introduction to embedded C, Program structure.	1	
	6	Data types: Character, byte, integer and word.	2	
	7	Variables and constant	2	
	8	Operators: Arithmetic operators, Comparison operators, Boolean operators and Bitwise operators.	3	
	9	Control statements: If else statement and Switch case statement.	2	
	10	Loops: While loop, Do while loop, For loop and Nested loop	3	
	11	Function and function declaration.	3	
	12	Strings.	2	
III		**Writing Arduino programming**	**10**	**15**
	13	Learning about the standard library of Arduino	3	
	14	Acquiring the skills for writing arduino sketch.Working with examples	2	
	15	Interfacing switches with arduino and Reading analog voltage using arduino	2	
	14	Interfacing LED and buzzer with arduino	1	
	15	Pulse width modulation	2	
IV		**The basic sensors and actuators using Arduino**	**18**	**20**
	16	Definition of sensor, Types of sensors. Difference between Analog and Digital sensors	2	
	17	Concept of ADC and roll of pull up and pull down resistor when interfacing sensors with an Arduino Uno.	2	
	18	Interfacing light sensor, temperature sensor, ultrasonic distance meter and humidity sensors to arduino uno board.	3	
	19	Reading data from the sensors on to the serial monitor.	3	
	20	Introduction to actuators	2	
	21	Actuator types and Principle of actuators.	2	
	22	Interfacing DC motor and stepper motor to arduino board.	4	
V		**Electronics Practical**	**30**	
	1	To blink an LED using arduino uno	30	

	2	Using push button to control LED using arduino uno.		
	3	Interfacing light sensor to arduino board		
	4	Interfacing temperature sensor to arduino board.		
	5	Interfacing DC motor to arduino Board		
	6	Interfacing stepper motor to arduino board.		

Note: The syllabus has five modules.There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

1. Arduino-Based Embedded Systems: By Rajesh Singh, Anita Gehlot, Bhupendra Singh,

and Sushabhan Choudhury.

2. https ://www.arduino.cc/en/Tutorial/HomePage

3. Arduino Made Simple by Ashwin Pajankar

4. Getting started with Arduino by Massino Banzi.

4. Embedded C, Pont, Michael J

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	1	-	-	-	1	-	-	-	2	-
CO 2	-	3	2	-	-	-	2	-	-	-	2	-
CO 3	-	-	2	-	2	2	2	-	-	-	2	-
CO 4	-	2	3	-	2	2	2	2	-	-	2	-
CO 5	-	2	3	-	2	2	2	2	-	-	2	-
CO 6	-	2	3	-	2	2	2	2	-	-	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low

2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE1MN102**				
Course Title	ARDUINO PROGRAMMING				
Type of Course	Minor				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
		3	-	2	75
Pre-requisites	Basic Electronics Devices Basics of Electronics Circuits Basic C Programming				
Course Summary	The "Arduino Programming" course offers a comprehensive journey into the world of Arduino microcontrollers boards, covering essential programming concepts, control structures, interfacing with hardware components, and hands-on project implementation.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize Arduino programming by enabling them to create and understand simple Arduino sketches.	U	C	Instructor-created exams / Quiz
CO2	Develop knowledge and skills necessary to effectively utilize control structures in Arduino programming. They will be able to implement conditional logic, iterative processes, and multi-way branching in their Arduino sketches.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Experiment with Arduino Uno boards, including their hardware components, pin configurations, and programming environments.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Demonstrate interfacing various hardware components with Arduino Uno boards. They will be able to connect, and	U	C	Instructor-created exams / Home Assignments
	program button switches, LEDs,			

	OLED displays, and LCD displays effectively, enabling them to create interactive and informative Arduino-based projects and prototypes.			
CO5	Identify Arduino programs for various real-world applications. They will be able to integrate different sensors, displays, and input devices to create interactive and functional Arduino-based projects and prototypes.	Ap	P	One Minute Reflection Writing assignments
CO6	Demonstrate critical thinking and problem-solving skills in Arduino Programming.	Ap	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)	Marks (98)
I		**Basic Arduino Programming**	**10**	**15**
	1	Introduction to Arduino programming language and structure of Arduino sketch.	2	
	2	Data types in Arduino: int, char and float.	2	
	3	Variables and variable declaration in Arduino	1	
	4	Increment (++) and decrement (--) Operators in Arduino	1	
	5	Relational and Equality Operators in Arduino	1	
	6	Arithmetic and Logical Operators in Arduino	2	
	7	The print() and delay() Functions in Arduino	1	
	Sections from References:			
II		**Control Structure in Arduino**	**10**	**15**
	8	The if , if- else and if- elseif -else statements	3	
	9	The for statement	2	
	10	The while and do-while statement	3	
	11	The switch statement	2	
	Sections from References:			
III		**Introduction to Arduino Uno boards**	**14**	**20**
	12	An overview of Arduino boards	2	
	13	Installing and setting up the Arduino IDE	2	
	14	Understanding the Arduino UNO board and its components	4	
	15	Pin configuration of Arduino Uno (R3)	2	

	16	Arduino Serial Monitor	1	

	17	Basics of PWM in Arduino programming	3	
	Sections from References:			
IV		**Arduino Uno Interfacing with button switch, LED and LCD**	**11**	**20**
	18	An overview of button switch, LED , OLED and LCD	3	
	19	Interfacing button switch with Arduino Uno board	2	
	20	Interfacing LED with Arduino Uno board	2	
	21	Interfacing OLED switch with Arduino Uno board	2	
	22	Interfacing LCD switch with Arduino Uno board	2	
	Sections from References:			
V		**Hands-on Arduino Programming:** **Practical Applications, Case Study and Course Project**	**30**	
	1	Implement the following: 1. Write an Arduino program to turn ON an LED. 2. Write an Arduino program to interface OLED. 3. Write an Arduino program to turn ON an LED using button switch. 4. Write an Arduino program to read voltage across a potentiometer and display it on LCD display. 5. Write an Arduino program to display room temperature in LCD display. 6. Write an Arduino program to display humidity in the serial monitor. 7. Write an Arduino program to detect an obstacle using IR sensor. 8. Write an Arduino program to read light intensity and display it on LCD display.	20	
	2	Case study	3	
	3	Capstone (/Course) Project: Build a practical application using Arduino Board	7	

Books and References:

1. Object Oriented Programming with C++ , E.Balagurusamy . Mc Grow Hill.
2. https://docs.arduino.cc/
3. https://www.instructables.com/Beginner-Arduino/

Note: The syllabus has five modules. There should be total 22 units in the first four modules together, composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. Internal assessments (30 marks) are split between the practical module (20 marks) and the first four modules (10 marks). The end-semester examination for the theory part will be based on the 22 units in the first four modules. The 70 marks shown in the last column, distributed over the first four modules, is only for the external examination.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-						
CO 2	2	3	-	-	-	-						
CO 3	-	-	1	-	-	-						
CO 4	-	-	2	3	-	-						
CO 5	-	1	-	-	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

Quiz / Assignment/ Quiz/ Discussion / Seminar
Midterm Exam
Programming Assignments (20%)
Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE2MN102**				
Course Title	IOT HARDWARE AND INTERFACING				
Type of Course	Minor				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
		3	-	2	75
Pre-requisites	Basic understanding of electronics Familiarity with Arduino Knowledge of programming				
Course Summary	The "IoT Hardware and Interfacing" course provides a comprehensive exploration of sensor and actuator technologies, focusing on their integration with Arduino microcontrollers for IoT applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize sensors and transducers, distinguishing between analog and digital variants.	U	C	Instructor-created exams / Quiz
CO2	Develop actuators and their role in Arduino projects.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Experiment with Node MCU development boards and their application in IoT projects. They will master the basics of IoT and its potential across diverse domains.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Outline IoT applications and their far-reaching impact across various sectors. They will delve into the specifics of implementing IoT solutions in smart cities, industrial settings, agriculture, precision farming, and home automation.	U	C	Instructor-created exams / Home Assignments

CO5	Identify IoT concepts, along with practical skills in sensor interfacing, motor control, relay applications, and simulation design, preparing them for real-world IoT projects and applications.	Ap	P	One Minute Reflection Writing assignments
CO6	Demonstrate critical thinking and problem-solving skills in IoT.	Ap	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)	Marks (98)
I		**Arduino Sensors**	**6**	**15**
	1	Introduction to Sensors and Transducers in Arduino	1	
	2	Analog and Digital Sensors: Understanding the Distinctions	2	
	3	Interfacing Analog and Digital Sensors with Arduino	2	
	4	Arduino-Compatible Sensor Modules and Shields	1	
II		**Arduino Actuators**	**13**	**21**
	5	Introduction to Actuators in Arduino	2	
	6	Interfacing DC Motors with Arduino	3	
	7	Interfacing Servo Motors with Arduino	2	
	8	Interfacing Stepper motor with Arduino	2	
	9	Interfacing Relays with Arduino	2	
	10	Understanding PWM (Pulse Width Modulation) for Actuator Control	2	
III		**Introduction to Node MCU and IoT**	**16**	**22**
	11	Overview of Node MCU and IoT	2	
	12	Introduction to Node MCU development board	2	
	13	Understanding the basics of IoT and its applications	2	
	14	Node MCU hardware components	2	
	15	Controlling Digital and Analog Pins: Understanding GPIO pins on Node MCU, Digital input and output operations and Analog input using Node MCU's ADC	3	
	16	Connecting Node MCU to Wi-Fi: Configuring Wi-Fi settings on Node MCU, Sending and receiving data over Wi-Fi.	3	
	17	Interfacing Sensors with Node MCU	2	
IV		**IoT Applications:**	**10**	**12**
	18	Introduction to IoT Applications: Scope and Impact	2	
	19	Smart Cities: IoT Solutions for Urban Management	2	
	20	Industrial IoT (IIoT): Transforming, Manufacturing and Operations	2	

	21	Agriculture and Precision Farming with IoT	2	
	22	Home Automation: Smart Homes and IoT	2	
V	**Hands-on IoT Hardware And Interfacing**: **Practical Applications, Case Study and Course Project**		**30**	
	1	Implement the following: 1. Setting Up IoT Simulation Environment: Installing and configuring IoT simulation software, Simulating basic IoT scenarios. 2. Analog Sensor Interface: Reading and displaying analog sensor values on the Arduino Serial Monitor, Calibration techniques for analog sensors. 3. Digital Sensor Integration: Connecting and interfacing digital sensors (e.g., motion sensors, switches). 4. Servo Motor Control: Interfacing and controlling a servo motor with Arduino, Writing code to control the servo motor's position. 5. DC Motor Speed Control: Connecting a DC motor to an Arduino for speed control. 6. Relay Applications: Integrating relays with Arduino for switching applications. 7. Smart Home Automation Simulation: Designing a simulation for home automation, Controlling lights, appliances, and security systems. 8. Agricultural IoT Implementation:, Designing a simulation for precision farming and monitoring crop conditions, Integrating sensors for soil moisture, temperature, etc.	20	
	2	Case study	3	
	3	Capstone (/Course) Project: Build a practical application using Node MCU development Board	7	
	Sections from References:			

Books and References:

1. "Sensors and Transducers", Patranabis.D, Wheeler publisher
2. Sensors And Actuators by Alegria Francisco Andre Correa, World Scientific India
3. https://www.instructables.com/Quick-Start-to-Nodemcu-ESP8266-on-Arduino-IDE/
4. https://randomnerdtutorials.com/getting-started-with-esp8266-wifi-transceiver-review/

Note: The syllabus has five modules. There should be total 22 units in the first four modules together, composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. Internal assessments (30 marks) are split between the practical module (20 marks) and the first four modules (10 marks). The end-semester examination for the theory part will be based on the 22 units in the first four modules. The 70 marks shown in the last column, distributed over the first four modules, is only for the external examination.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-						
CO 2	2	3	-	-	-	-						
CO 3	-	-	1	-	-	-						
CO 4	-	-	2	3	-	-						
CO 5	-	1	-	-	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

Quiz / Assignment/ Quiz/ Discussion / Seminar
Midterm Exam
Programming Assignments (20%)
Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓

CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE3MN202**				
Course Title	PYTHON PROGRAMMING FOR IOT APPLICATIONS				
Type of Course	Minor				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
		3	-	2	75
Pre-requisites	Knowledge in Electronics Experience in IDE Basic programming skills				
Course Summary	The "Python Programming for IoT Applications" course provides a comprehensive overview of Python's role in Internet of Things (IoT) development. It covers essential Python programming concepts, data handling techniques, file management, and integration with IoT hardware and cloud platforms.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Show Python's role in IoT development and equips them with the necessary skills to navigate through the various aspects of Python programming relevant to IoT applications.	U	C	Instructor-created exams / Quiz
CO2	Build cloud computing concepts and their integration with Internet of Things (IoT) applications.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Choose sensors and their pivotal role in IoT (Internet of Things) applications.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Outline control and automation within IoT (Internet of Things) applications.	U	C	Instructor-created exams / Home Assignments
CO5	Apply practical experience and reinforce theoretical concepts, enabling them to apply their learning	Ap	P	One Minute Reflection Writing

	effectively in real-world scenarios.			assignments
CO6	Demonstrate critical thinking and problem-solving skills in IoT and python programming.	Ap	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)	Marks (98)
I		**Introduction to Python for IoT**	**12**	**20**
	1	Role of Python in IoT development, Overview of Integrated Development Environments (IDEs) for IoT in Python.	2	
	2	Basic Python Programming Concepts: Variables, data types, and operators.	2	
	3	Basic Python Programming Concepts: Control flow: loops and conditional statements	2	
	4	Basic Python Programming Concepts: Functions and modules in Python	2	
	5	Data Handling in Python: Working with data structures (lists, tuples, dictionaries)	2	
	6	File handling in Python for IoT applications	2	
II		**Introduction to Cloud Platforms for IoT:**	**15**	**20**
	7	Role of Python in IoT development, Overview of Integrated Development Environments (IDEs) for IoT in Python.	2	
	8	Basic Python Programming Concepts: Variables, data types, and operators.	2	
	9	Basic Python Programming Concepts: Control flow: loops and conditional statements	3	
	10	Basic Python Programming Concepts: Functions and modules in Python	2	
	11	Data Handling in Python: Working with data structures (lists, tuples, dictionaries)	2	
	12	File handling in Python for IoT applications	2	
	13	Role of Python in IoT development, Overview of Integrated Development Environments (IDEs) for IoT in Python.	2	
III		**Introduction to Node MCU and IoT**	**10**	**18**
	14	Overview of sensors and their role in IoT.	2	
	15	Reading sensor data using Python from Arduino or Raspberry pi board	2	
	16	Introduction to sensor interfaces (I2C, SPI, GPIO)	2	
	17	Configuring and processing sensors in Python scripts	2	

	18	Overview of data storage options for sensor data	2	

IV		**Python-based Control and Automation for IoT**	**8**	**12**
	19	Introduction to Control and Automation in IoT	2	
	20	Automation with Python Scripting	2	
	21	Automation and Device Control with Python	2	
	22	Interfacing with motors and relays	2	
V		**Hands-on Python programming for IoT Applications** : **Practical Applications, Case Study and Course Project**	**30**	
	1	Implement the following: 1. Setting up the Development Environment: Installing Python and necessary libraries. 2. Use a 'for' loop to print numbers from 1 to 5. - Include a counter variable. 3. Implement a 'while' loop to print a countdown from 5 to 1. - Include proper loop control. 4. Use an 'if-else' statement to check if a number is even or odd. - Display the result. 5. Define a function that takes two parameters and returns their sum. - Call the function with different arguments. 6. Create a module with a function that multiplies two numbers. - Import the module into another script and use the function. 7. Create a list with at least five elements. - Perform operations like appending, slicing, and modifying elements. 8. Create a tuple with different data types. - Demonstrate the immutability of tuples and perform operations. 9. Create a dictionary with key-value pairs representing information. - Access and modify dictionary values. 10. Develop a script that automates a series of tasks in an IoT environment. 11. Write Python scripts that respond to specific events.	20	
	2	Case study	3	
	3	Capstone (/Course) Project: Build a practical application in IoT using Node MCU or Raspberry pi board	7	

Books and References:

1. Introduction to Computing and Problem Solving Using Python , Balagurusamy, Mc Graw Hill
2. Programming in Python, Pooja Sharma, BPB Publications

Note: The syllabus has five modules. There should be total 22 units in the first four modules together, composed of the theory topics. The number of units in the last module can vary.

There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. Internal assessments (30 marks) are split between the practical module (20 marks) and the first four modules (10 marks). The end-semester examination for the theory part will be based on the 22 units in the first four modules. The 70 marks shown in the last column, distributed over the first four modules, is only for the external examination.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-						
CO 2	2	3	-	-	-	-						
CO 3	-	-	1	-	-	-						
CO 4	-	-	2	3	-	-						
CO 5	-	1	-	-	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

Quiz / Assignment/ Quiz/ Discussion / Seminar
Midterm Exam
Programming Assignments (20%)
Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓

CO 6			✓	

Electronics (Minor)

Programme	B. Sc. Electronics
Course Code	**ELE1MN103**
Course Title	**Introduction to App Development**
Type of Course	Minor
Semester	1
Academic Level	100-199

<table>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours</td></tr>
<tr><td>4</td><td>3</td><td>-</td><td>2</td><td>75</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Basic knowledge in Science.</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course covers introduction to microcontrollers, fundamentals arduino platform, fundamentals of Embedded C, arduino programming and interfacing of sensors and actuators to the arduino board.</td></tr>
</table>

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize Mobile App Landscape	U	C	Instructor-Demonstration
CO2	Learn about Mobile Operating Systems	U	C	Instructor-created exams /
CO3	Experiment with Development Environment	Ap	C	Practical work
CO4	Discover No-code Tools	Ap	P	Practical work
CO5	Develop Your First App	Ap	P	Practical Work
CO6	Engage with no-code platforms in-depth, create simple apps	Ap	P	Practical work

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs	Marks (98)
I		**Introduction to Mobile Apps**	**8**	**15**
	1	Overview of Mobile Applications: Types, categories, and importance.	2	

	2	Operating Systems: Android vs. iOS.	2	
	3	Development Environments: Introduction to IDEs like Android Studio, Flutter, and App Inventor.	2	
	4	Basic Concepts: What is an app, front-end vs. back-end, and basic terminologies	2	
II		**Setting Up the Development Environment**	**12**	**20**
	5	Installing Android Studio	3	
	6	Introduction to Flutter: Installing and setting up Flutter.	3	
	7	Introduction to No-code Tools: App Inventor, Thunkable, etc.	3	
	8	First App: Creating a simple “Hello World” app.	3	
III		**User Interface (UI) Design Basics**	**14**	**15**
	9	Introduction to UI/UX: Principles of design.	2	
	10	Basic Widgets and Components: Buttons, text fields, images.	2	
	11	Basics of Layouts	2	
	12	Linear	2	
	13	Relative	2	
	14	Constraint Layouts	2	
	15	Designing Simple Interfaces: Practice with mockups	2	
IV		**Introduction to Programming Logic**	**16**	**20**
	16	Basic Programming Concepts	2	
	17	Variables	2	
	18	Data types	2	
	19	Loops and Conditionals	2	
	20	Event-Driven Programming: OnClick events, basic user interactions.	2	
	21	Introduction to XML: Designing layouts with XML in Android Studio.	3	
	22	Introduction to Dart (Flutter): Basics of Dart programming	3	
V		**App Development Without Programming-Practical**	**30**	
	1	1. Familiarisation of to No-code Platforms: Detailed exploration. 2. Creating Simple Apps: Using drag-and-drop interfaces. 3. Basic Calculator(Platform: App Inventor or Thunkable) 4. To-Do List App (**Platform:** Glide) 5. Recipe Finder App (**Platform:** Glide) 6. Fitness Tracker (**Platform:** App Inventor) 7. Quiz App (**Platform:** Thunkable 8. Publishing on the Web: Sharing apps created with no-code tools.	30	

Note: The syllabus has five modules.There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

1. “Mobile Application Development: With Web Technologies" by Reto Meier and Ian Lake

2. “Android Studio 3.0 Development Essentials" by Neil Smyth

3. "Flutter in Action" by Eric Windmill

4. "Don't Make Me Think" by Steve Krug

4. “Java: A Beginner's Guide" by Herbert Schildt

5. “Beginning Flutter: A Hands On Guide to App Development" by Marco L. Napoli

6. “The No-Code Guide to Mobile App Development" by David S. Anderson

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	1	-	-	-	1	-	-	-	2	-
CO 2	-	3	2	-	-	-	2	-	-	-	2	-
CO 3	-	-	2	-	2	2	2	-	-	-	2	-
CO 4	-	2	3	-	2	2	2	2	-	-	2	-
CO 5	-	2	3	-	2	2	2	2	-	-	2	-
CO 6	-	2	3	-	2	2	2	2	-	-	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations

CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Electronics (Minor)

Programme	B. Sc. Electronics				
Course Code	**ELE2MN103**				
Course Title	**Intermediate App Development**				
Type of Course	Minor				
Semester	II				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge in Science.				
Course Summary	This course covers introduction to microcontrollers, fundamentals arduino platform, fundamentals of Embedded C, arduino programming and interfacing of sensors and actuators to the arduino board.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Create aesthetically pleasing and functional interfaces.	Ap	C	Instructor-Demonstration
CO2	Develop Custom Widgets	Ap	C	Instructor-created exams /
CO3	Summarize Database Fundamentals	U	C	Instructor-created exams / Quiz
CO4	Implement SQLite for local data storage and Firebase for cloud-based solutions, mastering basic CRUD operations	Ap	P	Practical work
CO5	Incorporate Advanced App Features	An	P	Practical Work
CO6	Emphasize Testing and Debugging	Ap	P	Practical work

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Advanced UI Design**	**8**	**15**
	1	Material Design Principles: Implementing Material Design in Android.	2	
	2	Custom Widgets: Creating and customizing UI components	2	
	3	Responsive Design: Adapting apps for different screen sizes	2	
	4	Using Animations: Adding basic animations to enhance UX	2	
II		**Introduction to Databases**	**10**	**20**
	5	Database Basics: Introduction to SQL and NoSQL	3	
	6	Local Databases in Android: Using SQLite	2	
	7	Cloud Databases: Introduction to Firebase.	2	
	8	Storing and Retrieving Data:. Basic CRUD operations	3	
III		**Networking and APIs**	**18**	**15**
	9	Introduction to APIs: What they are and how to use them	3	
	10	Networking in Android: Making HTTP requests, handling JSON.	2	
	11	APIs in Flutter: Using Dart packages for API calls	2	
	12	Advanced No-code Platforms: Deeper dive into platforms like Glide, Adalo.	3	
	13	Integrating APIs: Using external data sources with no-code tools.	3	
	14	Advanced App Features: Adding login, user authentication, etc.	3	
	15	Practical Example: Building an app that fetches data from an API.	2	
IV		**Testing and Debugging**	**18**	**20**
	16	Importance of Testing: Unit tests, UI tests	2	
	17	Integration tests	2	
	18	Introduction to Debugging Tools	2	
	19	Android Studio debugger	3	
	20	Flutter inspector	3	
	21	Common Issues: How to identify and fix common bugs	3	
	22	Best Practices: Writing clean, maintainable code	3	
V		**Practical**	**30**	
	1	Expense Tracker App Skills Covered: CRUD operations, SQLite or Firebase integration, UI/UX design, data persistence.	30	
	2	Social Media Feed Reader Skills Covered :API integration, user authentication, content management, responsive layouts, and pagination.		

	3	E-Commerce App with Shopping Cart Skills Covered: Backend integration, payment gateway integration, user authentication, product management, state management		
	4	Task Management App with Notifications Skills Covered: Local notifications, background services, user data management, UI/UX design, time management		
	5	Music Streaming App with Playlist Feature Skills Covered: Media playback, streaming, playlist management, background audio, user interface design.		
	6	Recipe App with Ingredient Search Skills Covered: Search functionality, data filtering, user preferences, content management, social sharing.		

Note: The syllabus has five modules.There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

1. "Material Design Implementation: How to Implement Google's Material Design" by Matthew Ziegler

2. "Android UI Fundamentals: Learn the Basics of User Interface Design in Android" by Greg Nudelman

3. "Android Programming: The Big Nerd Ranch Guide" by Bill Phillips and Chris Stewart

4. "Android Animation and Graphics" by Reto Meier and Ian Lake

5. "SQL and NoSQL Databases: An Introduction" by Thomas Erl, et al

6. "Firebase Essentials: A Beginner's Guide to Firebase for iOS and Android" by Hammad Tariq

7. "Android Networking: How to Perform HTTP Operations and Handle JSON Data" by M. S. Thakur

8. "Android Programming: The Big Nerd Ranch Guide" by Bill Phillips and Chris Stewart

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	1	-	-	-	1	-	-	-	2	-
CO 2	-	3	2	-	-	-	2	-	-	-	2	-
CO 3	-	-	2	-	2	2	2	-	-	-	2	-
CO 4	-	2	3	-	2	2	2	2	-	-	2	-
CO 5	-	2	3	-	2	2	2	2	-	-	2	-
CO 6	-	2	3	-	2	2	2	2	-	-	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓

CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE3MN203**				
Course Title	**Advanced App Development and Deployment**				
Type of Course	Minor				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge in Science.				
Course Summary	This course covers introduction to microcontrollers, fundamentals arduino platform, fundamentals of Embedded C, arduino programming and interfacing of sensors and actuators to the arduino board.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Relate and Apply Advanced Programming Concepts	U	C	Instructor-Demonstration
CO2	Optimize App Performance	An	C	Instructor-created exams /
CO3	Develop Robust App Security Measures	Ap	C	Practical Work
CO4	Navigate App Deployment and Distribution	Ap	P	Practical work
CO5	Apply App Store Optimization	Ap	P	Practical Work
CO6	Build simple projects	Ap	P	Practical work
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Advanced Programming Concepts**	**8**	**15**
	1	Introduction to Object-Oriented Programming: Classes, objects, inheritance	2	
	2	State Management in Flutter: Using Provider, Riverpod	2	
	3	Multithreading in Android: Handling background tasks with AsyncTask, Executors	2	
	4	Advanced Dart Features: Futures, Streams, and async programming	2	
II		**App Performance Optimization**	**18**	**20**
	5	Optimizing UI/UX: Improving app responsiveness and design.	1	
	6	Memory Management: Reducing app memory usage	2	
	7	Performance Testing: Tools and techniques for measuring app performance	2	
	8	Introduction to App Profiling	3	
	9	Using Android Studio Profiler	2	
	10	Dart DevTools	3	
III		**App Security**	**10**	**15**
	11	Introduction to App Security: Common threats and vulnerabilities.	3	
	12	Data Encryption: Best practices for securing user data.	2	
	13	User Authentication: Implementing secure login and user sessions.	2	
	14	Securing APIs: Using OAuth	1	
	15	API keys	2	
		Token-based authentication.		
IV		**App Deployment and Distribution**	**18**	**20**
	16	Publishing on Google Play Store	2	
	17	App Store Optimization (ASO): Strategies to improve app visibility.	2	
	18	Maintaining Apps Post-Release	3	
	19	Handling updates		
	20	user feedback		
	21	Bug fixes		
	22	Monetization: Introduction to in-app purchases, ads, and subscriptions	3	
		Capstone Project :Practical	**30**	

V		1. Project Planning: Selecting a project, defining scope and objectives. 2. Development Phase: Applying learned skills to build a complete app. 3. On-Demand Service Booking App ¬ Description: Create an app for booking on-demand services like ridesharing, food delivery, or home services. The app should include features such as real- time tracking, payment integration, and user ratings/reviews. ¬ Skills Covered: Real-time tracking, payment gateway integration, API usage, advanced UI/UX design, user authentication. 4. Event Management App ¬ Description: Build an app for managing events, including features for creating events, sending invitations, tracking RSVPs, and providing event details. The app should support notifications, social sharing, and data synchronization. ¬ Skills Covered: Event management, notifications, social features, user data management, responsive design. 5. Presentation and Evaluation: Showcasing the app, peer review, and feedback. 6. Final Submission: Submitting the final app and documentation.	30	

Note: The syllabus has five modules.There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

1. "Object-Oriented Design & Programming" by Robert C. Martin

2. "Programming Dart" by Irina Gecht and Danilo Popov

3. "Mobile App Design: A Comprehensive Guide" by Adam Greenfield

4. "Android Performance Patterns: Performance Optimization Techniques" by K. T. Leung.

5. "Performance Testing: A Practical Guide" by Ian Molyneaux

6. "Mobile Security: A Comprehensive Guide" by J. A. Brierley

7. "Android App Marketing: The Essential Guide to Growing Your App Business" by James F. Arsenault

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	1	-	-	-	1	-	-	-	2	-
CO 2	-	3	2	-	-	-	2	-	-	-	2	-
CO 3	-	-	2	-	2	2	2	-	-	-	2	-
CO 4	-	2	3	-	2	2	2	2	-	-	2	-
CO 5	-	2	3	-	2	2	2	2	-	-	2	-
CO 6	-	2	3	-	2	2	2	2	-	-	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE1VN101**				
Course Title	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE				
Type of Course	**Vocational Minor**				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic Knowledge in computer.				
Course Summary	This course structure aims to provide a thorough introduction to AI, catering to beginners and those looking to consolidate their understanding of the field				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Recognize what AI is and recognize its impact across different sectors.	U	C	Instructor-created exams / Quiz/ Assignment
CO2	Compare human intelligence and artificial intelligence	Ap	P	Practical/ Viva Voce
CO3	Gain an appreciation for the evolution of AI technology and its pioneers.	Ap	C	Observation of Practical Skills / assignments
CO4	Summarize multidisciplinary contributions that form the basis of AI.	U	P	Practical / Viva Voce / Asignments
CO5	Inspect how AI is applied in different industries and its potential to solve real-world problems.	An	P	Practical / Viva Voce / Asignments
CO6	Develop AI strategies for solving complex problems and making decisions..	Ap	p	Viva Voce/Practical/Project

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs 45	Mark (98)
I		**Introduction**	**15**	**20**
	1	Introduction to Artificial Intelligence (AI)	2	
	2	Difference between Intelligence and AI	2	
	3	History of AI	2	
	4	Foundations of AI	2	
	5	Applications of AI	2	
	6	Comparison of AI with data science	3	
	7	Need of AI in machine Learning	2	
II		**Intelligent Agents**	**12**	**22**
	8	Introduction of Agents	2	
	9	Structure of Intelligent Agent	2	
	10	Properties of Intelligent Agent	2	
	11	Configuration of Agents	2	
	12	Types of Agents	2	
	13	Environment Types	2	
III		**Problem Solving**	**8**	**15**
	14	Problem Solving by Searching and Agents	2	
	15	Problem Formulation	2	
	16	Search Strategies	2	
	17	Games As Search Problem	2	
Specialization Tracks				
IV		**Specialization Tracks**	**10**	**13**
	18	AI in business	2	
	19	AI in Engineering	2	
	20	AI in Cybersecurity	2	
	21	AI in Social Science	2	
V		**Open Ended Module: Practical Applications**	**30**	
	1	Familiarization of the following AI tools 1. openai 2. Gamma 3. playwallhub 4. debug code.ai	20	

		5. gemini 6. yoodli.ai 7. playgroundai 8. merlin-ai 9. formula.dog		
	2	Assign project using AI tools	10	

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end- semester examination for the theory part will be based on the 22 units in the first four modules.

Text Books

1. Patrick Henry Winston, **Artificial Intelligence**, Third Edition, Addison-Wesley Publishing Company, 2004.
2. Nils J Nilsson, **Principles of Artificial Intelligence**, Illustrated Reprint Edition, Springer Heidelberg, 2014.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	2	2	2	1	3	2	-	2	2	-
CO 2	3	3	2	3	-	-	3	2	-	2	-	-
CO 3	3	3	2	3	-	-	3	2	-	2	-	-
CO 4	3	3	2	3	-	-	3	2	-	2	-	-
CO 5	3	2	2	2	2	1	3	2	-	2	2	-
CO 6	3	2	2	2	3	3	2	-	-	3	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project/Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6			✓	

Programme	**B.Sc. Electronics**				
Course Code	**ELE2VN101**				
Course Title	**MOBILE PHONE TECHNOLOGY**				
Type of Course	**Vocational Minor**				
Semester	**II**				
Academic Level	**100 - 199**				
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours**
	4	3	-	2	75
Pre-requisites	Basic Knowledge in Principles of Communication				
Course Summary	This course introduces the Basic conceptual and practical skills in Mobile Phone servicing and enables the aspiring students to exploit the area of mobile phone servicing.				

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Recall Parts and functions in the handset.	R	C	Internal Exam

CO2	Illustrate Peripherals and attachments of handsets.	U	C	Internal Exam
CO3	Recall the symptoms and repair the common faults in the Mobile handset	R	C	Discussion/ Assignment
CO4	Solve hardware and software problems.	Ap	P	Internal Exam
CO5	Plan Assembly and Disassembly of mobile devices.	Ap	P	Discussion/ Quiz
CO6	Solve, repair and service a handset.	Ap	P	Internal /Assignment
* Cognitive Level: R - Remember, U - Understand, Ap - Apply, An - Analyze, E - Evaluate, C - Create				
# Knowledge Level: F - Factual, C - Conceptual, P - Procedural, M - Metacognitive				

Detailed Syllabus:

Module	Unit	Content	Hours (45)	Marks (98)
I		**Mobile Phone Fundamentals**	**10**	**15**
	1	Evolution of mobile phone generations, types and it Working	2	
	2	Cell Phone Opening Mechanisms: *Screw Type,Lock Type,Screw with Lock Type,Slider Type,Flip Top Mobile,Palmtop Mobile*	3	
	3	Mobile Phone Accessories: *Headphone, Handsfree with Microphone, Double-Sided Handsfree,Bluetooth Handsfree*	3	
	4	Memory Cards and Readers, Types of Memory Cards, Memory Card Readers, Screen Guards	2	
		Sections from References: 1. Modern Mobile Phone Repair: Using Computer Software and Service Devices- M. Lotia, Pradeep Nair- BPB Publications. 2. Modern Mobile Phone Introduction & Servicing- Manahar Lotia - BPB Publications		
II		**Inside Components**	**12**	**20**
	5	Displays:*LCD Display, TFT Display, STN Display*	2	
	6	Display Components: *Display Flex Cable, Display Cleaners, Display Connectors*	1	
	7	Input Devices: *Cell Phone Inner Keypads, Cell Phone Keypads, Joysticks*	2	
	8	Integrated Circuits (ICs): Function-Specific ICs (*Power IC,Charging IC ,Audio IC , FM IC, Bluetooth IC, Camera IC, Keypad Light Controller IC ,SIM Card Control IC , Display Control IC)*	3	
	9	Network and Processing ICs:*PF IC, RF IC, Network IC, CPU, RAM, ROM, UEM IC*	2	
	10	Mobile Camera Resolutions: *QCIF, QVGA, CIF, VGA, SVGA, XGA, SXGA, UXGA*	2	
		Sections from References: 1. Modern Mobile Phone Repair: Using Computer Software and Service Devices- M. Lotia, Pradeep Nair- BPB Publications. 2. Modern Mobile Phone Introduction & Servicing- Manahar Lotia - BPB Publications		
III		**Mobile Phone Repair Techniques**	**15**	**25**
	11	Component Testing:Soldering and Desoldering, Speaker Testing:*External Speaker Testing Method, Buzzer Testing Method*, Microphone Testing Method, Vibrator Motor Testing	3	
	12	Battery Connector Testing, LED Testing: Keypad LED, SMD LED types, Damaged LED Finding Method	2	

	13	Testing Other Components:*MMC Port, Cracked Screw*	1	
	14	Jumper Tools ,Jumpering Techniques: *Audio Jumpering, Ringer Jumpering, Vibrator Jumpering, Keypad Jumpering, Display Jumpering, Keypad LED Jumpering, On-Off Switch Jumpering*	3	
	15	Common Mobile Phone Issues: Ripped Keypads, Water Damage, Power Problems, Network Problems,Insert SIM Problems, Locking Problems	3	
	16	Charging Problems, LED Problems, Display Problems,Ringer Problems, Incoming Voice Not Heard Problems, Outgoing Voice Not Sending Problems, Auto Shut Off Problems, Camera Not Working Problems	3	
	Sections from References: 1. Modern Mobile Phone Repair: Using Computer Software and Service Devices- M. Lotia, Pradeep Nair- BPB Publications.			
IV	**Mobile Phone Software Maintenance**		**8**	**10**
	17	Mobile Device Drivers and Flashing: Installation of UFS Driver,UFS Suite and its functionalities (brief overview) Flashing Files (concept and basic understanding)	2	
	18	Mobile Network and Identity Management: IMEI Number Detection Methods, Introduction to Mobile GSM Utility Codes	1	
	19	Wireless Technologies: Introduction to different Wireless Options (Bluetooth, Wi-Fi, etc.)	1	
	20	Mobile Operating Systems: Mobile OS Introduction (brief overview of common mobile operating systems like Android, iOS), OS Formatting (concept and basic understanding)	2	
	21	Computer Connections: SIM Card Reader, Memory Card Reader	1	
	22	Mobile Security: Virus Prevention Techniques, Removing Viruses from Mobile Phones (basic methods)	1	
	Sections from References: 1. Modern Mobile Phone Repair: Using Computer Software and Service Devices- M. Lotia, Pradeep Nair- BPB Publications.			
V	**Hands-on: Practical Applications**		**30**	**20**
	1	Operating the Hot air gun and the soldering station		
	2	Operating the Rework station to Desolder a component		
	3	Demonstration to replace SMD, Exchange SMD components.		
	4	Skill of Soldering a resistor onto a circuit board and then desoldering it safely.		

	5	Troubleshooting a faulty LED (e.g., keypad LED) on a phone, learning proper soldering and component handling techniques	
	6	Troubleshooting a faulty Microphone and the speaker	
	7	Troubleshooting the battery terminal and Charging Pin	
	8	Replacement of Filter cap and display	
		The students shall undergo the inplant training. The training center should be the authorized service center	

Resources:

Text Book	1. Modern Mobile Phone Repair: Using Computer Software and Service Devices- M. Lotia, Pradeep Nair- BPB Publications. 2. Modern Mobile Phone Introduction & Servicing- Manahar Lotia - BPB Publications. 3. Smartphones and Tablets Repairs: Money Making Venture Skill,Chukky Oparandu, Mondraim Books
Reference Books	1. ’Wireless Communication Principles and Practices’, Rappaport T. S, Pearson Education, Asia, New Delhi, 3rd Ed.2003. 2. Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications 3. ’Mobile communication’, JochenSchiller, Pearson Education,Asia.
Online Resource	1. http://www.mobilecellphonerepairing.com/mobile-phone-repairing-tutorial.html 2. https://www.lesics.com/how-does-your-mobile-phone-work.html

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	3	1	2	-	-	3	-	-	-	-	-
CO 2	2	2	1	2	-	-	3	-	-	-	-	-
CO 3	3	1	3	2	-	-	2	2	-	-	1	-
CO 4	3	1	3	2	-	-	2	2	-	-	1	-
CO 5	2	-	3	1	-	-	2	2	-	-	-	-
CO 6	2	1	3	1	-	-	2	2	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4	✓			✓
CO 5	✓	✓		
CO 6		✓		

Programme	B. Sc. Electronics				
Course Code	**ELE3VN201**				
Course Title	ROBOTICS & DRONE TECHNOLOGY				
Type of Course	**Vocational Minor**				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic knowledge of electronics, including understanding circuits, microcontrollers, and interfacing with sensors and actuators. 2. Proficiency in at least one programming language (e.g., Python, C++, Java) is essential. 3.Knowledge of matrices, vectors, and linear transformations is essential for understanding robot kinematics, dynamics, and computer vision.				
Course Summary	Learn about the fundamental principles of robotics and drones. Understand the components and systems that make up drones. Explore the applications and impact of drone technology across various industries. Discuss the ethical, legal, and social implications of drone technology.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize the principles of robotics and drone technology, including mechanics and electronics	U	C	Instructor-created exams / Quiz
CO2	Relate and select appropriate sensors, actuators, and controllers for different types of robotic and drone projects.	U	C	Practical Assignment / Observation of Practical Skills
CO3	Examine software tools for simulation, design, and testing of robotic systems and drones.	An	P	Practical Assignment / Observation of Practical Skills
CO4	Identify how machine learning and artificial intelligence can be applied to enhance the capabilities of robotic systems and drones.	Ap	P	Instructor-created exams / Home Assignments
CO5	Explore the ethical, legal, and societal implications of robotics and drone technology, including privacy, safety, and regulatory considerations.	U	P	One Minute Reflection Writing assignments
CO6	Gain insights into current research	U	P	Viva Voce

	trends and challenges in robotics and drone technology, setting a foundation for further education and innovation.			
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (45 +30)**	**Marks (98)**
I		**Introduction to Robotics and Drones**	**10**	**15**
	1	Overview of robotics and drone technology	2	
	2	History and evolution of drones	3	
	3	Types of drones	3	
	4	Applications of drones	2	
II		**Fundamentals of Flight**	**10**	**15**
	5	Principles of flight and aerodynamics	3	
	6	Drone components and systems	3	
	7	Introduction to Unmanned Aerial Vehicle	2	
	8	UAV design and engineering	2	
III		**Sensors and Navigation**	**15**	**25**
	9	Sensors used in drones (GPS, IMU, LiDAR, cameras)	2	
	10	Basics of navigation and control systems	2	
	11	Introduction to remote sensing and data collection	1	
	12	Understanding flight controllers	2	
	13	Basics of drone piloting and manual control	2	
	14	Introduction to autopilot systems and software	2	
	15	Principles of autonomous flight	1	
	16	Path planning and obstacle avoidance	1	
	17	Machine learning and AI in drones	2	
IV		**Drone Applications and Safety**	**10**	
	18	Surveying and mapping	2	
	19	Agriculture and environmental monitoring	2	
	20	Search and rescue, surveillance, and delivery services	2	
	21	Privacy concerns and surveillance, Regulatory and safety considerations	2	
	22	Future of drone technology and societal impact	2	
V		**Hands-on:** **Practical Applications, Case Study and Course Project**	**30**	
	1	1. Study of safety guidelines, especially when working with power tools, electronics, and flying drones 2. Study of local regulations regarding drone flying, especially concerning no-fly zones, altitude limits, and privacy laws 3. Build a simple robot that can follow a black line on a white surface with Arduino Uno, IR sensors, motors, motor driver board etc. 4. Create a robot that can autonomously navigate around obstacles using Arduino Uno, ultrasonic sensor, servo motor, wheels, motor driver. 5. Build a robot that can be controlled remotely using a smartphone or a remote controller using Arduino Uno, Bluetooth module (HC-05), DC motors, motor driver. 6. Learn the basics of drone flight without the risk of crashing an actual drone.	20	

		using Drone flight simulator software (many are available for free or have trial versions). 7. Study about DOF of a robotic arm to determine its ability to position and orient its end-effector in space. 8. Study the various sensors (encoders, force sensors, vision systems) used to monitor the state of the robotic arm and provide feedback for control. 9. Understand the different types of actuators used in robotic arms, including electric motors, hydraulic and pneumatic systems, and how they are controlled.		
	2	Case study: Medical Robotics: Explore the use of robotic arms in surgery and rehabilitation, focusing on the requirements for precision and safety.	3	
	3	Capstone Mini Project: Industrial Automation: Study how robotic arms are used in manufacturing for tasks like assembly, welding, and painting.	7	

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

Text Books:

1. Internet of Things: Robotic and Drone Technology, Edited ByNitin Goyal, Sharad Sharma, Arun Kumar Rana, Suman Lata Tripathi, CRC Press

2. Drone Technology: Future Trends and Practical Applications Editor(s):Sachi Nandan Mohanty, J.V.R. Ravindra, G. Surya Narayana, Chinmaya Ranjan Pattnaik, Y. Mohamed Sirajudeen, Wiley Publ.

3."Drone Technologies and Applications" authored by Koç Mehmet Tuğrul, edited by Dragan Cvetković https://www.intechopen.com/books/1002775

4 "Drones - Applications" edited by George Dekoulis https://www.intechopen.com/books/6465

5. "Introduction to Robotics: Mechanics and Control" by John J. Craig, Pearson Publ.

6. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education, 2009.

7. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, Special Edition, (2012).

8. Ganesh S Hegde, “A textbook on Industrial Robotics”, University science press, 3rdedition, 2017.

Web resources:

1. https://robotsguide.com
2. https://roboticscasual.com/best-online-resources-to-learn-robotics/

3. https://www.coursera.org/specializations/robotics
4. https://ocw.mit.edu/courses/2-12-introduction-to-robotics-fall-2005/
5. https://ardupilot.org/
6. https://px4.io/
7. https://dronecode.org/
8. https://diydrones.com/
9. https://www.edx.org/
10. https://www.youtube.com/user/sparkfun

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	-	3	-	-						
CO 2	1	3	-	-	3	-						
CO 3	-	-	-	-	2	-						
CO 4	-	1	2	3	-	-						
CO 5	-	1	-	2	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		✓		✓
CO 2		✓		✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE8VN301**				
Course Title	AI AND FLUTTER				
Type of Course	Vocational Minor				
Semester	VIII				
Academic Level	300- 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamentals of AI, Basic knowledge of programing				
Course Summary	This course provides a comprehensive introduction to Flutter development and the integration of AI, covering fundamental concepts and practical implementation within mobile applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize AI fundamentals and Flutter framework features, facilitating their ability to integrate AI functionalities effectively into Flutter apps.	U	P	Instructor-created exams / Quiz
CO2	Demonstrate Flutter app development concepts such as widgets, UI components, state management, user input handling, navigation, and routing.	U	P	Seminar Presentation / Group Tutorial Work
CO3	Outline knowledge in machine learning concepts, explore ML's role in mobile app development, and provide an overview of popular AI frameworks and libraries compatible with Flutter.	U	P	Practical Assignment / Observation of Practical Skills
CO4	Develop AI functionalities proficiently into Flutter apps, leveraging their understanding of AI concepts and Flutter framework features to develop innovative and intelligent mobile applications.	Ap	P	Practical Assignment / Observation of Practical Skills s
CO5	Illustration	U	P	Viva Voce

	of implementing text classification and language translation features within Flutter applications using ML Kit's natural language processing capabilities.			
CO6	Develop proficiency in designing and implementing advanced text classification and language translation features within Flutter applications, fostering their ability to create intelligent and dynamic user experiences.	Ap	P	Practical Assignment / Observation of Practical Skills s
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45+30)	Marks (98)
I		**Basic of AI and Flutter**	**5**	**10**
	1	Introduction to AI and its subsets	1	
	2	Introduction to Flutter	1	
	3	Overview of artificial intelligence and its applications.	1	
	4	Introduction to Flutter framework and its features.	1	
	5	Setting up the development environment for Flutter.	1	
II		**Intermediate Flutter Development**	**12**	**15**
	6	Basics of Flutter App Development	1	
	7	Flutter widgets	2	
	8	UI components	2	
	9	State management in Flutter apps	3	
	10	Handling user input and gestures	2	
	11	Handling navigation and routing	2	
III		**Machine Learning in Flutter**	**12**	**15**
	12	Introduction to AI in Mobile Apps	2	
	13	Concepts of machine learning.	3	
	14	Role of ML in mobile app development.	3	
	15	Overview of popular AI frameworks	2	
	16	AI libraries compatible with Flutter.	2	
IV		**AI Services in Flutter**	**16**	**30**
	17	Text Classification with Flutter	2	
	18	Text Classification with ML Kit	2	
	19	Introduction to ML Kit for Flutter.	3	
	20	Text classification using ML Kit's natural language processing capabilities.	3	
	21	Developing a text classification feature within a Flutter app.	3	

	22	Implementing language translation in Flutter	3	
	Hands-on practical with PLC		**30**	
V	1	Setting up Flutter development environment.	2	
	2	Creating a simple Flutter app to understand the basic structure.	2	
	3	Building UI components using Flutter widgets.	2	
	4	Implementing state management in a Flutter app.	2	
	5	Handling user input and gestures within a Flutter app. Navigating between screens and handling routing in a Flutter app.	4	
	6	Exploring machine learning concepts through practical examples.	2	
	7	Exploring popular AI frameworks and libraries compatible with Flutter.	4	
	8	Setting up and integrating ML Kit for Flutter.	4	
	9	Implementing text classification features in a Flutter app. Hands-on practice with ML Kit's natural language processing capabilities for text classification.	4	
	10	Integrating language translation functionalities into a Flutter app.	4	

REFERENCES

1. Beginning App Development with Flutter, Rap Payne
2. Beginning Flutter: A Hands On Guide to App Development, Marco L. Napoli
3. Flutter for Beginners, Thomas Bailey, and Alessandro Biessek
4. https://www.tutorialspoint.com/flutter/flutter_tutorial.pdf
5. https://www.classcentral.com/report/best-flutter-and-dart-courses/
6. https://www.youtube.com/watch?v=VPvVD8t02U8

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 45 instructional hours for the fixed modules and 30 hours for the open-ended one. Module Vis designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V.Internal assessments (30 marks) are split between the practical module (20 marks) and the first four modules (10 marks).The end-semester examination for the theory part will be based on the 22 units in the first four modules. The 70 marks shown in the last column, distributed over the first four modules, is only for the external examination.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1		1	2	-	1	1						
CO 2	-	2	1	-	1	1						

CO 3	-	2	1	-	1	1						
CO 4	-	2	1	-	1	1						
CO 5	-	1	1	-	1	-						
CO 6	-	3	1	-	-	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓		✓	✓
CO 4			✓	✓
CO 5			✓	✓
CO 6			✓	✓

Programme	B. Sc. Electronics				
Course Code	**ELE1VN102**				
Course Title	**BASICS OF ELECTRICAL AND ELECTRONICS**				
Type of Course	**Vocational Minor**				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic Knowledge in Physics.				
Course Summary	This course provides students with a foundational understanding of electrical and Electronic circuits and equipping them with practical skills essential for designing and analyzing electronic systems in a professional context.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize the safety and reliability of electrical installations based on compliance with safety standards and regulations.	U	C	Instructor-created exams / Quiz/ Assignment
CO2	Design wiring layouts and circuit diagrams for various electrical installations.	Ap	P	Practical/ Viva Voce
CO3	Apply the principles of AC power generation and measurement to calculate power and energy consumption.	Ap	C	Observation of Practical Skills / assignments
CO4	Evaluate the efficiency and performance of transformers and motors based on their specifications.	An	P	Practical / Viva Voce / Asignments
CO5	Develop and test electronic circuits and systems for specific applications.	Ap	P	Practical / Viva Voce / Asignments
CO6	Apply the understanding of electrical and electronic principles in practical applications and projects.	Ap	p	Viva Voce/Practical /Project
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs 45	Mark (98)
I		**Basics of Electricity**	**14**	**20**
	1	Identify Different Circuit Elements: Resistor, Capacitor and Inductor, Measure Resistor values with multimeter.	1	
	2	Concepts of Voltage & Current, AC and DC Power Sources, Use of analog and digital meters, Connection of Ammeters and Voltmeters in the circuit.	2	
	3	Ohm's Law , Analysis of simple circuits with dc excitation.	1	
	4	AC power generation,Time period,Frequency,Amplitude,RMS Value.Average Value.	2	
	5	Phase and Phase difference, Types of loads-Resistive, Inductive and Capacitive	1	
	6	AC Power : kW, kVA, kVAR, Power and energy measurement,Use of Tong tester, Power factor, Power factor improvement.	3	
	7	Connection of Wattmeter and Energy meter, Calculation of Energy Bill	2	
	8	Three Phase Circuits, Star and Delta connections, Phase and Line values, Three phase power.	2	
Circuits and Networks-Sudhakar and Shyam Mohan,Electrical Technology by B.LTheraja and A.K Theraja.				
II		**Electrical Wiring Fundamentals**	**16**	**22**
	9	Electrical Wiring : Safety precautions, First aid practice, I.E rules related to house wiring, Tools and Accessories.	2	
	10	Types of wires: Line, Neutral, Earth, Ratings ,Voltage drops in cables, Testing of wiring installation,Use of Megger.	2	
	11	Electrical accessories : Switches,outlets and sockets,plugs,junction boxes,light fixtures and lamp holders.Fuses: re-wireable & HRC, MCB, MCCB, ELCB. Relays and contactor.	3	
	12	Types of house wiring: PVC Conduit, Casing and capping, Lay out and circuit diagrams , Series, Parallel, Stair case, Master control, Bell and buzzer-Hospital wiring.	3	
	13	Earthing: Importance, Size of earth electrodes, Pipe earthing and Plate earthing.	2	
	14	Transformer : function, parts, rating, losses ,efficiency and application.	1	
	15	AC motors: single and three phase induction motors, rating, losses and efficiency, circuit diagram of star and delta connected motors.	3	
Circuits and Networks- Sudhakar and Shyam Mohan,Electrical Wiring Residential-Ray C Mullin and Phil Simmons				
III		**Basic Electronic Devices**	**7**	**15**
	16	Identify and test: PN junction Diode,Zener Diode and LED.	1	
	17	Bipolar Junction Transistor,Types,Construction,Operation and application as an amplifier.	3	
	18	Identification and Applications of LCD,photodiode,photo transistor, Thermistor and LDR.	3	
Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky				
IV		**Applications**	**8**	

	19	Soldering and De soldering techniques, tools and materials for soldering, Soldering of electronic components in PCB.	3	**13**
	20	Assembling of LED lamps,LED strip construction, working, testing, identifying and rectifying LED strip level fault.	3	
	21	LED and LCD Display Modules :Types and Applications	1	
	22	Battery Charging Circuit:Block Diagram and Working.	1	
"Practical Electronics for Inventors" by Paul Scherz and Simon Monk.				
V	**Hands-on: Basics of Electrical and Electronics**		**30**	
	1	1. Safety precautions for electrical installations and handling tools. 2. Introduction and use of measuring instruments - Voltmeter, Ammeter, Multimeter, Oscilloscope and Function generator 3. Wiring practice of single switch and single lamp. 4. Series, Parallel and Stair case wiring practice. 5.Identify and test the circuit breaker . 6. Build a dc Power supply using Zener Diode and calculate percentage regulation. 7. Construct and test a transistor based switching circuit. 8.Construct an amplifier using BJT.	20	
	2	Mini Project:1. Soldering and testing of simple circuits . 2. Design and build a 12 Volt Battery Charging Unit.	10	

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

Text Books	1. "Circuits and Networks"- A Sudhakar and Shyam Mohan S Palli 2. Electrical Technology by B.LTheraja and A.K Theraja. 3. "Electrical Wiring Rsidential"-Ray C Mullin and Phil Simmons. 4. Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky,Pearson Education Publications. 5. "Practical Electronics for Inventors" by Paul Scherz and Simon Monk.
Web Resources	1. Dr. Mahesh B Patil, Department of Electrical Engineering, IIT Bombay: https://youtu.be/IoDoW5kykkw?si=20su7DXd3gMoGNt3 2. https://www.learnabout-electronics.org

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	2	2	2	1	3	2	-	2	2	-
CO 2	3	3	2	3	-	-	3	2	-	2	-	-
CO 3	3	3	2	3	-	-	3	2	-	2	-	-
CO 4	3	3	2	3	-	-	3	2	-	2	-	-
CO 5	3	2	2	2	2	1	3	2	-	2	2	-
CO 6	3	2	2	2	3	3	2	-	-	3	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project/Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE2VN102**				
Course Title	SOLAR POWER TECHNOLOGY				
Type of Course	Vocational Minor				
Semester	II				
Academic Level	100- 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basics of electrical and electronics.				
Course Summary	Master the principles and applications of solar photovoltaic technology, including cell types, system configurations, auxiliary equipment, and design considerations for efficient solar energy integration in both on- grid and off-grid settings				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize the fundamentals of electrical concepts, wiring techniques, safety protocols, and equipment usage to ensure efficient and safe electrical installations	U	P	Instructor-created exams / Quiz
CO2	Demonstrate solar photovoltaic technology, from cell functions to module parameters, enabling the understanding and implementation of diverse solar energy applications and system configurations.	U	P	Seminar Presentation / Group Tutorial Work
CO3	Summarize knowledge of essential components and their functions in solar PV systems, covering batteries, converters, inverters, and MPPT technology, with focus on selection, maintenance, and optimization for efficient energy conversion and management.	U	P	Practical Assignment / Observation of Practical Skills
CO4	Apply the principles of solar PV system components, including batteries, converters, inverters, and MPPT technology, to effectively design, select, and maintain systems	Ap	P	Practical Assignment / Observation of Practical Skills s

	for optimal performance and efficiency.			
CO5	Develop proficiency in designing solar PV systems, incorporating technical standards, capacity limitations, site considerations, metering arrangements, and grid connectivity for both on-grid and off- grid applications.	Ap	P	Practical Assignment / Observation of Practical Skills s
CO6	Demonstrate battery fundamentals, types, parameters, and configurations, enabling proficient selection, maintenance, and fault detection in solar PV systems.	U	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45+30)	Marks (98)
I		**Basic Terms and Electrical Wiring**	**5**	**10**
	1	Voltage, Current, DC Power, AC Power, Energy, Harmonics	1	
	2	Electrical Wiring, Types of Wire, Wire Sizing, DC cabling, AC cabling.	1	
	3	Junction Box, Array Combiner Box, AC Distribution Box	1	
	4	Electrical Grounding, Earth Resistance and Insulation Resistance Measurements.	1	
	5	Electrical Safety, Electrical Safety Rules, Simple First Aid, General Safety of Tools and Equipment, Fire Extinguishers.	1	
II		**Solar Photovoltaic Cell and Module**	**15**	**20**
	6	Solar Cell and its function, Solar Technologies –Thermal and Photovoltaic.	1	
	7	Solar Energy Applications - solar cooking, solar water heater, solar powered water pumps, solar Lighting system, Roof top solar system.	4	
	8	Types of Solar PV Systems – On-grid, Off-grid and Hybrid.	3	
	9	Solar Cell technologies, Crystalline Cells: Mono- crystalline and poly – crystalline cells,	1	
	10	Solar Cell Parameters, Efficiency of Solar Cell	1	
	11	Solar PV Module, Rating of Solar PV Module, PV Module Parameters, Efficiency of PV Module,	2	
	12	Solar Photovoltaic Module Array, Connection of PV Module in Series and Parallel, Estimation and Measurement of PV Module Power, Selection of PV Module.	3	

III	**Solar PV System Auxiliary Equipments – Batteries, Charge Controller, MPPT and Inverter**		**15**	**20**
	13	Basic functions of Battery, Charge controller, MPPT and Inverter in Solar PV System.	2	
	14	Battery function, Types of Batteries, Battery parameters, Series Parallel combination of Batteries	2	
	15	Selection of Batteries in Solar PV system, Battery Maintenance and Measurements, Battery Fault Detection and Test.	2	
	16	AC to DC Converter, Battery Charge controller	2	
	17	DC to DC power converter, Buck and Boost Converter, Fly back Converter	2	
	18	DC to AC Converter, Full Bridge Inverter, Specification of Inverter and charger.	3	
	19	Function of Maximum Power Point Tracking (MPPT) in SPV system	2	
IV	**Solar PV System Design and Integration**		**10**	**20**
	20	Design methodology for SPV system, Technical Standards and Specification of roof top solar system, Capacity Limiting, Technical and site Considerations	3	
	21	Design considerations of On-grid Rooftop Solar System, Design considerations of Off Grid Solar Power Plant.	5	
	22	Various types of metering arrangements, Solar Radiation, Energy Measurements, Net Metering.	2	
	Hands-on practical		**30**	
V	1	Measurement of electrical and non-electrical quantities using instruments such as, ammeter, voltmeter, clamp on-meter, tong tester, irradiance meter and temperature sensors.	4	
	2	Measuring SPV cell/ Module Parameters and plotting Voc, Isc, Vmp, Imp and Pmp on the I-V curve.	2	
	3	Solar PV Module Efficiency and Maximum power point determination.	2	
	4	Economic analysis of solar photovoltaic systems based on the current Rooftop Solar Programme by Government of India and State Government schemes.	2	
	5	Installation of on-grid PV system and measure current, voltage, power and energy from the system, Monitoring of incoming and outgoing power at junction box & inverter output. Analysis on import, export energy units.	4	
	6	Design and Development of Solar Street Light and Solar Lantern	2	
	7	Check list preparation and Installation of small off-grid PV system and testing of PV panel, inverter, charger and storage devices.	4	

	8	Battery Installation for PV system and fault detection of battery cell.	4	
	9	Making and reading sun path diagrams, Shading Analysis with Solmetric SunEye.	2	

	10	Project: Installing, testing and commissioning on-grid 3KW Solar PV Power Plant – Site considerations, Safety factors, Maintenance activities, Metering, Energy credits, Payback period calculation.	4	

REFERENCES

1. Solar Power Hand Book, Dr. H. Naganagouda (2014)

2. Solar Photovoltaic; Chetansingh solanki; PHI, Learning private ltd., New dehli- 2018.

3. Rai. G.D," Solar energy utilization", Khanna publishers, 5th Edition, 2008..

4. Rai. G.D, "Non-conventional energy sources", Khanna publishers, 6th Edition, 2017

5. Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Signal K.C New Arrivals –PHI; 2 Edition (2011)

6. Non-conventional energy sources, B.H. Khan, McGraw Hill., 3rd Edition, 2017

7. Solar Energy: Resource Assessment Handbook, P. Jayakumar, e-book., 2009.

8. Solar energy- Principles of Thermal collection and Storage. Suhas P Sukhatme, 15th Edition, TMH., 2006

9. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press. 3rd edition, 2012

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 45 instructional hours for the fixed modules and 30 hours for the open-ended one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V.Internal assessments (30 marks) are split between the practical module (20 marks) and the first four modules (10 marks).The end-semester examination for the theory part will be based on the 22 units in the first four modules. The 70 marks shown in the last column, distributed over the first four modules, is only for the external examination.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	2	1	-	-						
CO 2	-	2	1	2	-	-						
CO 3	-	-	1	2	-	-						
CO 4	1	2	1	1	-	-						
CO 5	2	1	3	1	-	-						
CO 6	-	1	2	1	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓		✓	✓
CO 4			✓	✓

CO 5			✓	✓
CO 6		✓		✓

Programme	B. Sc. Electronics				
Course Code	**ELE3VN202**				
Course Title	**CONSUMER ELECTRONICS**				
Type of Course	Vocational Minor				
Semester	3				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge in science				
Course Summary	This course introduces some of the basic consumer electronics equipment like microwave oven, washing machine, air condition and refrigerator.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize the working and maintenance of microwave Oven,	U	C	Instructor-Demonstration
CO2	Illustrate the working and maintenance of washing machines and vacuum cleaners.	U	C	Instructor-created exams /
CO3	Summarize the working and maintenance of AC and Refrigerator.	U	C	Instructor-created exams / Quiz
CO4	Outline the working and maintenance of Facsimile machine, barcode scanner, calculator and digital clocks.	U	C	Instructor-created exams / Quiz
CO5	Identify components or parts of various consumer electronics equipment.	Ap	P	Practical Work
CO6	Solve problems in various consumer electronic equipment.	Ap	P	Practical work
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Microwave oven**	**10**	**16**
	1	Microwave Oven block diagram and principle of operation	2	
	2	Concept of LCD timer with alarm used in Microwave Oven.	2	
	3	Use of Single-chip Controllers in Microwave Oven.	2	
	4	Types of Microwave Oven	2	
	5	Wiring and Safety Instructions for a microwave Oven.	1	
	6	Care and Cleaning for Microwave Oven.	1	
II		**washing machine**	**15**	**20**
	5	Electronic controller for washing machines	2	
	6	Washing machine hardware and software	2	
	7	Types of washing machines	2	
	8	Fuzzy logic washing machines	2	
	9	Features of washing machines	2	
	10	Block diagram, basic working mechanism, maintenance of Dishwasher	2	
	11	Block diagram, basic working mechanism and maintenance of Vacuum cleaner.	3	
III		**Air Condition and Refrigerators**	**10**	**17**
	12	Air conditioning, Components of air conditioning systems	2	
	13	Basic principle and components of All air-air conditioning system,	3	
	14	Basic principle and components of Unitary and central air conditioning systems, Basic principle of Split air conditioners.	2	
	15	Refrigerator Block diagram , working mechanism and maintenance	3	
IV		**Electronic Gadgets and Domestic Appliances**	**10**	**17**
	16	Basic Structure of a calculator.	1	
	17	Internal organization of a calculator	1	
	18	servicing electronic calculators	1	
	19	Basics of barcode scanner and decoder.	1	
	20	Block diagram and working mechanism of Digital clocks	2	
	21	Block diagram and basic details of Xerographic copier	2	
	22	Home security system, CCTV.	2	
V		**Electronics Practical** **Hardware implementation or Simulation Lab**	**30**	

	1	1) Understand the steps to diagnose the common issues with the microwave oven 2) Understand the steps to diagnose the common issues with the washing machine. 3) Understand the steps to diagnose the common issues with the AC 4) Understand the steps to diagnose the common issues with the Refrigerator. 5) Study the parts/components of calculator and barcode scanner 6) Understand the steps to diagnose the common issues with the Photocopier. 7)Market survey of microwave oven, 8) Market survey of washing machines. 9) Market survey of AC. 10) Market survey of refrigerators.	30	

Note: The syllabus has five modules.There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

1. Bali S.P. Consumer Electronics, Pearson Education India, latest edition.

2. The Washing Machine Manual: DIY Plumbing, Fault-finding, Repair and Maintenance, Graham Dixon, J H Haynes & Co Ltd; 4th edition, 2006.

3. A Textbook of Refrigeration & Air Conditioning by R. K. Rajput , S.K. Kataria & Sons

4. Textbook of Refrigeration and Air Conditioning by R. S. Khurmi, Joyeeta Gupta , S Chand & Co Ltd ,R.S.Khurmi and Joyeeta.Gupta

5. HP41 Repair: A beginner's guide to repairing your HP41 calculator by The Calculator Store

6. B. R. Gupta, V. Singhal, “Consumer Electronics”, S. K. Kataria & Sons, 2013

7. Microwave oven user manual.

https://www.lg.com/cac/support/products/documents/3%20KROW M000001993.pdf

8. User manual dishwasher

file:///C:/Users/user/Downloads/DT8B.pdf

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-	1	1			1	
CO 2	2	3	-	-	-	-	1	1			1	
CO 3	-	-	1	-	-	-	1	1			1	
CO 4	-	-	2	3	-	-	1	1			1	
CO 5	-	1	-	-	-	-	1	1			1	
CO 6	-	-	-	3	-	-	1	1			1	

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓

CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE8VN302**				
Course Title	LIGHT AND SOUND ENGINEERING				
Type of Course	**Vocational Minor**				
Semester	VIII				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Fundamentals of Electrical and Electronics				
Course Summary	This course offers an immersive introduction to lighting and sound engineering, blending foundational theory with hands-on application. Through a combination of lectures, lab experiments and projects, the course aims to equip students with the practical skills and creative insights necessary for a successful career in audiovisual engineering.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize the basic properties of light and sound	U	C	Instructor-created exams / Quiz
CO2	Discover the functions and applications of various lighting fixtures and sound equipment	An	P	Practical Assignment / Observation of Practical Skills
CO3	Determine optimal illumination levels for various settings. They will also apply knowledge of loudspeaker specifications and power requirements to set up a sound system for live events.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Analyse and design advanced lighting and sound systems	An	P	Instructor-created exams / Home Assignments
CO5	Create innovative projection mappings and other projection technologies.	C	P	Practical Assignment / Observation of Practical Skills
CO6	Evaluate the advantages and disadvantages of different types of projectors and sound systems	E	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (98)
I		**Fundamentals of Lighting**	**11**	**14**
	1	Basics of light: color temperature, brightness, and intensity	2	
	2	Overview of lighting fixtures and their functions	1	
	3	Types of Lighting -Ambient, task and accent lighting; understanding different light sources (LED, fluorescent, halogen, etc.)	3	
	4	Lighting Calculations and Measurements-Calculating illumination levels, understanding lumens, lux and foot-candles, using light meters.	3	
	5	Lighting Controls and Systems - Dimmers, motion sensors and smart lighting systems	2	
		"Lighting Design Basics" by Mark Karlen and James R. Benya. "IES Lighting Handbook" by Illuminating Engineering Society. "Lighting Control: Technology and Applications" by Robert S. Simpson.		
II		**Introduction to Projection Techniques**	**12**	**18**
	6	Understanding different types of projectors	2	
	7	Projection surfaces and aspect ratios.	2	
	8	Projection Mapping- techniques for mapping video content to irregular surfaces	3	
	9	Creating interactive displays using projectors and motion sensors.	2	
	10	3D and holographic projections	2	
	11	cutting-edge projection technologies	1	
		"Projection Displays" by Edward H. Stupp and Matthew S. Brennesholtz. "Projection mapping A Complete Guide" by Gerardus Blokdyk		
III		**Introduction to Sound**	**12**	**20**
	12	Sound waves- amplitude, frequency and phase.	2	
	13	Room acoustics and soundproofing	2	
	14	Microphones, mixers and amplifiers	2	
	15	Loudspeakers specifications and power requirements.	2	
	16	Placement strategies for optimal sound, use of SPL meters for calibration.	2	
	17	Setting up a sound system for a live event	2	
		"The Sound Reinforcement Handbook" by Gary Davis and Ralph Jones "Modern Recording Techniques" by David Miles Huber and Robert E. Runstein		
IV		**Introduction to Advanced Sound Systems**	**11**	**18**
	18	Principles of surround sound, 5.1 and 7.1 setups.	3	
	19	Concepts of Object-based audio	2	
	20	Basics of Dolby Atmos	2	
	21	Overview of DTS:X and other DTS sound systems	2	
	22	Comparison between DTS and Dolby Atmos.	2	
		"Surround Sound: Up and Running" by Tomlinson Holman. Dolby Atmos / DTS official documentation and guides.		
V		**Practical:**	**30**	
	1	Understand the concepts of ambient, task, and accent lighting and their practical applications.		

		• Explore different lighting fixtures and understand their specific functions and applications. • Explore the functionality and benefits of dimmers, motion sensors, and smart lighting systems. • Compare and contrast the functionality and applications of various types of projectors, including DLP (Digital Light Processing), LCD (Liquid Crystal Display), and LED (Light Emitting Diode) projectors. • understand the impact of different projection surfaces and aspect ratios on image quality. [various surfaces (white wall, specialized screen, textured fabric), and content in different aspect ratios (16:9, 4:3, 21:9)] • explore the technique of projection mapping by projecting video content onto irregular surfaces. [mapping software (e.g., MadMapper, VPT7), objects with irregular surfaces (e.g., mannequin, small architectural model)] • Record natural sounds and voices, then visualize the waveforms using audio editing software to identify parameters like frequency, amplitude, and phase. • Create a simple sound system setup with microphones, mixers, amplifiers, and speakers • Set up a live sound system and experiment with microphone and speaker placement to control feedback.		

Note: The syllabus has five modules. There should be a total of 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules

References

1. "Lighting Design Basics" by Mark Karlen and James R. Benya.
2. "IES Lighting Handbook" by Illuminating Engineering Society.
3. "Lighting Control: Technology and Applications" by Robert S. Simpson.
4. "Projection Displays" by Edward H. Stupp and Matthew S. Brennesholtz.
5. “Projection mapping A Complete Guide” by Gerardus Blokdyk
6. "The Sound Reinforcement Handbook" by Gary Davis and Ralph Jones
7. "Modern Recording Techniques" by David Miles Huber and Robert E. Runstein
8. "Surround Sound: Up and Running" by Tomlinson Holman.
9. Dolby Atmos / DTS official documentation and guides.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-						
CO 2	2	3	-	-	-	-						

CO 3	-	-	1	-	-	-						

CO 4	-	-	2	3	-	-						
CO 5	-	1	-	-	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code	**ELE1FM105**				
Course Title	CLEAN ENERGY SOLUTIONS				
Type of Course	MDC				
Semester	I				
Academic Level	100- 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45

Pre-requisites	1. Basic Knowledge of Physical Science and Electricity.
Course Summary	This course serves as an introduction to the fundamental concepts of clean energy, emphasizing its role in sustainable development. Participants will explore a wide range of energy sources, with a particular focus on renewable technologies, and gain insights into the solar power generation, components of solar PV system and their functions

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize clean energy sources and articulates its significance in addressing climate change and environmental challenges.	U	C	Assignment / Seminar Presentation
CO2	Illustrate conventional and non-conventional energy sources	U	C	Assignment / Seminar Presentation
CO3	Develop proficiency in assessing the economic feasibility of clean energy projects.	Ap	P	Assignment / Seminar Presentation
CO4	Illustrate the basics of solar energy, its applications, and methods for storage	U	P	Seminar Presentation / Group Tutorial Work
CO5	Summarize different solar PV systems, considering off- grid, on-grid, and hybrid configurations.	U	P	Instructor-created exams / Quiz
CO6	Demonstrate functions and importance of charge controllers and inverters in solar power systems	U	P	Assignment / Seminar Presentation

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (36+12)	Marks (70)
I		**Introduction to Clean Energy**	**5**	15
	1	Definition of Power and energy, Distinguishing Power from Energy	2	
	2	The Crucial Role of Energy in Development	1	
	3	Defining Clean Energy. Importance of Clean Energy in Climate	1	
	4	Global Clean Energy Initiatives and Sustainability Goals.	1	
II		**Energy Sources**	**11**	**20**
	5	Classification of Energy Sources – Conventional and Non- conventional	1	
	6	Conventional energy (Non- Renewable) sources - Hydro Electric, Thermal and Nuclear,	2	
	7	Advantages and disadvantages of Conventional energy sources	2	
	8	Non-Conventional Energy (Renewable) sources - Bio-mass, geo-thermal, solar, wind energy, ocean energy and wave	2	
	9	Advantages and disadvantages of Non-Conventional Energy sources	2	
	10	Comparison of Conventional and Non-Conventional Energy sources	2	
	11	Commercial energy sources - fossil-fuels, coal, oil, natural gas, hydro electric power, and nuclear	2	
	12	Advantages and disadvantages of Commercial energy sources	1	
III		**Solar Power System**	**15**	**20**
	13	Solar Energy Overview and Importance, storage of solar energy, solar applications- solar pump, solar water heater, solar distillation, solar cooker, solar green houses.	4	
	14	Storage of Solar Energy, Solar Energy Conversion, Solar PV Systems, Basic Components: Solar Panel, Battery System, Power Converter.	4	
	15	Types of Solar PV systems - off-grid, On-grid and Hybrid.	4	
	16	Comparison of Solar PV systems, Initial cost and payback period	3	
IV		**Solar PV system components and selection parameters**	**5**	**15**
	17	Solar Cell Function, Solar Technologies, Solar Cell Parameters – Voltage, Power Ratings, Efficiency.	2	
	18	Energy Storage: Battery Function, Types, Parameters, Selection, Maintenance.	2	
	19	Charge Controller and Inverter (Basic Functions)	1	
	Open Ended Module : Solar PV system		**12**	

.

V	1	**Case studies:** 1. Discuss clean energy initiatives 2. Classification of Energy sources **Real-World Applications and Trade-offs:** 1. Identification of Solar components 2. Economic Analysis of installing solar PV system **Assessment:** **Group Assignment:** Types of Solar PV system		

Note: The course is divided into five modules, with four having total 19 fixed units and one open-ended module with a variable number of units. There are total 36 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 19 units from the fixed modules.

References

a) Renewable energy; power for a sustainable future; oxford; Stephen peake; oxford university press- 2017
b) Renewable energy systems; Devid M, Buchla, Thomas E kissell, Thomas, L Floyd; Pearson India Education Services Pvt. Ltd. 2017
c) Fundamentals of Renewable Energy Systems Paperback – D.Mukherjee, New Age International Publisher; First edition (2011)
d) Solar Power Hand Book, Dr. H. Naganagouda(2014)
e) Solar Photovoltaic; Chetansingh solanki; PHI, Learning private ltd., New dehli- 2018
f) Non-conventional Sources of Energy , G.D Rai, Khanna Publishers, Delhi, 2012
g) Solar Power Hand Book, Dr. H. Naganagouda (2014)
h) Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Signal K.C New Arrivals –PHI; 2 Edition (2011)
i) "Renewable energy power for a sustainable future" by Godfrey Boyle ,2004 Oxford University Press in association with the Open university.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	1	-	-	-	-						
CO 2	1		-	-	-	-						
CO 3	-	1	2	-	-	-						
CO 4	-	-	-	2	-	-						
CO 5	-	-	1	-	-	-						

CO 6	-	-	-	2	-	-						

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		✓		✓
CO 2		✓		✓
CO 3	✓			✓
CO 4	✓			✓
CO 5	✓			✓
CO 6	✓			✓

Programme	B. Sc. Electronics				
Course Code	**ELE2FM106**				
Course Title	Mobile App Development				
Type of Course	MDC				
Semester	2				
Academic Level	100- 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	1. Basic understanding of electronics and digital circuits 2. Fundamental computer and number system Concept				
Course Summary	This course covers the fundamental concepts of computer hardware, including number systems, logic gates, internal components, operating systems, and software. Through a combination of theory and practical classes, students will gain a comprehensive understanding of how computers work and how to interact with them effectively.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Identify Mobile Phone Types and Features	Ap &U	C	Instructor-created exams / Quiz
CO2	Discover the characteristics of major mobile operating systems including Android OS, BlackBerry OS, iPhone OS, and Windows Phone.	An & U	C	Assignment / Seminar Presentation
CO3	Identify the principles of mobile computing.	Ap& U	P	Seminar Presentation / Group Tutorial Work
CO4	Examine the various no-code app builders like Jotform, Flip a Bit, Softr, Bubble, and Glide.	An& U	F	Instructor-created exams / Home Assignments

CO5	Analyze and Compare No-Code App Builders	An & U	C	One Minute Reflection Writing assignments
CO6	Explore advanced frameworks and tools like React Native, Xamarin, PhoneGap, Sencha Touch, Kendo UI, VuForia, and jQuery Mobile, understanding their unique features and application scenarios.	Ap& An	P	Instructor-created exams / Home Assignments

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Mark (70)
I		**Introduction to Mobile Phone**	**8**	**10**
	1	Types	1	
	2	Features	1	
	3	Operating System	1	
	4	Mobile operating systems: Android OS, BlackBerry OS, iPhone OS- Windows Phone	3	
	5	Mobile Computing	2	
II		**Introduction to Mobile App Development**	**7**	**10**
	6	Mobile app Introduction	1	
	7	Mobile app tools- Features and Installation	1	
	8	Important Menu of mobile app tools	1	
	9	Android Studio	2	
	10	Graphics Basics	2	
III		**No Code Mobile App Tools**	**6**	**12**
			10	
	11	No code app builder	2	
	12	Database, User Interface	3	
	13	No Code App Builder: Jotform, Flip a Bit, Softr, Bubble, Glide	3	
	14	Comparison of diffrent No Code App Builder	2	
	https://zapier.com/blog/best-no-code-app-builder/			
IV		**Mobile app builder with coding**	**10**	**18**
	15	Coding language basics: Javascipt and HTML	2	
	16	React Native : Features, Advantages and Disadvantages	2	
	17	Xamarin	1	
	18	PhoneGap	1	
	19	Sencha Touch	1	
	20	Kendo UI	1	
	21	VuForia	1	
	22	jQuery Mobile	1	
	https://www.besanttechnologies.com/mobile-app-development-tools			
V		**Open Ended Module: Mastering Hashing for Efficient Data Handling**	**9**	
	1	**Hand on Training on Mobile App Development** Using mobile app builder **Assessment:** **Presentation of Created App**	9	

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	3	1	-	2	2	3	-	-	-	1
CO 2	3	-	-	3	-	-	3	-	-	-	1	-
CO 3	-	3	-	-	2	-	1	-	-	1	-	-
CO 4	-	2	-	3	-	-	3	-	-	2	-	-
CO 5	-	1	-	-	-	-	-	1	-	-	-	-
CO 6	1	-	-	-	-	3	3	3	-	-	1	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓

CO 4				✓
CO 5		✓		✓
CO 6			✓	

REFERENCES

1. http://www.tutorialspoint.com/android/android_tutorial.pdf
2. **https://developer.android.com/guide/topics/sensors/sensors_overview**
3. Dr.K.SomasundaramProgramminginJAVA2,JaicoPublishingCompany,Mumbai,2005
4. EdBurnette,"Hello,Android",3rd Edition,ShroffPublishers&Distributorspvt.Ltd., 2010.
5. ChryssaAliferi,"AndroidProgrammingCookbook",ExelixisMediaP.C.,2016
6. Reto Meier,"Professional Android™ 4 Application Development", John Wiley & Sons,Inc.,2012
7. JamesKeogh,"TheCompleteReferenceJ2ME",McgrawHigherEd.,1st Edition

Programme	**B. Sc. Electronic Science**				
Course Code	**ELE3FV108**				
Course Title	**GREEN ENERGY FOR SUSTAINABLE DEVELOPMENT**				
Type of Course	**VAC**				
Semester	**III**				
Academic Level	**100 - 299**				
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours**
	3	3	-	-	48
Pre-requisites	1. Fundamental Science Concepts.				
Course Summary	The course provides a comprehensive overview of energy and its intersection with environmental concerns, focusing on India's energy scenario in comparison to the global context.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize production and consumption trends between India and the world, evaluating their impact on climate change, global warming, and ozone depletion.	U	C	Assignment / Seminar Presentation
CO2	Demonstrate the roles and functions of international agreements such as the United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Parties (COP) in addressing global energy and environmental challenges.	U	C	Assignment / Seminar Presentation
CO3	Illustrate conventional energy sources and land pollution, while understanding environmental	U	P	Assignment / Seminar Presentation

	standards, measurement techniques, and control measures to mitigate emissions effectively.			
CO4	Examine the basics of renewable energy sources, its potential, and their relative merits and demerits.	Ap	P	Seminar Presentation / Group Tutorial Work
CO5	Demonstrate proficiency in examining the energy strategies for integrating renewable energy sources into existing energy systems, develop roadmaps for ethanol blending in fuel, optimize energy efficiency measures, and formulate balanced energy mixes to promote sustainability and resilience.	U	P	Instructor-created exams / Quiz
CO6	Apply national and state energy policies, including initiatives such as the National Solar Mission and National Hydrogen Mission, and evaluate their effectiveness in promoting renewable energy integration, energy efficiency, and sustainable development goals.	Ap	P	Assignment / Seminar Presentation
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	**Unit**	**Content**	**Hrs (36+12)**	**Marks (70)**
I		**ENERGY SCENARIO**	**5**	**6**
	1	Comparison of energy scenario – India Vs World with respect to energy production and consumption	2	
	2	Climate Change, Global Warming	1	
	3	Ozone Depletion, Carbon credits	1	
	4	UNFCCC, COP.	1	

II		**ENERGY AND ENVIRONMENT**	**8**	**10**
	5	Conventional Energy Sources - Coal, Oil, Gas.	2	
	6	Emissions from fuels – Air, Water and Land pollution	2	
	7	Advantages and disadvantages of Conventional energy sources	2	
	8	Environmental standards - measurement and controls	2	
III		**RENEWABLE ENERGY TECHNOLOGY**	**10**	**14**
	9	Renewable Energy – Sources and Potential	2	
	10	Technologies for harnessing from Solar, Wind, Hydro, Biomass and Oceans	6	
	11	Principle of operation	1	
	12	Relative merits and demerits	1	
IV		**ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT**	**13**	**20**
	13	National & State Energy Policy	2	
	14	National solar mission	2	
	15	Framework of Central Electricity Authority	1	
	16	National Hydrogen Mission	1	
	17	Energy and climate policy - State Energy Action Plan	2	
	18	RE integration, Road map for ethanol blending	2	
	19	Energy Efficiency and Energy Mix	2	
	Open Ended Module : Solar PV system		**12**	
V	1	**Case studies:** 1. Evaluate the roles and functions of international agreements such as the United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Parties (COP) in addressing global energy and environmental challenges.		

		2. Analyse national and state energy policies, including initiatives such as the National Solar Mission and National Hydrogen Mission, and evaluate their effectiveness in promoting renewable energy integration **Real-World Applications and Trade-offs:** 1. Examine the renewable energy sources used in India for energy production, its potential, and their relative merits and demerits. 2. Economic Analysis of installing solar PV system in various sectors.		

Note: The course is divided into five modules, with four having total 19 fixed units and one open-ended module with a variable number of units. There are total 36 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 19 units from the fixed modules.

References

a) Energy Manager Training Manual (4Volumes) available at http://www.emea.org/gbook1.asp, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004

b) Twidell, J.W. & Weir A., "Renewable Energy Resources", EFNSpon Ltd., UK, 2015.

c) Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012.

d) Pratap Bhattacharyya, "Climate Change and Greenhouse Gas Emission", New India Publishing Agency- Nipa, 2020.

e) Matthew John Franchetti , Defne Apul "Carbon Footprint Analysis: Concepts, Methods, Implementation, and Case Studies" CRC Press, 2012

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h) Sustainable development in India: Stocktaking in the run up to Rio+20: Report prepared by TERI for MoEF, 2011

i) Dhandapani Alagiri, Energy Security in India Current Scenario, The ICFAI University Press, 2006

j) https://www.niti.gov.in/verticals/energ

Mapping of COs with PSOs and POs :												
	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6

CO 1	1	1	-	-	-	-						
CO 2	-	1	-	-	-	-						
CO 3	1	1	-	-	-	-						
CO 4	-	1	-	2	-	-						
CO 5	1	1	1	-	-	-						
CO 6	-	1	-	-	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		✓		✓
CO 2		✓		✓
CO 3	✓			✓
CO 4	✓			✓
CO 5	✓			✓
CO 6	✓			✓

Programme	**B.Sc. Electronics**
Course Code	**ELE4FV110**
Course Title	**E-WASTE MANAGEMENT**

Type of Course	**VAC**				
Semester	**IV**				
Academic Level	**100-199**				
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours**
	3	3	-	-	45
Pre-requisites	NA				

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize the environmental impacts of e-waste.	U	C	Instructor-created inventories
CO2	Apply concepts of e-waste management hierarchy.	Ap	C	Practical Assignment / Observation
CO3	Categorize the role of various national and internal act and laws applicable for e-waste management and handling.	An	P	Group Tutorial Work
CO4	Analyze the e – waste management measures proposed under national and global legislations.	An	P	Assignments/seminar
CO5	Categorize different e-wastes based on the origin and their impacts.	Ap	P	Field Work

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (70)
I		**Introduction :**	**9**	**8**
	1	E- waste; composition and generation	1	
	2	E-waste pollutants	1	
	3	Global context in e- waste	1	
	4	E waste hazardous properties	2	
	5	Effects of pollutant (E- waste) on human health and surrounding environment	2	
	6	Effects of pollutant (E- waste) on human health and surrounding environment	2	
II		**E-waste - Effects on Global trade :**	**10**	**12**
	7	Essential factors in global waste trade economy	2	
	8	Waste trading as an essential part of electronic recycling	1	
	9	Import of hazardous e-waste in India	1	
	10	India's stand onliberalizing import rules	2	
	11	E-waste economy in the organized andunorganized sector	2	
	12	Estimation and recycling of e-waste in metro cities of India.	2	
III		**E-waste control measures:**	**8**	**15**
	14	Need for stringent health safeguards and environmental protection laws in India	2	
	15	Extended Producers Responsibility (EPR)	2	
	16	Import of e-waste permissions	2	
	17	Administrative Controls & Engineering controls	1	
	18	monitoring of compliance of Rules	1	
IV		**The International legislation**:	**8**	**10**
	19	The Basel Convention	1	
	20	The Bamako Convention	1	
	21	The Rotterdam Convention	2	
	22	Waste Electrical and Electronic Equipment (WEEE) Directive in the European Union	2	
	23	Restrictions ofHazardous Substances (RoHS) Directive	2	
V		**Open Ended Module**	**10**	
		• Prepare Inventory and estimate the magnitude of electrical and electronic waste from home ,college or the selected site • Categorise e-waste into different types as per international and national guidelines • Preparation of list of certified electronics recyclers in your city and have an interactive session to learn from the processes being followed. • Prepare a poster showing the salient features of the e-waste management act of India.		

Learning Resources

Text Books
1. Rakesh Johri , E-waste: implications, regulations, and management in India and current global bestpractices, TERI Press, New Delhi 2. Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009
Reference Books
1. Fowler B, Electronic Waste – 1st Edition (Toxicology and Public Health Issues), 2017Elsevier
E-Resources
1. ~~https://news.mit.edu/2013/ewaste-mit~~ 2. https://youtube.com/playlist?list=PLzX8jgv9ZCbSrFhXR2TMALJTNiRPwr35k&si=NEr2PHV5Xa-XK3cJ

Programme	**B. Sc. Electronics**				
Course Code	**ELE5FS112**				
Course Title	COMPUTER AIDED DESIGN AND 3D PRINTING				
Type of Course	SEC				
Semester	V				
Academic Level	100- 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	48
Pre-requisites	Digital and analog electronics, Microprocessor and Microcontrollers				
Course Summary	The course will provide a balanced understanding of both CAD for PCB design and 3D printing technology, enabling students to integrate these technologies for innovative solutions in diverse industries.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize various PCB manufacturing technologies and processes involved in creating layouts that meet industry standards and functional requirements.	U	C	Instructor-created exams / Quiz
CO2	Show CAD layout for devices/components that may be mounted on PCB.	U	P	Assignment / Seminar Presentation
CO3	Develop the PCB layout techniques for optimized component density and power saving.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Develop design and printing of PCB with the help of various image transfer and soldering techniques	Ap	P	Practical Assignment / Observation of Practical Skills
CO5	Outline the technology involved with 3D printing process from conceptualizing designs to the selection of appropriate additive manufacturing techniques.	U	C	Seminar Presentation / Group Tutorial Work
CO6	Develop a 3D printing model with selected materials and selected processes.	Ap	P	Practical Assignment / Observation of Practical Skills

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (36+12)	Marks (70)
I		**CAD for PCB Design**	**10**	**12**
	1	Introduction to CAD	1	
	2	General Rules of Layout, Layout of Resistance, Capacitance and Inductance	3	
	3	Conductor Spacing, Supply and Ground Conductors, Component Placing and Mounting.	3	
	4	PCB Types: Single sided board, double sided, Multilayer boards, Plated through holes technology	2	
	5	Benefits of Surface Mount Technology (SMT).	1	
II		**PCB Manufacturing Process**	**10**	**15**
	6	Laminates, Manufacture of Copper Clad Laminates	2	
	7	Basic Printing Process for Double Sided PCB's – Photo Resists, Wet Film Resists, Coating Process for Wet Film Resists, Dry Film Resists.	4	
	8	Introduction to Etching, Etchant System .	1	
	9	Principles of Solder Connection , Solder Joints, Solder Alloys, Soldering Fluxes , Soldering - De-soldering Tools and Techniques.	3	
III		**Introduction to 3D printing technology**	**10**	**15**
	10	Prototyping fundamentals, Introduction to 3D printing, 3D Printing - Process, Classifications, Advantages.	3	
	11	3D modeling, CAD for Additive Manufacturing	2	
	12	RP data formats, STL format, Data translation, Data loss	1	
	13	Data transmission, Checking and preparing, Building, Post processing	1	
	14	Additive Manufacturing Techniques: Stereo- Lithography, LOM, FDM, SLS, SLM.	2	
	15	Binder Jet technology	1	
IV		**3D Printing Materials and Applications**	**6**	**8**
	16	Printing Materials: Polymers, Metals, Non-Metals	1	
	17	Ceramics Process, Process parameter, Process Selection for various applications.	1	
	18	Various forms of raw material- Liquid, Solid, Wire, Powder.	1	
	19	Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools.	3	
V		**Open Ended Module: CAD for PCB modelling**	**12**	
	1	**Case studies:** 1. Discuss various steps in circuit modelling in CAD s/w 2. Design single sided PCB for a IC based circuit	12	

		Real-World Applications and Trade-offs: 1. Design a basic circuit in CAD software and fabricate PCB 2. Familiarize net-list, autorouting and other features in CAD software **Group Assignment:** 3D modelling design and printing exercises		

Note: The course is divided into five modules, with four having total 19 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 19 units from the fixed modules.

REFERENCES

1. Printed circuit Board – Design & Technology by Walter C. Bosshart, Tata McGraw Hill.
2. Printed Circuit Board –Design, Fabrication, Assembly & Testing, R.S. Khandpur, TATA McGraw Hill Publisher.
3. Printed Circuits Handbook. Clyde F. Coombs, Jr, Happy T. Holden, 6th Edn., TMH Education, 2016.
4. Complete PCB Design Using OrCAD Capture and PCB. Kraig Mitzner Bob Doe Alexander Akulin Anton Suponin Dirk Müller, 2nd Edition., 2019.
5. Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
6. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.
7. Khanna Editorial, "3D Printing and Design", Khanna Publishing House, Delhi.
8. CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1		1	1	1								
CO 2	1		1	1								
CO 3			2	1								
CO 4	1	3	1									
CO 5				1	1							

CO 6	1		1			1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4			✓	✓
CO 5		✓		✓
CO 6			✓	✓

Programme	**B. Sc. Electronic Science**				
Course Code	**ELE6FS113**				
Course Title	EV TECHNOLOGY				
Type of Course	SEC				
Semester	VI				
Academic Level	100- 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	48
Pre-requisites	1. Basic electrical wiring and control logic, Digital and instrumentation electronics, Microprocessor based computer system and basic mechanical and automobile concepts.				
Course Summary	To equip students with the knowledge and skills necessary for understanding, selecting, and effectively utilizing Electric Vehicle Technology and to provide them insight to the EV drive components such as battery, motors and other control systems used in this technology.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Infer the basic components in EV/HEV drive and differntiate between various configuratrion and architecture structures.	U	C	Instructor-created exams / Quiz
CO2	Develop a solid understanding of energy storing methods, EV battery charging parameters, EV battery technologies and also acquire fundamental understanding of modern energy storage devices such as fuel cells and super capacitors.	Ap	P	Assignment / Seminar Presentation
CO3	Examine different types of motors used in EV drive applications and to analyse the motor performance parameters including torque/power-speed characteristics and efficiency maps of various motors.	An	P	Seminar Presentation / Group Tutorial Work
CO4	Summarize Electric Vehicle grid interface frameworks, including Grid-to- Vehicle (G2V), Vehicle-to-Grid (V2G), Vehicle-to-Vehicle (V2V), and Vehicle- to-Home (V2H).	U	P	Instructor-created exams / Home Assignments
CO5	Illustrate Electric Vehicle Control Systems, including Energy Management Systems (EMS), Battery Management Systems (BMS), regenerative braking, and anti-roll back control.	U	C	One Minute Reflection Writing assignments
CO6	Summarize the basics of automotive software (AUTOSAR) and gain familiarity with vehicle communication protocols (CAN).	U	P	Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (36+12)	Marks (70)
I		**Electric Vehicle System**	**8**	**15**
	1	Introduction to EV system, EV system Components	1	
	2	Power transmission in ICEV and EV, EV/ICEV comparison	1	
	3	HEV system components, Classification of HEV based on electric energy utilization - Micro Hybrid, Mild Hybrid, Full Hybrid and PHEV.	2	
	4	Architecture of HEV- Series hybrid, Parallel hybrid, Series-parallel hybrid.	3	

	5	Power flow in HEV, In-wheel drives.	1	
II		**EV Battery**	**9**	**10**
	6	Energy storing, Battery parameters, Battery capacity, Battery voltage, State of Charge, Depth of Discharge, Discharge rate.	3	
	7	Battery life and deep cycle, Equalizing.	1	
	8	Battery Types - Lead-acid battery, Nickel-based batteries, Lithium-ion battery.	2	
	9	Battery charging and discharging characteristics.	1	
	10	Basic principle and operation of Fuel Cell, Hydrogen Fuel cell, Super capacitors	2	
III		**EV Motors**	**9**	**15**
	11	Motor rating, EV motor Parameters - speed, torque, power, Efficiency, motor weight, Torque per unit volume.	2	
	12	Basic study on EV Motors - Brushless DC Motor, Switched Reluctance Motor, Induction Motor.	4	
	13	EV Motor performance parameters - Torque/power -speed characteristics, Efficiency map.	2	
	14	Basic function of EV motor controller	1	
IV		**EV Control System and EV charging**	**10**	**10**
	15	EV control systems - EMS, BMS, Regenerative braking, Anti-roll back control, Basic function of Speed and Torque control of EV drive.	3	
	16	EV auxiliaries - Auxiliary power supplies, Air conditioners, Navigation systems.	2	
	17	Introduction to automotive software – AUTOSAR and Vehicle communication protocol – CAN.	2	
	18	EV Charging - Domestic charging infrastructure, Public charging infrastructure, Fast charging, Inductive Charger, Battery swapping stations	2	
	19	EV grid interface frameworks - G2V, V2G, V2V and V2H.	1	
V		**Open Ended Module: Mastering Hashing for Efficient Data Handling**	**12**	
	1	**Case studies:** 1. Discuss the cost analysis b/w ICEV and EV use 2. Simulation of EV drive control using battery, motor and controller using Matlab/Simulink software **Real-World Applications and Trade-offs:** 1. Demonstration of EV components in 2/3/4 wheelers. 2. Integration of EV components and testing. **Group Assignment:** Assembling or retrofitting trail of EV components in 2/3/4 wheelers.	12	

Note: The course is divided into five modules, with four having total 19 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 19 units from the fixed modules.

REFERENCES

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
3. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2021.
4. Wie Liu, "Hybrid Electric Vehicle System Modeling and Control", Second Edition, John Wiley & Sons, 2017
5. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, 1st edition, CRC Press, 2004.
6. Build Your Own Electric Vehicle,Seth Leitman , Bob Brant, McGraw Hill, Third Edition 2013.
7. Advanced Electric Drive Vehicles, Ali Emadi, CRC Press, First edition 2017.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	2	1	-	-	-						
CO 2	1	1	2	-	-	-						
CO 3	-	1	-	-	-	1						
CO 4	2	-	-	1	-	-						
CO 5	-	-	-	1	-	1						
CO 6	-	-	-	-	1	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6		✓		✓

I Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE1CJ101: ELECTRICAL AND ELECTRONIC FUNDAMENTALS

(credits: 4)

Maximum Time: 2 hours **Maximum Marks: 70**

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. State the relation between Electric Field and Electric Potential.
2. What are the various types of capacitors?
3. Compare AC and DC power supply.
4. Explain the characteristics of a sinusoidal voltage waveform.
5. What do you mean by inductive reactance? Explain.
6. Define drift and diffusion currents in semiconductors.
7. What do you mean by avalanche breakdown?
8. Differentiate between Static and Dynamic resistance in a Diode.
9. What are the applications of wave shaping circuits?
10. What is the importance of rectifiers in power supply.

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Explain the features of constant current sources and voltage sources.
12. Explain Voltage division rule and Current division rule with an example.
13. Compare Single- phase and Three- phase systems.
14. Define r.m.s value of an alternating current and derive the expression.
15. Explain the concept of energy bands. Classify the materials according to energy bands.
16. Elaborate the construction and working of LED.
17. Give an explanation for the working of Zener diode as Voltage regulator.
18. Explain the formation of depletion layer in PN junction diodes.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Explain the VI characteristics of PN-junction diode.
20. With neat sketches explain the working of bridge rectifier circuit.

II Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE2CJ101: SEMICONDUCTOR DEVICES AND CIRCUITS

(credits: 4)

Maximum Time: 2 hours

Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What do you mean by operating point of a transistor?
2. Compare CE, CB and CC configurations.
3. Mention any three differences between BJT and FET.
4. Explain the Concept of CMOS.
5. Compare voltage amplifiers and power amplifiers.
6. Draw the circuit of Two Stage RC Coupled Amplifier.
7. How can you convert an amplifier into an oscillator?
8. Differentiate between Voltage series and voltage shunt feedback connection .
9. Give the Bark hausen criteria required for sustained oscillations.
10. Define stability factor of a biasing circuit.

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Explain the current transportation phenomenon in a BJT .
12. Explain the construction of JFET with a neat diagram.
13. What are the different types of MOSFET? Explain.
14. Explain class AB operation of power amplifiers.
15. Define frequency response of an amplifier and Explain the factors that affect the frequency response.
16. Compare Class A, Class B and Class C amplifiers.
17. Explain the features of Voltage Divider Bias.
18. What are the Advantages of Negative Feedback?

Section C

[Answer any one. Each question carries 10 marks]

(1x 10= 10 mark)

19. Draw the circuit and explain the working principle of Phase-shift

Oscillator.

20. With the help of circuit diagram and waveforms explain astable multivibrator.

Third semester BSc Electronics (CUFYUGP) Degree Examinations, November 2025

ELE3CJ201 Foundational Mathematics

(Credits:4)

Maximum Time: 2 Hrs **Maximum marks: 70**

Section A

[Answer All. Each question carries 3 Marks] (Ceiling: 24 Marks)

1. Determine LCM of 54 and 60.
2. If cos x = -3/5, 'x' lie in the third quadrant, find the value of other five trigonometric functions.
3. Find roots of quadratic equation $100x^2-20x+1=0$.
4. Evaluate $\text{Lim}_{x\to 3} [x(x+1)]$
5. Find derivative of $y=x^2-2$ at x=10.
6. Integrate $^3 3x^2+4x^3$.
7. Represent the complex number z= 1+1.73i in the polar form.
8. Find AXB, if A= 2i+j+3k and B= 3i+5j-2k.
9. State Green's theorem.
10. Find Laplace transform of 2t+6.

Section B

[Answer All. Each question carries 6 Marks] (Ceiling: 36 Marks)

11. Find gradient of $F(x,y,z)= xy^2+3x^2-z^3$.
12. Find Laplace transform of e^{at}.
13. If A= $\begin{bmatrix} \cos a & \sin a \\ -\sin a & \cos a \end{bmatrix}$ Find A^TA
14. Find dy/dx, if x= a cos ϴ, y= a sin ϴ.
15. Evaluate $\text{Lim}_{x\to 2} [(x^3-2x^2)/(x^2-5x+6)]$.
16. Find i) $\int x\, e^x\, dx$. ii) $\int \log x\, dx$

17. Prove that [sin(x+y)]/ [sin(x-y)] = [tan x+ tan y]/ [tan x- tan y].

18. Find conjugate of [(3-2i)(2+3i)]/[(1+2i)(2-i)].

Section C

[Answer any one. Each question carries 10 Marks] (1X10= 10 Marks)

19. Solve the system of equation by using cramer's rule

$x+y+z=6 \qquad 2x+3y-z=5 \qquad 6x-2y-3z=-7.$

20. Find Fourier series of the function defined by

$$f(x) = \begin{cases} 0 & -2<x<0 \\ 1 & 0<x<2. \end{cases}$$

III Semester B.Sc. (CUFYUGP) Degree Examinations October 2025

ELE3CJ202: DIGITAL ELECTRONICS

(credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[***All questions can be attended. Each question carries 3 marks***]

1. Convert (a) $(A8C)_{16}$ to decimal number (b) What is BCD equivalent of decimal 98?
2. Implement an OR function using NAND and NOR gates.
3. Simplify $ABC[AB + (\overline{BC} + AC)]$
4. Differentiate SOP and POS
5. Compare combinational and sequential circuits
6. Draw the logic diagram of a half-adder.
7. Differentiate Latch and Flip flop.
8. How will you convert a JK FF to D FF?
9. Define de-multiplexer and list out its applications.
10. What do you meant by toggle condition and how it is eliminated?

(***Ceiling 24 Marks***)

Section B (Short Essay type questions)

(All questions can be attended. Each question carries 6 marks.)

11. Explain the rules of Boolean algebra.
12. Explain the universal property of NAND gate.
13. Explain the operation and truth table of S-R flip flop.
14. What is race around condition in J-K flip flop? How it is rectified?
15. Draw a logic diagram of 2 input multiplexer with its truth table.
16. Explain 3-to-8 line decoder in brief with necessary logic diagram
17. Explain the working of 1:4 demultiplexer. Explain the operation and logic circuit of full adder.
18. Explain the working of 2-bit comparator.

(***Ceiling 36 Marks***)

Section C (Essay type questions)

(Answer any one question. Each question carries 10 Marks)

19. Explain in detail the operation and truth table of different type of flip flops.
20. Explain in detail the operation and logic circuit of different type of shift registers.

(***1 x 10 =10 Marks***)

IV SEMESTER B. Sc ELECTRONICS (CUFYUGP) DEGREE EXAMINATIONS

ELE4CJ203 NETWORK ANALYSIS

Time: 2 Hrs **Max. Mark: 70**

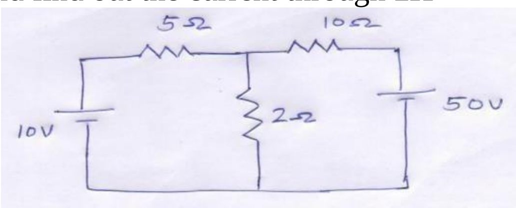
Section A
(All Questions can be attended. Each Question Carries 3 Marks)

1. State and explain KCL
2. Comment on ideal V and I sources.
3. What do you meant by transient?
4. State and prove maximum power transfer theorem.
5. Obtain the AC VI relationship in an inductor.
6. From voltage and current, obtain the reactance of a capacitor. Comment on j factor.
7. Differentiate series and parallel Resonance.
8. With phasor, explain the current through an RC circuit.
9. Comment on power triangle.
10. Explain Q factor. What is its importance?

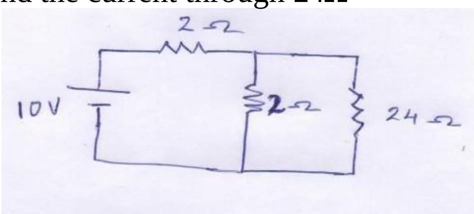
(Ceiling 24 Marks)

Section B
(All Questions can be attended. Each Question Carries 6 Marks)

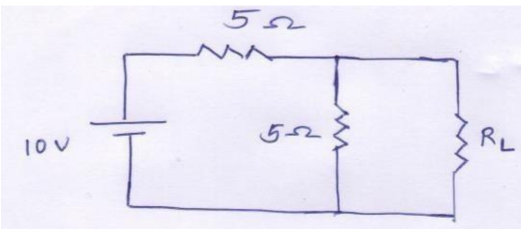
11. Perform Mesh analysis and find out the current through 2Ω



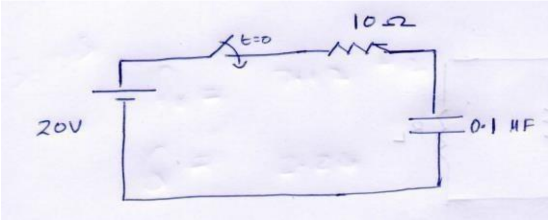
12. Using Norton's theorem, find the current through 24Ω



13. Find the maximum power delivered at load resistance.



14. Derive the expression for current through an RC circuit exited using an AC source.
15. Perform DC transient analysis on RL circuit.
16. Find the expression of current through the circuit at t=0+ and find the values at t=0 sec, 0.5 sec and 1 sec



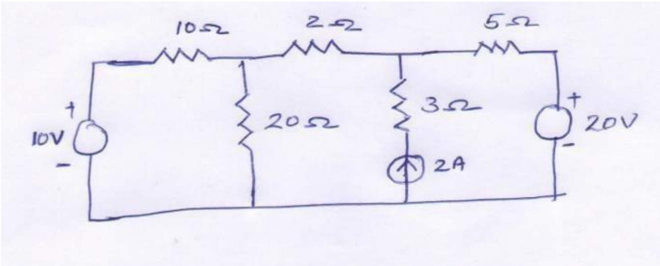
17. A series RC circuit with R=10 Ohm and Xc=-10j is connected to a voltage source of 2+2j volts. Obtain apparent power, power factor and average power
18. A series RLC circuit is made up of R=10 Ohm, L=10 mH and c=10 microfarad. Obtain Resonant frequency, Q factor and BW of the circuit

(Ceiling 36 Marks)

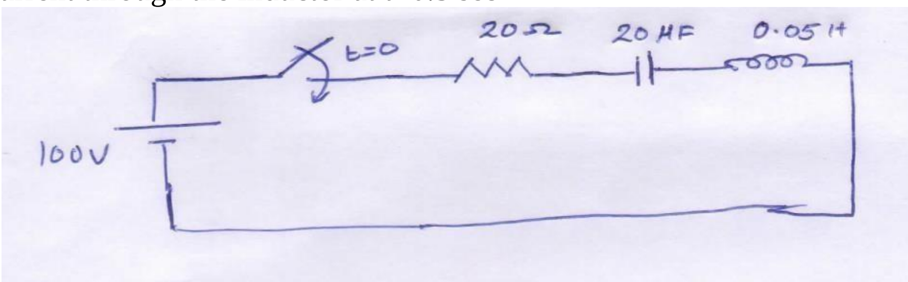
Section C

(Answer any one questions. Each question carries 10 Mark)

19. State Super position theorem Using super position theorem, find the current and hence power at 2Ω



20. Find the current through the inductor at t=0.5 sec



(10 Marks)

Fourth semester BSc Electronics (CUFYUGP) Degree Examinations, March 2026

ELE4CJ204 Microprocessors and Microcontrollers (Credits : 4)

Maximum Time: 2 Hrs **Maximum marks: 70**

Section A

[Answer All. Each question carries 3 Marks] (Ceiling: 24 Marks)

1. What are the peculiarities of Accumulator in 8085.?
2. Explain about instruction sequencing in 8085.
3. Compare between data bus and address bus in 8085.
4. What is the structure of PSW in 8051.?
5. Illustrate the concept of bit addressability.
6. Mention any four special function registers in 8051.
7. Which are the various interrupts in 8051?
8. How many I/O Ports are there in 8051.?
9. Explain briefly the operation of PUSH and POP instructions in 8051.
10. Differentiate between the instructions MOV R0,30H and MOV R0,#30H.

Section B

[Answer All. Each question carries 6 Marks] (Ceiling: 36 Marks)

11. Explain about the software generated interrupts in 8051.
12. How Mode 0 timer operation is being implemented in 8051. Explain.
13. Define addressing modes in 8051. Explain about various types.
14. Write a program in 8051 assembly language for a one second delay.
15. Draw the internal RAM organization in 8051. Explain.
16. What is the use of stack pointer in 8051. Explain.
17. Compare between microprocessor and microcontroller.
18. Explain bus organization in 8085.

Section C

[Answer any one. Each question carries 10 Marks] (1X10= 10 Marks)

19. Explain in detail about the architecture of 8085 with the help of neat diagram.
20. Classify the various instructions in 8051and explain it in detail.

IV Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE4CJ205: ANALOG ELECTRONICS

(credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[***All questions can be attended. Each question carries 3 marks***]

1. Draw the pin diagram of IC 741
2. Write the ideal op-amp characteristics
3. Explain Schmitt trigger circuit with suitable diagrams
4. Draw and explain summing amplifier circuits
5. Discuss about variable voltage regulators
6. Draw and explain an RC oscillator
7. What is a voltage follower? Draw the circuit diagram
8. Differentiate virtual ground and actual ground
9. Explain Digital to Analog converter
10. What is clamping circuits? Why is it used?

(***Ceiling 24 Marks***)

Section B (Short Essay type questions)

(All questions can be attended. Each question carries 6 marks.)

11. Draw and explain internal block diagram of IC 555 Timer
12. Discuss inverting and noninverting amplifiers
13. Explain integrator and differentiator using op-amp
14. Draw and explain basic comparator circuit and zero crossing detector.
15. Explain Triangular wave generator with the help of a circuit diagram
16. Draw and explain circuit diagrams and corresponding waveforms of different types of clippers.
17. What is the application of monostable multivibrator? Explain the working of it.
18. Draw the block diagram of PLL and explain the operating principle.

(***Ceiling 36 Marks***)

Section C (Essay type questions)

(Answer any one question. Each question carries 10 Marks)

19. Draw and explain the functional block diagram of Astable multivibrator using IC 555
20. Explain different types of filters in detail.

(***1 x 10 =10 Marks***)

V SEMESTER B. Sc ELECTRONICS (CUFYUGP) DEGREE EXAMINATIONS

ELE5CJ301 FIELD THEORY

Time: 2 Hrs **Max. Mark: 70**

Section A

(All Questions can be attended. Each Question Carries 3 Marks)

1. What is magnetic flux?
2. What do you meant by magnetic field intencity?
3. Give differential and integral forms of Gauss Law in magneto statics.
4. Comment on the term Poynting vector.
5. What is displacement current?
6. What do you meant by TEM wave?
7. What is a boundary in electrostatics?
8. Comment on the term polarization.
9. What do you meant by capacitance?
10. Comment on group velocity.

(Ceiling 24 Marks)

Section B

(All Questions can be attended. Each Question Carries 6 Marks)

11. State and prove Gauss law in electrostatics
12. State and explain Coulomb's Law.
13. State and explain Biot Savart's Law.
14. Derive energy stored in magnetic field.
15. Explain magnetic vector potential.
16. Differentiate TE and TM wave.
17. State and explain Poynting Theorem.
18. Ampere's circuital theorem is inconsistent. Justify

(Ceiling 36 Marks)

Section C

(Answer any one questions. Each question carries 10 Mark)

19. Explain Maxwell's equation. Give its integral form.
20. Derive transmission line equations from primary constants.

(10 Marks)

V SEMESTER B Sc (CUFYUGP) DEGREE EXAMINATIONS OCTOBER 2024

ELE5CJ302 Python Programming

(CREDITS :4)

Maximum time:2 hrs　　　　　　　　　　Maximum marks:70

Section A

(Answer all questions. Each carries 3 marks)　　(ceiling:24 marks)

1. What are the key features of Python that differentiate it from C?
2. What are the different ways to implement input and output operations in Python?
3. Explain the rules defining identifiers in Python?
4. How does the **if..else** statement differ from the **if** statement?
5. Explain how indexing works in Python arrays.
6. How can you iterate over the keys and values of a dictionary using a for loop?
7. Describe the process of creating a list in Python, highlighting its flexibility and common use cases.
8. Differentiate between a procedure-oriented approach and an object-oriented approach in programming.
9. Define the purpose of the **self** variable in Python classes.
10. Enumerate the different types of files that can be handled in Python.

Section B

(answer all questions. Each carries 6 marks)　　(ceiling:36 marks)

11. Explain the concept of operator precedence and associativity in Python with examples.
12. Differentiate between built-in datatypes and user-defined datatypes in Python.
13. Explain how to use the if…elif…else statements in Python to create a simple program that takes an integer input from the user and prints whether the number is less than 10, between 10 and 20, or greater than 20.
14. Explain the differences and use cases for break, continue, and pass statements in Python loops. Include an example where all three might be used within the same loop.

15. Describe the process of creating a list in Python, highlighting its flexibility and common use cases. Explain how elements can be accessed, updated, and deleted from a Python list, providing examples for each operation

16. Describe how to perform slicing on a string in Python to extract a substring. Include examples of slicing from both the beginning and the end of a string.

17. List and explain the key features of Object-Oriented Programming (OOPS).

18. Explore the concept of classes in Python, emphasizing their role in code structuring and organization. Discuss how objects are created from classes.

Section C

(Answer any one question. Each carries 10 marks) (1x10=10marks)

19. What is the basic structure of a while loop in Python? How can you create an infinite loop using the for statement in Python?

20. Discuss the concept of recursion in Python by explaining how a function can call itself. Provide an example of a recursive function, such as one that calculates the factorial of a number.

V SEMESTER B. Sc ELECTRONICS (CUFYUGP) DEGREE EXAMINATIONS

ELE5CJ303 SIGNALS AND SYSTEMS

Time: 2 Hrs **Max. Mark: 70**

Section A
(All Questions can be attended. Each Question Carries 3 Marks)

1. Define signal.
2. What do you meant by energy signal?
3. Classify signal as even and odd.
4. Differentiate causal and non causal system.
5. What do you meant by LTI system?
6. Define convolution sum.
7. Differentiate IIR and FIR system.
8. Comment on twiddle factor.
9. Define Impulse response.
10. Explain time shifting property of Z transform.

(Ceiling 24 Marks)

Section B
(All Questions can be attended. Each Question Carries 6 Marks)

11. Represent Unit impulse and unit ramp in graphical and sequential representation methods
12. Differentiate discrete time and continues time signals in detail.
13. Check whether the system $y(n) = 3x^2(n)$ is LTI or not. Explain.
14. Define and explain Fourier transform of discrete signals.
15. Find DTFT of $x(n) = n^2$ for $0 \leq n \leq 4$
16. Obtain the bit reversal order for N=16
17. Differentiate Laplace and Z transform in detail.
18. Find the Z transform of $x(n) = n\,u(n)$ for $n \leq 4$

(Ceiling 36 Marks)

Section C
(Answer any one questions. Each question carries 10 Mark)

19. Find the output of a system having an input $x(n) = \begin{cases} n & \text{for } n \leq 3 \\ 0 & \text{otherwise} \end{cases}$ and impulse response $h(n) = \{1,2,3,4\}$. Given the impulse response is periodic.
20. Find 4 point DFT of unit impulse using DIT and DIF FFT technique. Compare the results.

(10 Marks)

VI Semester B.Sc. (CUFYUGP) Degree Examinations October 2026

ELE6CJ304: OPTO ELECTRONICS

(credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[***All questions can be attended. Each question carries 3 marks***]

1. What is Stoke's shift?
2. Differentiate radiative and non radiative recombination
3. Explain Graded Junction and Heterojunction
4. Discuss about Silicon Photodiode.
5. What are the advantages of optical communication.
6. Explain total internal reflection in optical fiber
7. Write a short note on LCD
8. What is the working principle of PL and EL displays
9. Briefly explain Quantum well and Quantum dots
10. What is the relation between absorption and emission.

(***Ceiling 24 Marks***)

Section B (Short Essay type questions)

(All questions can be attended. Each question carries 6 marks.)

11. What is a phototransitor? Explain. Write the two disadvantages of photo transistors.
12. Explain Liquid Crystal Displays in detail. What is the advantage of LCD compared to cathode ray tube?
13. With necessary diagrams and equations explain the current flow in forward biased and reverse biased p-n junctions.
14. Explain PIN Phototransistor.
15. Differentiate spontaneous emission and stimulated emission
16. Draw the structure of Double Heterojunction and explain the working
17. Write short notes on a,Numerical aperture, b, Acceptance angle
18. Explain thermodetectors. Describe different types of thermal detectors

(***Ceiling 36 Marks***)

Section C (Essay type questions)

(Answer any one question. Each question carries 10 Marks)

19. Explain LASER principle and characteristics and give examples of different LASERs with suitable diagrams
20. Obtain an expression for optical power generated internally in the LED. Compare the characteristics of LED & LCD

(***1 x 10 =10 Marks***)

VI semester BSc Electronics (CUFYUGP) Degree Examinations, March 2028

ELE6CJ305 Analog and Digital Communication (Credits : 4)

Maximum Time: 2 Hrs **Maximum marks: 70**

Section A

[Answer All. Each question carries 3 Marks] (Ceiling: 24 Marks)

1. In an AM wave V_{max} = 3.5V and V_{min} = 1.3 V. What will be the percentage of modulation?
2. Define phase modulation.
3. Find the bandwidth of AM signal if the highest modulation frequency is 4 kHz.
4. What is a mixer?
5. Explain about image frequency.
6. Illustrate the function of AGC.
7. What is sampling?
8. Draw the PAM and PWM waveforms.
9. Explain ASK.
10. Explain about coherent BPSK detection.

Section B

[Answer All. Each question carries 6 Marks] (Ceiling: 36 Marks)

11. What is modulation? Explain the need for modulation.
12. Compare wideband FM and narrow band FM.
13. With neat block diagram explain the operation of time division multiplexing.
14. With necessary diagrams, explain the different pulse modulation schemes.
15. What is aliasing? How can it be avoided?

16. Explain about FSK modulation.
17. Explain the terms selectivity and sensitivity.
18. What is amplitude modulation? Obtain frequency spectrum of AM wave.

Section C

[Answer any one. Each question carries 10 Marks] (1X10= 10 Marks)

19. What is pulse code modulation? Explain a PCM transmission system.
20. Write short note on :
    a) IF amplifiers
    b) Pre emphasis and De emphasis

VI Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE6CJ306 Embedded System Design with IOT (Credits: 4)

Maximum Marks: 70 Section A Hour : 2 hour

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What is an embedded system, and what are its application areas?
2. Explain the hardware and software architecture of embedded systems.
3. How do you declare variables in embedded C programming?
4. List and briefly explain the different types of operators in Embedded C.
5. What are control flow statements in programming, and how are they used in Embedded C?
6. How do you interface a button, switch, LED, and OLED with the Arduino Uno board?
7. What is MQTT, and how is it used in IoT communication?
8. What are the hardware components of Node MCU?
9. How do you interface sensors with Node MCU in IoT applications?
10. What are the basics of IoT, and what are some common applications of IoT technology?

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Discuss the concept of embedded systems and their significance in various application areas.
12. Describe the hardware and software architecture of embedded systems,
13. Explain the usage of operators, including relational, equality, arithmetic, and logical operators.
14. Explain the usage of loops, including while, do-while, and switch statements, in Embedded C programming.
15. Explain the concept of arrays and pointers in Embedded C programming.
16. Discuss the pin configuration of Arduino Uno and its capabilities for interfacing with external components.
17. Describe the process of connecting Node MCU to Wi-Fi, configuring Wi-Fi settings, and sending/receiving data over Wi-Fi.
18. Explain how to control digital and analog pins on Node MCU using GPIO pins.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Explain the categories of embedded systems based on complexity, size, and real-time requirements.
20. Provide an overview of Arduino boards, including the Arduino Uno (R3). Discuss the pin configuration of Arduino Uno and its capabilities for interfacing with external components, such as sensors, actuators, and displays.

VII Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE7CJ401: Digital System Design (Credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What is asynchronous input in flip flops? Why are they called asynchronous?
2. Explain the difference between edge triggered and level triggered flip flops.
3. State and prove De Morgan's theorem for 2 variables
4. Define a two-level gate circuit and explain its limitations.
5. What is a hazard in a combinational circuit? Describe the types of hazards.
6. What is the purpose of state assignment in a sequential circuit?
7. Define: Register, Ripple counter, Synchronous counter.
8. What do you mean by state diagram?
9. Compare asynchronous and synchronous state machines.
10. What is the significance of IEEE standard logic types in VHDL?

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. What is Shift Register? Explain with the help of logic diagram 4 bit universal shift register.
12. What are prime implicants and essential prime implicants? simplify the Boolean function using K-Map and identify them $f(a,b,c,d)=\Sigma m(0,1,2,5,6,7,8,9,10,13,14,15)$
13. Design a carry look ahead 4-bit parallel adder. Show that the time for addition is independent of the length of operands
14. With the aid of block diagram clearly distinguish between a decoder and encoder
15. Compare between Combinational and Sequential circuits.
16. Explain Mealy and Moore model of a clocked synchronous sequential network.
17. Define state, present state, state diagram and state table.
18. Write VHDL code for 2x1Multiplexer.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Describe the working principle of Programmable Logic Array with block diagrams.
20. a) Design a counter to generate the repetitive sequence 0,3,5,7,4.

(OR)

b) Explain Bidirectional Shift Register with parallel load.

VII Semester B.Sc. (CUFYUGP) Degree Examinations October 2027

ELE7CJ402: ANTENNA AND RF TECHNOLOGY

(credits: 4)

Maximum Time: 2 hours   Maximum Marks: 70

Section A

[***All questions can be attended. Each question carries 3 marks***]

1. Define directivity of an antenna
2. What is a dipole antenna?
3. Define cut off frequency of a rectangular waveguide
4. List out the characteristics of TE waves.
5. What are the limitations of conventional tubes at microwave frequencies?
6. What is the use of directional coupler in microwave?
7. Obtain the relationship between characteristic impedance and propagation constant.
8. What is the need for impedance matching?
9. What is S-parameters and how do you measure it?
10. What is meant by SAR?

(***Ceiling 24 Marks***)

Section B (Short Essay type questions)

(All questions can be attended. Each question carries 6 marks.)

11. Derive the relationship between effective aperture and directivity of an antenna.
12. Distinguish between broad side and End fire array.
13. Explain rectangular micro strip patch antenna and explain its design steps.
14. Describe principle of operation of reflex klystron tube.
15. Explain the principle of operation of magnetron
16. Compare different RF transmission lines
17. Briefly explain the types and uses of Smith chart.
18. Write short notes on RFiD technology

(***Ceiling 36 Marks***)

Section C (Essay type questions)

(Answer any one question. Each question carries 10 Marks)

19. What is an antenna array? What are the types of antenna arrays, for each type explain it with array diagram and radiation pattern.
20. With the help of velocity diagram explain principle of two-cavity Klystron amplifier

(1 x 10 =10 Marks)

VII Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE7CJ403: Advanced Digital Signal Processing (credits: 4)

Maximum Time: 2 hours **Maximum Marks: 70**

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What are the differences between Fourier Series and Fourier transform?
2. Calculate the mean and variance for the auto correlation function of random signals.
3. What is effect on power spectrum due to up sampling and down sampling
4. Define bias, unbiased and asymptotically unbiased estimate.
5. Discuss about the filter bank implementation
6. Describe the file types in MATLAB.
7. Explain the parameter estimation using Yule-Walker method.
8. Explain the concept of aliasing
9. What are the basic arithmetic operators in MATLAB
10. Compare parametric and non- parametric methods of spectral estimation .

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Calculate the mean and variance of the auto correlation function of random signals.
12. Discuss about the rules on variables and function names in MATLAB.
13. Explain the following parametric methods to measure the spectrum of long duration signals.
    (i) AR; MA model
    (ii) ARMA model
14. Explain interpolation.
15. Explain the concept of multirate signal processing with spectral interpretation of decimation of a signal from 6 KHz to 2 KHz and spectral interpretation of interpolation of signal from2 KHz to 6 KHz .
16. Explain briefly the non-parametric methods for spectral estimation : (1) co-variance method (2) Welch method
17. Compute the 8-point DFT of the sequence x(n) = { 1,2,3,4,4,3,2,1} using DIT FFT algorithms
18. Describe continuous and discrete wavelet transform.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10marks)

19. Explain IIR and FIR filter realisations.
20. Explain poly phase decimation and interpolation using Z Transform.

VII Semester BSc Electronics (CUFYUGP) Degree Examinations, March 2026

ELE7CJ404 Control system Engineering (Credits : 4)

Maximum Time: 2 Hrs **Maximum marks: 70**

Section A

[Answer All. Each question carries 3 Marks] (Ceiling: 24 Marks)

1. Define transfer function.
2. What are the asymptotes in Root locus?
3. What do you mean by closed loop control system?
4. Explain about poles and zeros of the transfer function.
5. State Mason's gain formula.
6. Why are the test signals needed?
7. How is control systems classified?
8. What is the effect of feedback on stability?
9. Give the advantages of block diagram reperesentation.
10. Define impulse response of a system.

Section B

[Answer All. Each question carries 6 Marks] (Ceiling: 36 Marks)

11. Explain the unit step response of a first order system.
12. Explain about temperature control system.
13. How signal flow graphs are utilized to find the overall transfer function of a control system.
14. Explain the terms delay time and rise time in detail.
15. What is the importance of relative stability? Explain.
16. What is corner frequency in Bode plot.Explain.
17. Explain about summing point and branch point in block diagram

18. Sketch the root locus of the open loop transfer function:

$$G(s)H(s) = K/s(s+2)(s^2+2s+5)$$

Section C

[Answer any one. Each question carries 10 Marks] (1X10= 10 Marks)

19. Compare block diagram and signal flow graph methods in detail.
20. Sketch the Bode plot and determine the gain cross over frequency for the following system.

$$G(s) = 10/ (s(s+0.5s)(1+0.1s)$$

VII Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE7CJ405: Digital Image Processing (credits: 4)

Maximum Time: 2 hours **Maximum Marks: 70**

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Define pixel and explain its significance in digital image processing.
2. What is the difference between grayscale and color images?
3. What is histogram equalization, and how does it enhance image contrast?
4. Describe the process of image segmentation in digital image processing.
5. What is edge detection, and why is it important in image processing?
6. What is image sampling, and why is it important in digital image processing?
7. What is dithering in image processing?
8. Brief about the common D transforms used in image processing.
9. What are the uses of DCT and DST?
10. Brief about how Hadamard Transform is related to Walsh Transform.

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Explain the concept of the Slant Transform in the context of document analysis and recognition.
12. Describe the Haar Transform and its significance in image processing.
13. Explain the principle behind the Karhunen-Loève Transform (KLT) and its role in feature extraction.
14. Explain the concept of Singular Value Decomposition (SVD) and its significance in image processing.
15. Discuss the advantages of Wavelet Transform over traditional Fourier-based transforms.
16. Explain the concept of spatial averaging and its significance in image enhancement.
17. Explain the concept of gray-level interpolation and its role in image resizing.
18. Illustrate the application of Wiener filtering in improving image quality and preserving image details in noisy environments.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10marks)

19. Explain the concept of image segmentation and its importance in image processing and computer vision.
20. Discuss the application of neural networks in recognizing shapes from digital images.

VIII Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE8CJ406: OPTICAL FIBER COMMUNICATION

(credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[***All questions can be attended. Each question carries 3 marks***]

1. What do you understand by scattering loss ?
2. Why the refractive index of core and cladding are different? Which one has greater refractive index and why?
3. State Snell's Law.
4. Draw the structure of Optical fiber and explain
5. What are the advantages of optical communication.
6. Explain critical angle and total internal reflection in optical fiber
7. Write a short note on LED and its characteristics
8. Write and explain different types of Fiber to Fiber joints
9. Explain Photodiodes and Phototransistors
10. Draw a block diagram of fiber optic communication system and describe the function of each component

(***Ceiling 24 Marks***)

Section B (Short Essay type questions)

(All questions can be attended. Each question carries 6 marks.)

11. What is optical amplifiers?Explain SOA and EDFA
12. Explain the principle of LASER diode. What are the pumping techniques of LASER diode?
13. Discuss the linear scattering losses in optical fibers with respect to a) Rayleigh Scattering b) Mie Scattering
14. Differentiate between step index and Graded index fiber. How the rays do propagates in both fibers?
15. What is the difference between acceptance angle, critical angle and numerical aperture? A step index fiber has a core and cladding refractive index of 1.50 and 1.46 resp. what is the value of NA and acceptance angle of the fiber?
16. Which are the different splicing techniques. Explain any one technique

17. Write short notes on a, DFB Lasers b, Tunable DBR Lasers
18. Explain different types of losses in optical fiber communication

(***Ceiling 36 Marks***)

Section C (Essay type questions)

(Answer any one question. Each question carries 10 Marks)

19. Classify Fibers with respect to refractive index and number of modes and explain with suitable diagrams
20. Discuss various Dispersion mechanisms in detail

(***1 x 10 =10 Marks***)

VIII Semester B.Sc. (CUFYUGP) Degree Examinations October 2027

ELE8CJ407: SATELLITE AND RADAR SYSTEMS

(credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[***All questions can be attended. Each question carries 3 marks***]

1. State Kepler's law.
2. What are the geostationary satellites?
3. What are the advantages of TDMA over FDMA?
4. Define dilution of precision in GPS
5. State Friis transmission formula.
6. Define the term radar range resolution and write the equation.
7. Define Doppler Effect.
8. Express a relation between Doppler frequency shift and radial velocity of a moving target.
9. Define MTI radars.
10. What is Monopulse Tracking Radar?

(***Ceiling 24 Marks***)

Section B (Short Essay type questions)

(All questions can be attended. Each question carries 6 marks.)

11. Differentiate geostationary and geosynchronous satellite
12. List the differences between LEO and MEO satellites
13. What are the three main systems for tracking satellites? How can tracking systems be affected?
14. Explain in detail the Code division multiple access technique and lists its advantages
15. Explain the principle of operation of CW Doppler radar
16. Explain how range and Doppler measurements are performed using FM CW radar.
17. Explain the principle of operation of MTI radar
18. Distinguish between MTI and Pulse Doppler Radar.

(***Ceiling 36 Marks***)

Section C (Essay type questions)

(Answer any one question. Each question carries 10 Marks)

19. Illustrate the orbital parameters used for positioning a satellite. Estimate the suitable equations for look angles and the range for geostationary satellite.
20. Explain the basic principles of Radar and discuss about various parameters which improve the performance of the Radar.

(***1 x 10 =10 Marks***)

VIII Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE8CJ408: Optimisation Algorithms (credits: 4)

Maximum Time: 2 hours **Maximum Marks: 70**

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Distinguish between supervised and unsupervised learning?
2. What are classification and regression trees?
3.Brief about Gradient of a function.
4. Compare interior and exterior penalty function methods.
5.Mention the importance of fitness in genetic algorithm.
6. What are the features of CART algorithm?
7.How are genetic algorithms different from traditional methods?
8.Brief about constraint in optimisation.
9.Brief about penalty function.
10. Mention about non-gradient based optimization technique.

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Explain the activation function used in ANN.
12.Explain the binary decision tree structure used to solve classification problems.
13.Show that Newton's method finds the minimum of quadratic function in one iteration.
14. Explain Ant colony optimization.
15. Explain the concept of a local optimum in optimization problems. How does it differ from a global optimum?.
16. Describe the basic principles of genetic algorithms (GAs) in optimization. How do GAs maintain diversity within the population during the search process?
17. Explain the Marquardt Method in the context of nonlinear least squares optimization?
18. Explain the role of fitness functions in optimization algorithms. What characteristics make a fitness function suitable for a particular optimization problem?

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. What is travelling salesman problem? Explain.
20. Examine the role of constraint handling techniques in optimization algorithms. Discuss different approaches for handling constraints.

V Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE5EJ304: SEMICONDUCTOR FABRICATION TECHNOLOGY
(credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Define Lithography.
2. What is doping?
3. What are the main steps in wafer processing.
4. Write the advantages of MOS transistor over Bipolar transistor.
5. What is the role of Silicon Dioxide in IC fabrication.
6. Define Epitaxy. Explain various salient features of epitaxy.
7. What is Moore's Law? Explain.
8. What are the Advantages of ICs over Discrete Components.
9. Explain the Features of Monolithic IC Technology.
10. What is chemical vapour deposition.

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Explain the process of diffusion and ion implantation of adding impurities to a silicon structure**.**
12. Define the processes Lithography and Explain X- ray lithography.
13. What do you understand by dry etching and wet etching.
14. Explain in brief the growth mechanism of silicon dioxide.
15. Explain the process flow of the starting material to silicon wafer.
16. Elaborate the metallization process with the help of diagrams.
17. Give the flow chart of the complete NMOS fabrication process.
18. Write a short note on Clean room technology.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10mark)

19. Explain the Epitaxial Processes with neat diagram.
20. With neat sketches explain n–p–n bipolar transistor fabrication sequence.

V SEMESTER B.Sc. (CUFYUGP) DEGREE EXAMINATIONS OCTOBER 2024
ELE5EJ306 SMART MATERIALS
(CREDITS :4)

Maximum Time:2 hrs Maximum Marks:70

Section A

(Answer All. Each question carries 3 marks) (Ceiling:24 marks)

1. What are smart materials? Explain its applications in various fields.
2. Describe ultra-light materials?
3. List out the applications of MR fluids.
4. Explain in detail about Piezoelectric sensors.
5. What are the characteristics of Shape Memory Alloys
6. Explain Carbon Nanotube with properties
7. What are the applications of shape memory alloys?
8. Describe the parts of Magneto-Rheological Fluid?
9. List out the properties of nanomaterials?
10. List out the different microscopic techniques for the characterisation of nanomaterials?

Section B

(Answer All. Each question carries 6 marks) (Ceiling:36 marks)

11. What are the important fabrication techniques of nano-materials?
12. Explain the working principle of FESEM?
13. Give detailed classifications of smart materials?
14. Explain Magneto strictive Materials?
15. Explain classifications of nanomaterials with examples?
16. Explain vibration control using shape memory alloys?
17. List out the Properties & characteristics of MR fluids.
18. Briefly explain the applications of nanomaterials in different fields?

Section C

(Answer any one. Each question carries 10 marks) (1x10=10marks)

19. What do you mean by ER fluids? Explain with examples, the applications of ER fluids in different modes. Also state the advantages of ER fluids?
20. Explain with neat sketches the one-way and two-way shape memory effect?

VI Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE6EJ307: VLSI technology
(credits: 4)

Maximum Time: 2 hours   Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Explain the differences between combinational and sequential circuits. Why is this distinction important in VLSI design?
2. Describe the main differences between monolithic and hybrid ICs. How have these differences influenced the evolution of VLSI technology?
3. How do different VLSI design styles (e.g., full-custom, semi-custom, and standard cell) impact the design process and final device performance?
4. Discuss the role of delay models in addressing these issues and how different layout styles can mitigate performance degradation?
5. Explain the concept of partitioning in VLSI and Why is partitioning considered a critical step in the design process, and what are its primary objectives?
6. Describe the evolution of programmable logic devices from PAL and PLA to CPLD and FPGA.
7. Explain the role of logic blocks and interconnection resources in FPGA technology.
8. Describe the key resources found in FPGA technology. How do these resources enable the flexibility of FPGAs in various applications?
9. Why is Verilog considered a fundamental tool in the design and modeling of digital systems?
10. Compare and contrast behavioral Verilog with structural Verilog?

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Describe the digital logic design flow, emphasizing the review and application of combinational circuits within this process?
12. Describe the processes of floor planning and pin assignment in the context of VLSI physical design?
13. Detail the FPGA design flow from initial design entry to the final implementation process. Highlight the challenges encountered at each step and discuss the strategies employed to overcome these challenges?
14. Compare and contrast the FPGA offerings from Xilinx and Altera. Discuss the unique features and strengths of each?
15. Describe the role of Hardware Description Languages (HDL) in VLSI technology, with a focus on Verilog. Why is Verilog considered a fundamental tool in the design and modeling of digital systems?
16. Compare CPLD, PLA and PAL ?

17. Discuss the role of multiplexers and demultiplexers in VLSI design. In your discussion, explain how these components facilitate data management and signal routing in complex circuit designs.
18. Describe the digital logic design flow, emphasizing the review and application of combinational circuits within this process?

Section C

[Answer any one. Each question carries 10 marks] (1x10=10marks)

19. Evaluate the role of programming technologies (Static RAM, Anti Fuse, EPROM, and EEPROM) in the versatility and performance of FPGAs.
20. Expand on the modeling of sequential circuits, including Finite State Machines (FSM) and Finite State Machine with Datapath (FSMD), highlighting the unique considerations and challenges posed by each type.

VI SEMESTER B Sc(CUFYUGP) DEGREE EXAMINATIONS OCTOBER 2024

ELE6EJ309 Introduction to AI

(CREDITS :4)

Maximum time:2 hrs Maximum marks:70

Section A

(answer all questions. Each carries 3 marks) (ceiling:24 marks)

1. Define Artificial Intelligence and provide a brief overview of its goals.
2. Define the concept of rationality in the context of intelligent agents.
3. Explain the role of problem-solving agents in the field of AI.
4. Define a heuristic function in the context of search algorithms.
5. Define the term "constraint satisfaction problem."
6. What is the difference between a knowledge-based agent and a simple reflex agent?
7. Define First Order Predicate Logic. How is it used in knowledge representation?
8. Define robot planning in the context of artificial intelligence.
9. Briefly describe the process of sentiment analysis in NLP
10. Describe the difference between precision and recall in evaluating search results

Section B

(answer all questions. Each carries 6 marks) (ceiling:36 marks)

11. Describe the concept of intelligent agents and their dynamic interaction with environments. Discuss how agents perceive and act in response to their surroundings
12. List and briefly describe three diverse applications of AI
13. Discuss the strengths and weaknesses of uninformed and informed search strategies in the context of AI problem-solving. Include examples to illustrate your points.
14. Describe the backtracking algorithm for solving CSPs.
15. What is the difference between forward chaining and backward chaining inference?
16. What is ontological engineering, and why is it important in knowledge representation?

17. What are the key components of a natural language processing pipeline?

18. Describe the two main approaches to speech recognition: acoustic modeling and language modeling.

Section c

(answer any one question. Each carries 10 marks)

(1x10=10marks)

19. Elaborate on the significance of alpha-beta pruning in the context of the minimax algorithm. How does it improve efficiency?

20. Explain the role of logic in building intelligent agents. How does a knowledge-based agent use logic for decision-making?

VIII Semester B Sc(CUFYUGP) Degree Examinations October 2024
ELE8EJ409 Introduction To Machine Learning
(CREDITS :4)

Maximum time:2 hrs Maximum marks:70

Section A

(answer all questions. Each carries 3 marks) (ceiling:24 marks)

1. What is the goal of maximum likelihood estimation (MLE) in machine learning
2. What is the Bayesian approach in machine learning?
3. Define machine learning in simple terms. What distinguishes it from traditional programming?
4. What is overfitting in the context of regression?
5. What is the primary objective of SVM in classification?
6. What is the main goal of dimensionality reduction in machine learning?
7. What are some common similarity measures used in clustering algorithms?
8. Define model evaluation in machine learning.
9. Explain the concept of bootstrapping in machine learning.
10. Define ensemble methods in machine learning.

Section B

(answer all questions. Each carries 6 marks)

(ceiling:36 marks)

11. Differentiate between supervised and unsupervised learning.
12. Define Gaussian Mixture Models (GMMs) and their use in machine learning.
13. Differentiate between logistic regression and linear regression.
14. Briefly describe how a random forest works.
15. Explain the basic idea behind Hierarchical Agglomerative Clustering
16. What is the main purpose of using the Expectation-Maximization (EM) algorithm?
17. Briefly explain the concept of cross-validation and its benefits in model evaluation.
18. Discuss the significance of the Area Under the Curve (AUC) in the ROC curve. How does it indicate the performance of a binary classifier?

Section c

(answer any one question. Each carries 10 marks) (1x10=10marks)

19.Explain the role of perceptrons in the context of artificial neural networks. How do they form the building blocks of more complex networks?

20. Describe the concept of principal component analysis (PCA) and its role in dimensionality reduction. Explain how PCA transforms data into a lower-dimensional space while preserving essential information.

VIII Semester B.Sc. (CUFYUGP) Degree Examinations
October 2024 ELE8EJ411 Drone Technology
(credits: 4)

Maximum Time: 2 hours **Maximum Marks: 70**

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What is kinematics in robotics?
2. What is the role of sensors in robotics?
3. What is the difference between open-loop and closed-loop control systems?
4. What is SLAM and why is it important in robotics?
5. What are the main components of a quadcopter drone?
6. How does GPS assist in drone navigation?
7. What is the purpose of a flight controller in a drone?
8. What are some common applications of drones in industry?
9. What are the main categories of drones?
10. What is an Unmanned Aerial Vehicle (UAV)?

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Discuss the fundamental principles of flight and aerodynamics.
12. Explain the key principles that enable autonomous flight in modern drones and aircraft.
13. Discuss the symbiotic relationship between path planning and obstacle avoidance in robotic navigation.
14. Discuss the challenges and considerations involved in manually controlling drones.
15. Examine the role of autopilot systems and software in modern aviation and unmanned aerial vehicles (UAVs).
16. What are the key principles and methodologies involved in remote sensing?
17. Examine the significance of drone surveying and mapping in modern geospatial applications.
18. What are the key principles and standards guiding the responsible deployment and use of surveillance technologies?

Section C

[Answer any one. Each question carries 10 marks] (1x10=10marks)

19. Discuss the role and significance of sensors in the operation and functionality of drones with emphasis on GPS, IMU, LiDAR, and cameras.
20. How do drones revolutionize traditional practices and unlock new possibilities in

agriculture, construction, environmental conservation, public safety and surveillance?

VIII Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE8EJ413 Integrating AI with Flutter
(credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Define AI and name one AI application in mobile development
2. What is Flutter? Who developed Flutter?
3. Define machine learning. Differentiate between artificial intelligence and machine learning.
4. What is natural language processing (NLP)?
5. Explain the concept of machine learning algorithms in AI applications
6. Define widget in Flutter. List two features of the Flutter framework
7. Discuss the advantages of using Flutter for mobile app development
8. Describe the Flutter architecture.
9. Compare Flutter with other mobile app development frameworks.
10. Discuss the advantages of using Dart language for Flutter development

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Evaluate the benefits and drawbacks of different state management approaches in Flutter apps
12. Analyse the impact of UI design patterns in Flutter applications.
13. Discuss the significance of widget composition and inheritance in Flutter app development.
14. Analyze advanced state management patterns in Flutter apps.
15. Evaluate the usability and accessibility implications of different input methods and interaction patterns in Flutter apps.
16. Analyze the performance considerations of handling user input and gestures in Flutter apps.
17. Discuss the benefits of using ML Kit as a machine learning solution for Flutter apps
18. Discuss the steps involved in implementing language translation functionalities using ML Kit in a Flutter app.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10marks)

19. Explain how ML Kit's text classification models utilize natural language processing techniques to classify text data. Discuss the factors that may affect the accuracy of ML Kit's text classification predictions in Flutter apps.
20. Describe the process of integrating AI functionalities into Flutter apps using AI libraries and discuss the benefits for app developers and end-users.

V SEMESTER B.Sc. (CUFYUGP) DEGREE EXAMINATIONS OCTOBER 2024

ELE5EJ305 Computer Hardware & Network Maintenance (CREDITS :4)

Maximum Time:2 hrs Maximum Marks:70

Section A

(Answer All. Each question carries 3 marks) (Ceiling:24 marks)

1. Define the three primary components of a computer system and briefly describe the function of each.
2. Identify and describe the purpose of two input devices and two output devices in a computer system.
3. Discuss any two major considerations when upgrading laptop components.
4. What are the critical precautions that should be taken during assembly.
5. Discuss device drivers, operating system updates and firewall security.
6. Explain the concepts of PC tuning and overclocking.
7. Discuss the role of cooling solutions in maintaining system stability.
8. Explain two methods for backing up data.
9. Explain the differences between LAN and WAN.
10. What are network protocols, and why are they important?

Section B

(Answer All. Each question carries 6 marks) (Ceiling:36 marks)

11. Describe the sequence of steps that occur during the boot process of a computer.
12. What is the purpose of BIOS/UEFI in a computer system, and how does it differ from the operating system?
13. Describe the essential steps involved in assembling a PC. Highlight one critical precaution that should be taken during assembly.
14. Explain how users can customize their operating system environment in both Windows and Linux
15. Discuss the importance of upgrading PC components and provide examples of two upgrades that significantly enhance a computer's performance.
16. Identify two common hardware issues encountered in PC systems and discuss a repair technique for each.
17. Discuss the importance of network troubleshooting and mention two common tools used for diagnosing network issues.
18. Explain the significance of network security and list two measures that can be implemented to enhance the security of a network.

Section C

(Answer any one. Each question carries 10 marks) (1x10=10marks)

19. Outline the general process of installing an operating system (OS) such as Windows or Linux. Mention one critical step that must be followed for both OS types during installation.
20. Describe the key steps involved in setting up and configuring both a wired and a wireless network. Mention one advantage of each type of network.

V Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE5EJ307 POWER ELECTRONICS (Elective)
(Credits: 4)

Maximum Time: 2 hours **Maximum Marks: 70**

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What is a Snubber circuit?
2. What do you mean by second breakdown in power BJT?
3. Differentiate holding current from latching current
4. Define Threshold voltage of Power Mosfet
5. What are the advantages of GTO over SCR?
6. Define rectification and explain its significance in converting AC to DC.
7. What is meant by commutation of a SCR?
8. What is thermal runaway? How can it be avoided?
9. List two methods of voltage control employed in AC voltage controllers.
10. Describe the role of an induction coil in the induction heating process.

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. What are various methods for turning on the SCR?
12. Draw the two-transistor model of SCR and derive an expression for anode current.
13. Discuss the basic structure and working of power IGBT
14. Explain in detail the different SCR commutation methods.
15. Make a detailed comparison of different triggering circuits for the SCR.
16. Explain the operation of the Single phase AC voltage controller with RL load with a neat circuit diagram.
17. With the help of a suitable diagram, explain the principle of operation of step up DC choppers.
18. Draw the circuit of the Emergency lighting system and describe its operation.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Draw the circuit of the Single Phase bridge inverter and describe its operation. Draw the waveforms of various voltages involved.
20. Draw the block diagram and describe the working of Switched mode power supply.

VI Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE6EJ308: MEDICAL ELECTRONICS
(Credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A
[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What is dialyser?
2. What is a transducer?
3. Explain sodium pump?
4. Write a short note on MRI?
5. What is bioelectric potential?
6. Name the four factors that are considered in the design of biomedical instrument system
7. What is the significance of frequencies in EEG?
8. What is dialyser?
9. Write a short note on diathermy?
10. 10.What is ECG?

Section B
[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Explain different types of Electrodes?
12. Explain electrical safety in medical environment?
13. Explain nerve and muscle stimulators?
14. What are the requirements of physiological signal amplifier or biomedical pre amplifier?
15. What are the various parts of generalized instrumentation system?
16. What are the important parts of ECG recorder.
17. Differentiate Internal and External Pacemaker.
18. Explain the working principle of X-ray imaging?

Section C
[Answer any one. Each question carries 10 marks] (1x10=10marks)

19. Different types of biotelemetry systems?
20. Explain (a)Ultrasonography
    (b) Endoscopy
    (c) Thermography

VI Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE6EJ310 Mobile Communication (Credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A
[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Briefly explain the concept of wireless communication and its advantages over wired communication.
2. What is the purpose of Bluetooth technology and some of its applications?
3. Discuss the main challenges faced in wireless communication systems.
4. Briefly describe the principle of channel reuse and its impact on system capacity.
5. Explain a common interference mitigation technique used in cellular systems.
6. Describe the process of location update for a mobile station in a GSM network.
7. Briefly describe the types of services offered by GPRS (General Packet Radio Service).
8. Briefly describe the concept of High-Speed Downlink Packet Access (HSDPA) and its benefits.
9. Explain the concept of MIMO (Multiple-Input Multiple-Output) technology and its advantages in wireless communication.
10. What is the significance of IEEE standard logic types in VHDL?

Section B
[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Illustrate a simple block diagram of a basic wireless communication system, labelling the key components (e.g., antenna, modulator, demodulator).
12. Briefly explain the features and applications of Zigbee technology in wireless sensor networks.
13. Discuss the concept of handoff prioritisation strategies used in cellular systems to ensure seamless connectivity.
14. Explain the phenomenon of diffraction losses in radio wave propagation and its impact on cellular coverage.
15. Explain the role of the Mobile Switching Center (MSC) and Visitor Location Register (VLR) in call routing and location management within a GSM network.
16. Compare and contrast the Air Interface and Abis Interface in GSM, considering aspects like protocol, data format, and signalling.
17. Describe the packet scheduling techniques employed in HSUPA to improve uplink performance in 3G networks.
18. Explain the basic architecture of a WiMAX (Worldwide Interoperability for Microwave Access) network and its key features.

Section C
[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Discuss the evolution of GSM technology from EDGE (Enhanced Data Rates for GSM Evolution) towards higher data rate capabilities. Explain the key features and improvements introduced by EDGE.
20. Explain LTE system Architecture

VIII SEMESTER B.Sc. (CUFYUGP) DEGREE EXAMINATIONS OCTOBER 2024
ELE8EJ410 LIGHT AND AUDIO SYSTEMS ENGINEERING
(CREDITS :4)

Maximum Time:2 hrs Maximum Marks:70

Section A

(Answer All. Each question carries 3 marks) (Ceiling:24 marks)

1. What is meant by the term "color temperature"
2. Define amplitude, frequency, and phase in sound waves.
3. Define the role of a preamplifier in an audio system.
4. What a decibel (dB) is and why it is used to measure sound levels.
5. Why is it important to maintain correct polarity in loudspeaker connections?
6. Describe two factors to consider when placing loudspeakers in a room or venue.
7. Discuss the differences between LED, fluorescent, and halogen light sources
8. Explain two cutting-edge projection technologies.
9. Compare Dolby Atmos and DTS:X
10. Explain how Dolby Atmos utilizes object-based audio principles to enhance the home theatre experience.

Section B

(Answer All. Each question carries 6 marks) (Ceiling:36 marks)

11. Explain the difference between brightness and intensity
12. Describe a basic sound system model, including the key components from the sound source to the listener's ear.
13. Describe ambient, task, and accent lighting.
14. Define the concept of aspect ratio and discuss its importance in projection systems.
15. Describe how stage monitors are used in live performances and the key considerations for their placement on stage.
16. Describe the process of projection mapping onto irregular surfaces.
17. Explain the technology behind 3D projections and how they differ from standard projections.
18. Compare and contrast the use of different wire sizes and connectors in loudspeaker setups. Discuss how these choices can affect the overall performance of a sound system.

Section C

(Answer any one. Each question carries 10 marks) (1x10=10marks)

19. Describe the acoustical and electrical characteristics important for microphone performance. How do these characteristics influence microphone selection for different audio recording scenarios? Provide examples
20. Explain how the choice of projection surface can affect the quality of the projected image. Discuss three different types of surfaces and the scenarios in which each would be the most appropriate choice.

VIII SEMESTER B.Sc. (CUFYUGP) DEGREE EXAMINATIONS OCTOBER 2024

ELE8EJ412 FUNDAMENTALS OF ROBOTICS AND APPLICATIONS

(CREDITS :4)

Maximum Time:2 hrs Maximum Marks:70

Section A

(Answer All. Each question carries 3 marks) (Ceiling:24 marks)

1. Explain Robot Drive system and its types?
2. Briefly explain the characteristics of a robotic sensor?
3. Explain the components and structure of a robot arm ?
4. Explain about Robot anatomy in detail?
5. Explain End Effectors and its type?
6. Sketch and explain the four basic robot configurations classified according to the coordinate system. ?
7. What are the applications of robotics in Medical, Agricultural and Space field?
8. Classify the robot as per the type of control and mobility
9. What are the four basic robot configuration available commercially?
10. What are different robot programming languages?

Section B

(Answer All. Each question carries 6 marks) (Ceiling:36 marks)

11. Describe the tools as end effectors?
12. Explain different type of robots?
13. Describe robot control types?
14. Explain the significance of artificial intelligence in robotics?
15. Sketch a robot and name its parts.
16. Explain different types of robot sensors?
17. Explain unmanned vehicles?
18. Discuss the importance of microcontrollers in robotics?

Section C

(Answer any one. Each question carries 10 marks) (1x10=10marks)

19. With neat sketch explain any five types of mechanical grippers
20. Discuss about the salient features of different drive systems used in robots.

VIII Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE8EJ414 Industrial Automation
(credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Discuss three key benefits of implementing automation systems in manufacturing processes.
2. Define PID control and explain its three components: Proportional, Integral, and Derivative.
3. Define manually operated switches and provide two examples of their applications in everyday life.
4. Explain the function of a proximity sensor and discuss its advantages over other types of sensors for detecting the presence or absence of objects in industrial automation systems.
5. Explain the advantages of using solid-state relays (SSRs) over electromechanical relays in industrial control systems.
6. Discuss the function of process control valves as actuators in industrial automation systems.
7. What is the significance of 0-10V and 4-20mA in industrial communication?
8. Differentiate between PLC and SCADA systems, highlighting their respective functions.
9. Differentiate between analog and digital input/output (I/O) modules in PLC systems.
10. Explain the difference between on-delay timer and off-delay timer

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Explain different types of sensors used in industry and also specify their application area.
12. Explain the concept of speed control in DC motors using drives. Discuss the role of pulse-width modulation (PWM) techniques in varying the speed of a DC motor.
13. Describe the basic principles of speed control in AC motors using variable frequency drives (VFDs).
14. Discuss the evolution of PLCs and their significance in industrial automation. Explain how PLCs have replaced traditional relay-based control systems
15. Discuss the significance of sequential flowcharts in PLC programming. Explain how sequential flowcharts are used to organize and visualize the sequential control logic of industrial processes.
16. Discuss the functionality of counter instructions in PLC programming, including up-counters and down-counters.

17. Explain the operation and applications of Modbus and Profibus in industrial bus systems, including their differences and similarities.
18. Explore the fundamental principles of basic relay instructions and latching relays in PLC programming.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10marks)

19. Describe the basics of PLC programming, focusing on ladder logic and ladder diagrams. Provide examples to illustrate the representation of logical operations and control functions using ladder logic symbols.
20. Discuss the different types of sensors used for measuring temperature, pressure, force, displacement, speed, flow, level, humidity, and proximity in industrial automation. Explain the operating principles of each sensor type and provide examples of their applications in various industries.

I Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE1MN101: Electronic Fundamentals (Credits:

4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What is meant by passive electronic component? Give an example.
2. Define capacitance and also write its unit.
3. Name the majority and minority charge carriers in P type semiconductor.
4. Which are the 3 regions of a bipolar junction transistor?
5. Define the current gain of transistor in CE configuration.
6. Which are the different types of FET?
7. Draw the input and output wave forms of half wave rectifier.
8. Two capacitors C_1= 10µF and C_2 = 5µF are connected in parallel. Find the equivalent capacitance.
9. Write notes on LED.
10. What is meant by depletion layer of PN junction?

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Explain Kircoff's laws with necessary diagrams.
12. Explain the working of bridge rectifier with circuit diagram.
13. Draw and explain the block diagram of DC power supply.
14. Explain the different modes of operation of transistor with necessary diagrams.
15. Compare BJT and FET.
16. Compare between voltage source and current source.
17. Compare the ripple factor and efficiency of full wave and half wave rectifiers.
18. Explain the working of Zener diode.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Draw and explain the input and output characteristics of transistor in CE configuration.
20. Draw the circuit diagram and explain the working of CE transistor amplifier.

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II Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE2MN101: Fundamentals of Digital Electronics (Credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Convert the given decimal numbers into hexadecimal number.
   a) 255 b) 534
2. Find the 1's complement and 2's complement of binary number 100011100
3. Define POS form of expression. Give an example.
4. Draw the circuit of half subtractor?
5. Convert the decimal number 456 to into BCD.
6. Draw the logic circuit and truth table of EXOR gate.
7. What is meant by Gated D Latch?
8. Which are the types of RAM?
9. What is meant by De-multiplexer?
10. What are the two basic functions of shift registers?

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Explain 4 x1 multiplexer with logic circuit.
12. Explain the operation of JK flip flop with logic circuit.
13. State and prove De Morgan's theorems.
14. Briefly explain the steps involved in the minimization of SOP expression.
15. Explain general memory operations.
16. Briefly explain different types of ROM.
17. Explain 2 bit asynchronous counter using logic circuit.
18. State and prove any 5 rules of Boolean algebra.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Realize all other logic gates using NOR.
20. Explain the Johnson counter and Ring counter with logic circuits.

III Semester B.Sc. (CUFYUGP) Degree Examinations October2024

ELE3MN201: Arduino Coding with Embedded C(Credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Describe the function of the USB interface on the Arduino Uno board.
2. How does the Arduino Uno differ from other Arduino boards?
3. How do you program the Arduino Uno? Explain the software and the programming language used.
4. What is the microcontroller used in the Arduino Uno, and what are its specifications?
5. Write an Arduino program to display "Hello world" on to the serial monitor.
6. What is the purpose of the pinMode() function in Arduino programming? How is it used?
7. Explain the analogRead() function in Arduino. How is it used, and what does it return?
8. How many digital and analog pins are available on the Arduino Uno, and what are their functionalities?
9. What is the purpose of the setup () function in an Arduino sketch?
10. What is meant by a digital sensor? Give an example.

Section B

[Answer All. Each question carries 6 marks]

(Ceiling: 36 Marks)

11. Explain the features of AVR microcontroller.
12. Explain about the comparison operators with an example.
13. Explain about various data types of Arduino programming with an example
14. Write an Arduino program to display digital sensor value in serial monitor.
15. What is PWM (Pulse Width Modulation), and how is it implemented in Arduino programming?
16. Describe the for loop in Arduino programming. How is it used, and what are its components?
17. How do you declare variables in Arduino programming? Provide examples of different variable types.
18. Explain the process of interfacing a light-dependent resistor (LDR) with an Arduino Uno for light sensing.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. What is an Arduino UNO? Explain various components of the Arduino UNO board.
20. Explain the process of interfacing stepper motor with an Arduino Uno.

I Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE1MN102 Arduino Programming (Credits: 4)

Maximum Time: 2 hours

MaximumMarks:70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What is an embedded system, and what are its application areas?
2. Explain the hardware and software architecture of embedded systems.
3. How do you declare variables in embedded C programming?
4. List and briefly explain the different types of operators in Embedded C.
5. What are control flow statements in programming, and how are they used in Embedded C?
6. How do you interface a button, switch, LED, and OLED with the Arduino Uno board?
7. What is MQTT, and how is it used in IoT communication?
8. What are the hardware components of Node MCU?
9. How do you interface sensors with Node MCU in IoT applications?
10. What are the basics of IoT, and what are some common applications of IoT technology?

Section B

[Answer All. Each question carries 6 marks]

(Ceiling: 36 Marks)

11. Discuss the concept of embedded systems and their significance in various application areas.
12. Describe the hardware and software architecture of embedded systems,
13. Explain the usage of operators, including relational, equality, arithmetic, and logical operators.
14. Explain the usage of loops, including while, do-while, and switch statements, in Embedded C programming.
15. Explain the concept of arrays and pointers in Embedded C programming.
16. Discuss the pin configuration of Arduino Uno and its capabilities for interfacing with external components.
17. Describe the process of connecting Node MCU to Wi-Fi, configuring Wi-Fi settings, and sending/receiving data over Wi-Fi.
18. Explain how to control digital and analog pins on Node MCU using GPIO pins.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Explain the categories of embedded systems based on complexity, size, and real-time requirements.
20. Provide an overview of Arduino boards, including the Arduino Uno (R3). Discuss the pin configuration of Arduino Uno and its capabilities for interfacing with external components, such as sensors, actuators, and displays.

II Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE2MN102: IOT Hardware and Interfacing (Credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What is the role of sensors and transducers in Arduino projects?
2. Differentiate between analog and digital sensors.
3. How do you interface digital sensors with Arduino?
4. What are actuators in Arduino, and how are they used?
5. Explain how to interface servo motors with Arduino.
6. How do you interface relays with Arduino for control?
7. How do you connect Node MCU to Wi-Fi, and what are the steps involved in configuring Wi-Fi settings?
8. How do you connect Node MCU to Wi-Fi, and what are the steps involved in configuring Wi-Fi settings?
9. How do you interface sensors with Node MCU?
10. What are some applications of IoT in agriculture and precision farming?

Section B

[Answer All. Each question carries 6 marks]

(Ceiling: 36 Marks)

11. Explain the role of sensors and transducers in Arduino projects. What types of sensors are commonly used?
12. Describe the process of interfacing analog sensors with Arduino, including the connection setup and data acquisition.
13. Discuss some popular sensor modules and shields that are compatible with Arduino boards.
14. What types of actuators are commonly used, and how are they interfaced with Arduino boards?
15. Define PWM and its significance in controlling actuators such as motors and servos in Arduino projects. How does PWM vary the signal to regulate actuator speed or position?
16. How does Node MCU enable connectivity and data exchange in IoT projects?
17. Describe the hardware components of Node MCU and explain GPIO pins for digital and analog operations.
18. Discuss the scope and impact of IoT applications in various domains, including smart cities, industrial IoT (IIoT), agriculture, and home automation.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Explain the process of interfacing both analog and digital sensors with Arduino boards. Discuss the wiring configurations, programming techniques, and data acquisition methods involved in integrating sensors into Arduino-based systems.

20. Discuss the hardware components of Node MCU, its compatibility with Arduino, and its capabilities for Wi-Fi connectivity and data exchange in IoT projects.

III Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE3MN202 Python Programming for IOT Applications
(Credits: 4)
Maximum Marks: 70

Section A
[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. How does Python contribute to IoT development, and what are its key features that make it suitable for IoT projects?
2. Describe the fundamental concepts of Python programming, including variables, data types, and operators.
3. Discuss control flow in Python, focusing on loops and conditional statements.
4. Discuss data handling in Python
5. Provide an overview of actuators in Arduino
6. How is PWM used to vary the speed or position of actuators such as motors and servos?
7. Discuss IoT simulation environments and hardware platforms used for IoT development.
8. Explain endpoint interfacing in IoT and the process of connecting devices to simulation environments.
9. Provide an overview of IoT applications, their scope, and impact on various industries.
10. Explore the concept of smart cities

Section B
[Answer All. Each question carries 6 marks]
(Ceiling: 36 Marks)

11. Discuss the importance of choosing the right IDE for Python-based IoT development.
12. Describe the fundamental concepts of Python programming, including variables, data types and operators.
13. Explain the control flow mechanisms in Python, including loops and conditional statements.
14. Discuss the concept of functions in Python and their role in modular programming.
15. Explore Python's data structures .
16. Discuss file handling in Python and its relevance to IoT applications.
17. Provide an overview of actuators used in Arduino-based IoT projects.
18. Compare and contrast IoT simulation environments with hardware platforms used in IoT development.

Section C
[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Explore different IoT applications . How do these applications leverage IoT technologies to solve real-world challenges? Discuss the scope, impact, and future trends of IoT applications in various industries.

20. Describe control flow mechanisms in Python, including conditional statements and loops. How are these control flow structures used in IoT programming for decision- making and iterative processes?

I Semester B.Sc. (CUFYUGP) Degree Examinations October2024

ELE1MN103: Introduction to App Development (Credits: 4)

Maximum Marks: 70 Hour : 2

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What are the three main types of mobile applications? Give an example of each.
2. List two key differences between Android and iOS operating systems.
3. What is an Integrated Development Environment (IDE), and why is it important for mobile app development?
4. Describe the primary purpose of an app's front-end and back-end.
5. What is the main difference between Linear Layout and Relative Layout in Android development?
6. What role do widgets play in mobile app development? Name two commonly used widgets.
7. Explain the concept of event-driven programming with an example.
8. What is the purpose of XML in Android development?
9. Define 'variables' and 'data types' in the context of programming.
10. What are the basic principles of UI/UX design? Name two.

Section B

[Answer All. Each question carries 6 marks]
(Ceiling: 36 Marks)

11. Compare and contrast Android and iOS operating systems ?

12. Explain the process of setting up the Android Studio development environment. Include the steps for installation, configuring the Android SDK, and creating your first "Hello World" app?

13. Discuss the importance of UI/UX design in mobile app development?

14. Describe the basic layout types in Android development?

15. Outline the key components of an Integrated Development Environment (IDE) like Flutter. Describe how the IDE assists in app development, including features like code editing, debugging, and visual design tools?

16. Explain the concept of event-driven programming in mobile app development. Illustrate your answer by creating a basic app scenario that involves user interaction, such as a button click event?

17. Describe the process of designing a user interface using XML in Android Studio. Include an example of creating a simple layout with components like TextView, Button, and ImageView, and explain how these components are arranged within the layout.

18. Explain Variables, Data types and use of loops with example.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19.Discuss the key differences between developing mobile applications using traditional coding methods versus no-code tools? **(**In your answer, consider factors such as development speed, customization, complexity, and the learning curve. Provide examples of scenarios where each approach would be most suitable)

20. Evaluate the advantages and challenges of using Flutter for cross-platform mobile app development. Discuss how Flutter's architecture, widgets, and Dart programming language contribute to creating high-performance, visually appealing apps.

II Semester B.Sc. (CUFYUGP) Degree Examinations October ELE2MN103: Intermediate App Development

(Credits: 4)

Maximum Time: 2 hours **Maximum Marks: 70**

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What is Material Design, and how does it help improve the look and feel of an Android app?
2. How do you add a simple custom button widget in Flutter?
3. What is responsive design, and why is it important for mobile apps?
4. What is SQLite used for in Android app development?
5. What is the main difference between SQL and NoSQL databases?
6. How do you perform a basic HTTP request in Android to get data from an API?
7. Why are animations used in mobile apps, and can you give a basic example of an animation in Android?
8. What is Firebase, and what is one common use for it in mobile apps?
9. What does an API stand for, and why is it important in app development?
10. Name one tool in Android Studio that can help you find and fix bugs in your app.

Section B

[Answer All. Each question carries 6 marks]

(Ceiling: 36 Marks)

11. Explain how to implement Material Design in an Android app. Describe how you would use Material Components like buttons and text fields to enhance the app's user interface.
12. Describe the process of creating a custom widget in Flutter. How would you customize its appearance and functionality to suit a specific need in your app?
13. What are some basic techniques for making an app responsive to different screen sizes? Explain how you would use layouts like LinearLayout and ConstraintLayout in Android to achieve this.
14. How do you set up SQLite in an Android app for local data storage? Outline the steps involved in creating a database, adding data, and retrieving data.
15. Explain the basics of making an HTTP request in Android. How do you handle the response and update the app's user interface with the fetched data?
16. Describe the role of animations in mobile app development. Provide a simple example of how to add a fade-in animation to a view in Android.
17. What is Firebase, and how can you use it to manage data in a mobile app? Explain how you would set up Firebase in your app and perform basic CRUD operations.

18. What is an API, and how can it be used in Flutter apps? Describe how you would make an API call in Flutter and handle the data returned from the API.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Describe the process of creating a simple Android app using Material Design principles. Outline how you would set up the project, apply Material Design components like buttons and text fields, and test the app's appearance on different devices.
20. Explain the basics of setting up a Firebase database for an Android app. Describe the steps to integrate Firebase, perform simple data operations (like adding and retrieving data), and provide an example of how Firebase can be used to store user information.

III Semester B.Sc. (CUFYUGP) Degree Examinations October
ELE3MN203: Advanced App Development and Deployment
(Credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What is a class in Object-Oriented Programming, and how does it differ from an object?
2. Explain the role of the **Provider** package in Flutter for state management.
3. What is an AsyncTask in Android, and how is it used to handle background tasks?
4. What are Futures in Dart, and how do they help with asynchronous programming?
5. Name one tool used for performance testing in Android apps and briefly describe its purpose.
6. What is data encryption, and why is it important for app security?
7. How do you implement user authentication in an app? Give a brief overview of secure login methods.
8. What is App Store Optimization (ASO), and why is it important for app visibility?
9. Name one method of monetizing a mobile app and explain its basic concept.
10. What is the purpose of using Dart DevTools in Flutter development?

Section B

[Answer All. Each question carries 6 marks]

(Ceiling: 36 Marks)

11. Describe how to create a simple class in Dart and instantiate an object from it. Explain the concept of class properties and methods.
12. Explain how to use the **Riverpod** package for state management in Flutter. How does it differ from using **Provider**?
13. Discuss the role of Executors in handling background tasks in Android. How does it differ from using AsyncTask?
14. Outline the basic steps to optimize UI/UX in an app to improve responsiveness. Provide examples of techniques to enhance the user experience.
15. Describe how memory management can impact app performance. Provide examples of strategies to reduce memory usage in an Android app.
16. Explain how to use Android Studio Profiler to analyze and improve app performance. What are some key metrics you can monitor?
17. Discuss the common threats and vulnerabilities in app security. How can you secure user data to protect it from these threats?
18. Provide a brief overview of the process of publishing an app on the Google Play Store. What are the key steps involved?

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Explain the concept of state management in Flutter.

20. Describe the steps involved in securing an API?

I SEMESTER B Sc(CUFYUGP) DEGREE EXAMINATIONS OCTOBER 2024
ELE1VN101Fundamentals of ArtificialIntelligence
(CREDITS :4)

Maximum time:2 hrs. Maximum marks:70

Section A

(Answer all questions. Each carry 3 marks) (ceiling:24 marks)

1. Define Artificial Intelligence and provide a brief overview of its goals.
2. Define the concept of rationality in the context of intelligent agents.
3. Explain the role of problem-solving agents in the field of AI.
4. Define a heuristic function in the context of search algorithms.
5. Define the term "constraint satisfaction problem."
6. What is the difference between a knowledge-based agent and a simple reflex agent?
7. Define First Order Predicate Logic. How is it used in knowledge representation?
8. Define robot planning in the context of artificial intelligence.
9. Briefly describe the process of sentiment analysis in NLP
10. Describe the difference between precision and recall in evaluating search results

Section B

(answer all questions. Each carries 6 marks) (ceiling:36 marks)

11. Describe the concept of intelligent agents and their dynamic interaction with environments. Discuss how agents perceive and act in response to their surroundings
12. List and briefly describe three diverse applications of AI
13. Discuss the strengths and weaknesses of uninformed and informed search strategies in the context of AI problem-solving. Include examples to illustrate your points.
14. Describe the backtracking algorithm for solving CSPs.
15. What is the difference between forward chaining and backward chaining inference?
16. What is ontological engineering, and why is it important in knowledge representation?

17. What are the key components of a natural language processing pipeline?

18. Describe the two main approaches to speech recognition: acoustic modeling and language modeling.

Section c

(answer any one question. Each carries 10 marks)

(1x10=10marks)

19. Elaborate on the significance of alpha-beta pruning in the context of the minimax algorithm. How does it improve efficiency?

20. Explain the role of logic in building intelligent agents. How does a knowledge-based agent use logic for decision-making?

II Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE2VN101: MOBILE PHONE TECHNOLOGY (Credits: 4)
Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Briefly compare two different mobile phone form factors in terms of user experience. (e.g., flip phone vs. touchscreen phone)
2. List two functionalities of Bluetooth headphones that regular headphones lack.
3. Describe the key difference between LCD and TFT display technologies.
4. Explain the purpose of a display flex cable in a mobile phone.
5. What safety precaution is most important when soldering electronic components?
6. How can a technician identify a faulty microphone on a mobile phone?
7. What is the main benefit of updating a mobile phone's operating system?
8. Briefly explain the concept of IMEI number and its significance.
9. Name two common types of memory cards used in mobile phones.
10. What does CPU stand for in the context of mobile phones?

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Describe the advantages and disadvantages of two different mobile phone opening mechanisms (e.g., screw type vs. lock type). Discuss the tools typically required for each mechanism.
12. Compare and contrast the three main types of mobile phone displays (LCD, TFT, STN) in terms of technology, viewing angles, power consumption, and suitability for different phone models.
13. Imagine you are troubleshooting a phone with a malfunctioning display. Explain the steps involved in diagnosing the problem. List some possible causes of display issues and potential repair procedures.
14. Discuss the importance of backing up data on a mobile phone before performing a software update or formatting process. What are the potential consequences of not backing up data?
15. Explain the concept of soldering and desoldering in mobile phone repair. Describe the tools and techniques used for safe and effective soldering practices.

16. Explain the concept of mobile operating systems (OS) and discuss two common mobile OS platforms (e.g., Android, iOS). Highlight the functionalities and features managed by the OS.
17. Explain how you would identify potential causes and possible solutions to resolve the software problem.
18. A customer brings in a phone with no sound. Explain how you would identify the faulty component and potential repair solutions.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. a) Discuss the different types of soldering tools and techniques used for safe and effective repairs on SMT components.

(OR)

b) Describe the importance of proper solder selection and flux usage in the soldering process.

20. a) Discuss different software troubleshooting techniques (e.g., restarting the phone, clearing app cache) that can be attempted before resorting to a factory reset.

(OR)

b) Compare and contrast two common mobile operating systems (e.g., Android, iOS) focusing on their functionalities, features, update processes, and security considerations.

III Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE3VN201: Robotics and Drone Technology (credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. What is kinematics in robotics?
2. What is the role of sensors in robotics?
3. What is the difference between open-loop and closed-loop control systems?
4. What is SLAM and why is it important in robotics?
5. What are the main components of a quadcopter drone?
6. How does GPS assist in drone navigation?
7. What is the purpose of a flight controller in a drone?
8. What are some common applications of drones in industry?
9. What are the main categories of drones?
10. What is an Unmanned Aerial Vehicle (UAV)?

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Discuss the fundamental principles of flight and aerodynamics.
12. Explain the key principles that enable autonomous flight in modern drones and aircraft.
13. Discuss the symbiotic relationship between path planning and obstacle avoidance in robotic navigation.
14. Discuss the challenges and considerations involved in manually controlling drones.
15. Examine the role of autopilot systems and software in modern aviation and unmanned aerial vehicles (UAVs).
16. What are the key principles and methodologies involved in remote sensing?
17. Examine the significance of drone surveying and mapping in modern geospatial applications.
18. What are the key principles and standards guiding the responsible deployment and use of surveillance technologies?

Section C

[Answer any one. Each question carries 10 marks] (1x10=10marks)

19. Discuss the role and significance of sensors in the operation and functionality of drones with emphasis on GPS, IMU, LiDAR, and cameras.
20. How do drones revolutionize traditional practices and unlock new possibilities in

agriculture, construction, environmental conservation, public safety and surveillance?

VIII Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE8VN301 AI and Flutter (credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Define AI and name one AI application in mobile development
2. What is Flutter? Who developed Flutter?
3. Define machine learning. Differentiate between artificial intelligence and machine learning.
4. What is natural language processing (NLP)?
5. Explain the concept of machine learning algorithms in AI applications
6. Define widget in Flutter. List two features of the Flutter framework
7. Discuss the advantages of using Flutter for mobile app development
8. Describe the Flutter architecture.
9. Compare Flutter with other mobile app development frameworks.
10. Discuss the advantages of using Dart language for Flutter development

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Evaluate the benefits and drawbacks of different state management approaches in Flutter apps
12. Analyse the impact of UI design patterns in Flutter applications.
13. Discuss the significance of widget composition and inheritance in Flutter app development.
14. Analyze advanced state management patterns in Flutter apps.
15. Evaluate the usability and accessibility implications of different input methods and interaction patterns in Flutter apps.
16. Analyze the performance considerations of handling user input and gestures in Flutter apps.
17. Discuss the benefits of using ML Kit as a machine learning solution for Flutter apps
18. Discuss the steps involved in implementing language translation functionalities using ML Kit in a Flutter app.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10marks)

19. Explain how ML Kit's text classification models utilize natural language processing techniques to classify text data. Discuss the factors that may affect the accuracy of ML Kit's text classification predictions in Flutter apps.
20. Describe the process of integrating AI functionalities into Flutter apps using AI libraries and discuss the benefits for app developers and end-users.

I Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE1VN102: BASICS OF ELECTRICAL AND ELECTRONICS
(credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Explain how a resistor value is measured using multimeter.

2. What are the key parameters used to describe an AC waveform?

3.Explain the concept of power factor. Why it is important in AC power systems.

4. Differentiate between re-wireable fuses and HRC (High Rupturing Capacity) fuses.

5. Describe the differences between pipe earthing and plate earthing.

6. Explain the concept of voltage drop in cables.

7. Define the role of a transformer in electrical systems and list the key parts of a transformer.

8.What are the applications of LCD in electronic devices.

9.Identify a thermistor and explain its response to changes in temperature.

10. Name common tools and materials used for soldering

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Describe the process of measuring power and energy in an AC circuit using a watt meter and energy meter .

12. Compare and contrast resistive, inductive and capacitive loads in terms of their response to AC signals and their impact on power consumption in a circuit.

13. Discuss the difference between line and phase values in three-phase circuits.

14. Describe the construction and working principle of three-phase induction motors.

15. Explain the purpose of MCBs, MCCBs and ELCBs in electrical installations.

16.Explain the operation of an LDR and how its resistance varies with light intensity.

17. Describe the construction and working of LED strips .

18. Explain the working principle of a battery charging circuit and functions of each block in the diagram.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10mark)

19. Provide a detailed explanation of the layout and circuit diagrams for a typical household wiring installation.

20. Design a step-by-step procedure for soldering electronic components onto a PCB, ensuring proper alignment and connection.

II Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE2VN102 Solar Power Technology (credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Define voltage and current. Provide an example illustrating the relationship between them in an electrical circuit.
2. Explain the difference between DC power and AC power. Give an example of a device that operates on each type of power.
3. Mention the significance of electrical grounding in ensuring safety and preventing electrical hazards.
4. Identify three types of common electrical tools and equipment used in electrical installations, and outline general safety precautions associated with their use.
5. List three electrical safety rules and explain why they are essential to follow in any electrical work environment.
6. Explain the function of a solar cell and how it converts sunlight into electricity, with reference to the photovoltaic effect.
7. Define the rating of a solar PV module and explain how it is determined.
8. Describe two important parameters of solar cells and their significance in determining the overall efficiency of a solar PV system.
9. Define MPPT and its significance in solar PV system.
10. Mention the important battery parameters that defines its capacity

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Explain the procedure for measuring earth resistance and insulation resistance in an electrical system.
12. Explain the difference between thermal and photovoltaic solar technologies, providing examples of their respective applications.
13. Compare different types of solar cell technologies in terms of efficiency, cost, and performance.
14. Explain the concept of connecting PV modules in series and parallel configurations, including their effects on voltage, current, and power.
15. Define on-grid, off-grid, and hybrid solar PV systems, highlighting their distinct features and suitability for different scenarios.
16. Describe the basic functions of a battery, a charge controller, and an inverter in a solar PV system.
17. Explain various types of converts used in the solar PV system.
18. Explain the concept of net metering and its benefits for solar PV system owners and utility providers.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10marks)

19. Explain in detail various solar energy applications.
20. Discuss the technical standards and specifications that need to be considered when designing an on-grid rooftop solar system, highlighting their impact on system performance and safety.

III Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE3VN202 Consumer Electronics (Credits: 4)

Maximum Time: 2 hours Maximum Marks: 70

Section A

[Answer All. Each question carries 3 marks] (Ceiling: 24 Marks)

1. Explain the principle of operation of a microwave oven.
2. What are the advantages of front-loading washing machines over top-loading ones?
3. Which are the three components of an air conditioning system?
4. What are the care and cleaning instructions for the microwave oven?
5. Draw the simple block diagram of a digital clock.
6. How does insulation contribute to the efficiency of a refrigerator?
7. What role does the thermostat play in a refrigerator?
8. Why is the pump important in a washing machine?
9. How does a washing machine work?
10. Which are the main components of a dishwasher?

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 36 Marks)

11. Mention the types of a microwave oven?
12. Explain the features of the washing machine.
13. Explain the microwave oven safety instructions.
14. Explain the working of an Air Conditioning system.
15. How servicing the electronic Calculators
16. Explain the barcode scanner system
17. Explain the working of vacuum cleaners.
18. What is a Unitary Air Conditioning System?

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

19. Explain the LCD timer with alarm in the washing machine
20. Describe the Internal Organization of a Calculator and explain the servicing of it.

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VIII Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE8VN302 Light and Sound Engineering (Credits :4)

Maximum Time:2 hrs Maximum Marks:70

Section A

(Answer All. Each question carries 3 marks) (Ceiling:24 marks)

1. What is meant by the term "color temperature"
2. Define amplitude, frequency, and phase in sound waves.
3. Define the role of a preamplifier in an audio system.
4. What a decibel (dB) is and why it is used to measure sound levels.
5. Why is it important to maintain correct polarity in loudspeaker connections?
6. Describe two factors to consider when placing loudspeakers in a room or venue.
7. Discuss the differences between LED, fluorescent, and halogen light sources
8. Explain two cutting-edge projection technologies.
9. Compare Dolby Atmos and DTS:X
10. Explain how Dolby Atmos utilizes object-based audio principles to enhance the home theatre experience.

Section B

(Answer All. Each question carries 6 marks) (Ceiling:36 marks)

11. Explain the difference between brightness and intensity
12. Describe a basic sound system model, including the key components from the sound source to the listener's ear.
13. Describe ambient, task, and accent lighting.
14. Define the concept of aspect ratio and discuss its importance in projection systems.
15. Describe how stage monitors are used in live performances and the key considerations for their placement on stage.
16. Describe the process of projection mapping onto irregular surfaces.
17. Explain the technology behind 3D projections and how they differ from standard projections.
18. Compare and contrast the use of different wire sizes and connectors in loudspeaker setups. Discuss how these choices can affect the overall performance of a sound system.

Section C

(Answer any one. Each question carries 10 marks) (1x10=10marks)

19. Describe the acoustical and electrical characteristics important for microphone performance. How do these characteristics influence microphone selection for different audio recording scenarios? Provide examples
20. Explain how the choice of projection surface can affect the quality of the projected image. Discuss three different types of surfaces and the scenarios in which each would be the most appropriate choice.

I semester BSc Electronics (CUFYUGP) Degree Examinations, October 2024
ELE1FM105 Computer Hardware (Credits : 3)

Maximum Time: 1.5 Hrs Maximum marks: 50

Section A

[Answer All. Each question carries 2 Marks] (Ceiling: 16 Marks)

1. List out any two storage devices?
2. What is the 2's compliment of 1010 100.
3. Draw schematic diagram of EXOR gate. Give its truth table.
4. What is an ASCII code?
5. Differentiate bit and byte.
6. State De Morgan's theorems.
7. Find Hexa decimal equivalent of decimal number 16?
8. What is the function of ALU?
9. State any two Boolean laws.
10. Explain about SSD.

Section B

[Answer All. Each question carries 6 Marks] (Ceiling: 24 Marks)

11. Distinguish editor, compiler, assembler and interpreter.
12. Draw the basic block diagram of a computer. Explain.
13. Explain about malwares.
14. Compare between system software and application software.
15. Differentiate RAM and ROM.

Section C

[Answer any one. Each question carries 10 Marks] (1X10= 10 Marks)

16. Explain the different generations of computers in detail.
17. Which are the basic logic gates and universal gates. Explain its operations with the help of truth tables.

II semester BSc Electronics (CUFYUGP) Degree Examinations, October 2024
ELE2FM106 Mobile App Development
(Credits: 3)

Maximum Time: 1.5 Hrs   Maximum marks: 50

Section A

[Answer All. Each question carries 2 Marks]   (Ceiling: 16 Marks)

1. What are the primary types of mobile phones available today?
2. How do the features of modern smartphones differentiate them from older mobile phones?
3. What are the main features of operating systems used?
4. How do Android OS and iOS compare in terms of user experience and customization options?
5. explain the concept of mobile computing and its significance today?
6. What are the foundational concepts of mobile app development?
7. What key features should a mobile app development tool provide?
8. What are the important menus found in mobile app development tools and their functions?
9. What are the important menus found in mobile app development tools and their functions?
10. How do no-code app builders simplify the app development process for non-technical users?

Section B

[Answer All. Each question carries 6 Marks]   (Ceiling: 24 Marks)

11. What role do databases and user interfaces play in mobile app development?
12. compare the features of different no-code app builders like Jotform, Bubble, and Glide?
13. What are the basics of coding languages like JavaScript and HTML in mobile app development?
14. What are the key features, advantages, and disadvantages of using React Native for mobile app development?
15. What are the key factors to be considered while designing a mobile app considering usability and scalability?

Section C

[Answer any one. Each question carries 10 Marks] (1X10= 10 Marks)

16. Compare any five mobile app development tools with coding.
17. What are the main operating systems used in mobile phones?

III Semester B.Sc. (CUFYUGP) Degree Examinations October 2024

ELE3FV108 GREEN ENERGY FOR SUSTAINABLE DEVELOPMENT

(credits: 3)

Maximum Time: 1.5 hours Maximum Marks: 50

Section A

[Answer All. Each question carries 2 marks] (Ceiling: 16 Marks)

1. What is ozone depletion, and how does it occur?
2. Explain the concept of carbon credits.
3. What does UNFCCC stand for, and what is its purpose?
4. Briefly explain the significance of COP (Conference of the Parties) in the context of climate change negotiations.
5. Identify two disadvantages of relying on oil for energy production.
6. Define renewable energy and briefly explain its significance in the context of sustainable development.
7. Describe solar PV technology used for harnessing energy from solar power and its potential advantages.
8. Briefly explain the objectives of the National Solar Mission and its role in promoting solar energy adoption in India.
9. What are the main goals of the National Hydrogen Mission, and how does it contribute to India's energy transition?
10. Describe the key functions of the Central Electricity Authority and its role in regulating the electricity sector in India.

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 24 Marks)

11. Discuss the impacts of climate change on global ecosystems and human societies, providing specific examples.
12. Compare India's energy production and consumption patterns with the global energy scenario. Highlight at least three key differences and their implications for energy security and sustainability.
13. Describe the different types of conventional energy sources used in Industry
14. Discuss the environmental impacts of emissions from conventional energy sources on air quality, water bodies, and land ecosystems, highlighting the key pollutants involved in each case.
15. What is the purpose of environmental standards? Provide a brief explanation of one method used for measuring environmental pollutants and its significance in ensuring compliance with regulatory requirements.

Section C

[Answer any one. Each question carries 10 marks] (1x10=10marks)

16. Compare and contrast the potential of solar, wind, hydro, biomass, and ocean energy sources in meeting global energy demands. Discuss their merits and demerits.
17. Analyse the challenges and opportunities associated with integrating renewable energy sources into India's energy mix. Discuss the roadmap for achieving ethanol blending targets and its implications for energy security and environmental sustainability.

IV Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE4FV110 E-Waste Management (credits: 3)

Maximum Time: 1.5 hours Maximum Marks:

50

Section A

[Answer All. Each question carries 2 marks] (Ceiling 16 marks)

1. Which are the different sources of E-wastes? And which sector is the highest contributor?
2. Why do we need to recycle E-waste
3. How will you forecast the trend of E-waste generation for the year 2050?
4. What are the conclusions that can be derived from economic assessment of e-waste?
5. What are the objectives of E-waste management rules?
6. What are the responsibilities of manufacturers according to the implementation of E-waste rules 2011?
7. Which are the different stages of E-waste recycling?
8. What is meant by the process of refining
9. What is glass to glass recycling?
10. What are the effects of Nickel Exposure

Section B

[Answer All. Each question carries 6 marks] (Ceiling 24 marks)

11. Comment on the recycling of E waste in the metro cities of India.
12. Explain what is EPR
13. Briefly explain about Basel convention.
14. What are the basic principles of E-waste management.
15. What are the essential factors of global waste trade economy?

Section C

[Answer any one. Each question carries 10 marks] (1x10=10 marks)

16. Write an essay about environmental implications of E-waste
17. Briefly outline the process of energy recovery from electronic waste.

V Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE5FS112 Computer Aided Design and 3D Printing
(credits: 3)

Maximum Time: 1.5 hours Maximum Marks: 50

Section A

[Answer All. Each question carries 2 marks] (Ceiling: 16 Marks)

1. What is layout of resistance in PCB design
2. Mention key components in PCB design process
3. Explain the purpose of etching process
4. Mention the role of soldering fluxes in facilitating soldering and ensuring reliable joints.
5. What are the advantages of 3D printing models?
6. Explain the concept of binder jet technology
7. Define data loss in 3D printing process.
8. Explain the advantages of SMT over through-hole technology.
9. List the commonly used solder alloys and their compositions.
10. What is ceramic process in 3Dprinting?

Section B

[Answer All. Each question carries 6 marks] (Ceiling: 24 Marks)

11. Briefly explain various types of PCB board designs used in industry.
12. Describe the different types of additive manufacturing techniques
13. Briefly discuss the significance of each material type in the 3D printing process.
14. Discuss various forms of raw materials used in 3D printing process
15. Explain various application domains of 3D printing

Section C

[Answer any one. Each question carries 10 marks] (1x10=10marks)

16. Explain in detail the various steps involved in 3D printing technology
17. Explain in detail the various steps involved in PCB design

VI Semester B.Sc. (CUFYUGP) Degree Examinations October 2024
ELE6FS113 EV Technology
(credits: 3)

Maximum Time: 1.5 hours   Maximum Marks: 50

Section A

[Answer All. Each question carries 2 marks]   (Ceiling: 16 Marks)

1. Which are the main components of an Electric Vehicle and their functions
2. State two advantages of Electric Vehicles (EVs) over Internal Combustion Engine Vehicles (ICEVs)
3. What is in-wheel drive
4. What is the main difference between HEV and PHEV
5. Name two advantages of hydrogen fuel cells over traditional internal combustion engines.
6. Explain the concept of battery swapping stations and their significance in EV charging.
7. What is the purpose of equalizing batteries, and when is it typically performed?
8. Explain the concept of regenerative braking in EVs.
9. Define AUTOSAR and its role in automotive software development.
10. Explain the purpose of the CAN protocol in vehicle communication systems.

Section B

[Answer All. Each question carries 6 marks]   (Ceiling: 24 Marks)

11. Discuss the classification of HEV based on the electric energy utilization.
12. Explain the various architectures used in HEV configuration.
13. Compare and contrast different battery parameters. How do these parameters affect battery operation and efficiency?
14. Compare and contrast domestic and public charging infrastructures for Electric Vehicles (EVs). Discuss the advantages and limitations of each type of charging infrastructure in terms of convenience, accessibility, and charging speed.
15. Define EMS and BMS in the context of Electric Vehicles (EVs).

Section C

[Answer any one. Each question carries 10 marks]   (1x10=10marks)

16. Compare and contrast three types of Electric Vehicle (EV) motors: Brushless DC Motor, Switched Reluctance Motor, and Induction Motor. Analyse the performance characteristics of each motor type, including speed-torque characteristics, power output and efficiency.

17. Discuss and compare different types of battery technologies used in EV industry. Describe the charging and discharging characteristics of these batteries