Sri Sivasubramaniya Nadar College of Engineering

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Regulation 2024

Curriculum and Syllabi

for

B. E in Electronics and Communication Engineering

Sri Sivasubramaniya Nadar College of Engineering
(An Autonomous institution, Affiliated to Anna University Chennai)

Department of Electronics and Communication Engineering

B. E in Electronics and Communication Engineering

VISION

- To be in a position of enhanced national and global reputation as a department offering excellent educational programmes and undertaking internationally recognized research and development activities in electronics and communication engineering.

MISSION

- Continued focus on excellence in teaching and learning by investing in faculty and staff development and resources.
- Promoting an all-round development of our students through curricular and co- curricular activities that instill a spirit of social responsibility, innovation, creativity and entrepreneurship.
- Attracting a larger number of the best students at both the graduate and undergraduate level.
- Promoting high-quality research leading to publications in reputed journals and patents.
- Building partnerships with leading academic institutions and industries.
- Nurturing a learning and work environment that makes the department one of the best ECE communities for students, faculty and staff.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. **CORE KNOWLEDGE DEVELOPMENT:**
   Be competent in applying electronics and communication engineering principles to develop socially and environmentally acceptable engineering solutions.

2. **PROFESSIONAL DEVELOPMENT:**
   Find fulfilling career in electronic and communication engineering or associated industries or higher education and research, or as entrepreneurs.

3. **ATTITUDE TOWARDS LIFELONG-LEARNING:**
   Develop the ability and attitude to adapt to evolving technological and social challenges.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to

1. **Engineering Knowledge:**

   Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

2. **Problem Analysis:**

   Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).

3. **Design/Development of Solutions:**

   Design creative solutions for complex engineering problems and design/develop systems/components/ processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society, and environment as required. (WK5).

4. **Conduct Investigations of Complex Problems:**

   Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

5. **Engineering Tool Usage:**

   Create, select, and apply appropriate techniques, resources, and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6).

6. **The Engineer and The World:**

   Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture, and environment. (WK1, WK5, and WK7).

7. **Ethics:**

   Apply ethical principles and commit to professional ethics, human values, diversity, and inclusion; adhere to national & international laws. (WK9).

8. **Individual and Collaborative Teamwork:**

   Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams

9. **Communication:**

   Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

10. **Project Management and Finance:**

    Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

Life-Long Learning:

Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8).

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Design, develop and analyze electronic systems through application of relevant mathematics and engineering principles

PSO2: Design, develop and analyze communication systems through application of fundamentals from wireless communication network, signal processing, and RF & electromagnetics

PSO3: Adapt to emerging electronics and communication technologies and develop innovative solutions for existing and newer problems

PEOs mapping with POs and PSOs

PEOs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
PEO – I	3	3	3	3	3	1	1	1	1	2	1	3	3	1
PEO – II	1	1	1	2	1	2	2	3	3	3	3	1	1	2
PEO – III	1	2	2	2	1	2	2	3	3	3	3	1	1	3

Mapping Programme Outcomes with Graduate Attributes

Table 2: Mapping of Programme outcomes with NBA Graduate Attributes

Programme Outcomes		NBA's GAs
PO1:	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.	**GA1**
PO2:	**Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).	**GA2**
PO3:	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/ processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society, and environment as required. (WK5).	**GA3**
PO4:	**Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).	**GA4**
PO5:	**Engineering Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6).	**GA5**
PO6:	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture, and environment. (WK1, WK5, and WK7).	**GA10**
PO7:	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity, and inclusion; adhere to national & international laws. (WK9).	**GA10**
PO8:	**Individual and Collaborative Teamwork:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams	**GA6**

PO9:	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.	**GA8**
PO10:	**Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.	**GA7**
PO11:	**Life-Long Learning:** Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8).	**GA9, G11**

CO-PO-PSO MAPPING

Semester	Course Name	POs											PSOs		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
I	Communicative English (TCP)						1		1	3		1			
	Algebra and Calculus for Engineers	3	2			1						1	1		
	Engineering Physics (TCP)	3	2		1					2					
	Engineering Chemistry (TCP)	3			1		1		1			1			
	Problem Solving and Python Programming (TCP)	3	3	3	3	2	3	3	3	3	3	3			1

	Engineering Graphics	3				1				3		1			
II	Calculus of Vectors, Complex Functions and Laplace Transforms	3	2									1	1		
	Basic Electrical and Instrumentation Engineering	3	2	2	1		1	1	1	1		1	1		1
	Fundamentals of Electronic Devices (TCP)	2	1	2	3	3	2		3	2	1		3		
	Environmental Science						2	3	1	1		1			
	Circuits and Network Analysis	2	3	2	3	3				1		1	3		1
	Design Thinking and Engineering Practices Laboratory						2	2	2	2		2			
	Circuits and Devices Laboratory	3	2	2	3				3	2		1	2		1

TCP - Theory-cum Practical

Semester	Course Name	POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	1	2	3
III	Probability Theory and Stochastic Processes (TCP)	3	2			2						2			
	Humanities II – UHV: Understanding Harmony							3	2	3		1			
	Electronic Circuits	2	2		3							2	3	2	
	Digital System Design (TCP)	3	2	3	3	3	3		3	3	3				3
	OOPS and Data Structures	3	2	1	2	2						1	1		
	Signals and Systems	2	2	2	2	3						2	3	2	
	Design Thinking, Innovation and Entrepreneurship		2	3							3	2			
	Electronic Circuits Lab	2	2	3	3	3				2	2		3		
	OOPS and Data Structures Lab	3	2	2	2	2						1	1		

IV	Linear Algebra and Optimization	3	2												
	Microprocessors, Microcontroller, and Interfacing	3	2		2	2						2	3		3
	Indian Constitution						2		2	2	2				
	Digital Signal Processing	3	2	3	2	3							3	3	
	Analog Communication Systems	3	3	3	3	3			2	2		3		3	
	Linear Integrated Circuits (TCP)	3	3	3	3	3				3		3	3		
	Microprocessors, Microcontroller, and Interfacing Lab	3	3	3	3	3				2		2	3		3
	Digital Signal Processing Laboratory	3	3	3	3	3			3	3			3	3	

TCP - Theory-cum Practical

Curriculum – R-2024 (Choice Based Credit System)

SEMESTER I				Teaching and Learning Scheme (per semester)						
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**TW & SL#**	**TH**	**C**
	THEORY									
1	UEN3186	Communicative English (TCP)	HS	4	30	0	15	45	90	3.0
2	UMA3176	Algebra and Calculus for Engineers	BS	4	45	15	0	60	120	4.0
3	UPH3186	Engineering Physics (TCP)	BS	5	45	0	15	60	120	4.0
4	UCY3186	Engineering Chemistry (TCP)	BS	5	45	0	15	60	120	4.0
5	UGE3188	Problem Solving and Python Programming (TCP)	ES	5	15	0	30	45	90	3.0
6	UGE3176	Engineering Graphics	ES	5	15	0	30	45	90	3.0
7	UGA3176	Heritage of Tamils	HS	1	15	0	0	15	30	1.0
	PRACTICALS									
-	-	-	-	-	-	-	-		-	-
TOTAL				**29**	**210**	**15**	**105**	**330**	**660**	**22.0**
	SKILL DEVELOPMENT									
8	UGEV301	SDG Experiential Laboratory I $	EEC	2	0	0	15	15	30	1.0

#TW & SL – Term Work & Self Learning per semester

SEMESTER II				Teaching and Learning Scheme (per semester)						
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**TW & SL#**	**TH**	**C**
	THEORY									
1	UMA3276	Calculus of Vectors, Complex Functions and Laplace Transforms	BS	4	45	15	0	60	120	4.0
2	UEE3251	Basic Electrical and Instrumentation Engineering	ES	3	45	0	0	45	90	3.0
3	UEC3286	Fundamentals of Electronic Devices (TCP)	ES	3	30	0	15	75	120	4.0
4	UCY3276	Environmental Science	MC	3	15	0	0	15	30	1.0*
5		Humanities I-Elective	HS	4	30	0	15	45	90	3.0
6	UEC3201	Circuits and Network Analysis	ES	4	45	15	0	60	120	4.0
7	UGA3276	Tamils and Technology	HS	1	15	0	0	15	30	1.0
	PRACTICALS									
8	UGE3297	Design Thinking and Engineering Practices Laboratory	ES	3	0	0	30	15	45	1.5
9	UEC3211	Circuits and Devices Laboratory	ES	3	0	0	30	15	45	1.5
TOTAL				**28**	**225**	**30**	**90**	**345**	**690**	**23.0**
	SKILL DEVELOPMENT									
10	UGEV302	SDG Experiential Laboratory II $	EEC	2	0	0	15	15	30	1.0

$ Value added course – Credits will not be counted for CGPA Calculation.

* Mandatory Course

SEMESTER III					Teaching and Learning Scheme (per semester)					
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**TW& SL[#]**	**TH**	**C**
THEORY										
1	UMA3362	Probability Theory and Stochastic Processes (TCP)	BS	5	30	15	30	45	120	4
2	UHS3386	Universal Human Values 2: Understanding Harmony	HS	4	30	0	30	30	90	3
3	UEC3301	Electronic Circuits	PC	3	45	0	0	45	90	3
4	UEC3361	Digital System Design (TCP)	PC	5	45	0	30	45	120	4
5	UEC3302	OOPS and Data Structures	ES	3	45	0	0	15	60	3
6	UEC3303	Signals and Systems	ES	3	45	0	0	45	90	3
7	UGE3386	Design Thinking, Innovation and Entrepreneurship	EEC	3	15	0	60	15	90	3
PRACTICALS										
8	UEC3311	Electronic Circuits Lab	PC	3	0	0	45	15	60	1.5
9	UEC3312	OOPS and Data Structures Lab	ES	3	0	0	45	15	60	1.5
TOTAL				**32**	**255**	**15**	**210**	**300**	**780**	**26**
SKILL DEVELOPMENT										
10	UECV303	Skills for Industry Readiness I[$]	EEC	1	0	0	30	15	45	1

SEMESTER IV					Teaching and Learning Scheme (per semester)					
S. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**TW& SL#**	**TH**	**C**
THEORY										
1	UMA3451	Linear Algebra and Optimization	BS	3	45	0	0	45	90	3
2	UEC34101	Microprocessors, Microcontroller, and Interfacing	PC	3	45	0	0	45	90	3
3	UGA3476	Indian Constitution	MC	3	45	0	0	30	75	1
4	UEC3402	Digital Signal Processing	PC	3	45	0	0	45	90	3
5	UEC3403	Analog Communication Systems	PC	3	45	0	0	45	90	3
6	UEC3461	Linear Integrated Circuits (TCP)	PC	5	45	0	30	45	120	4
		PRACTICALS								
7	UEC3411	Microprocessors, Microcontroller, and Interfacing Lab	PC	3	0	0	45	15	60	1.5
8	UEC3412	Digital Signal Processing Laboratory	PC	3	0	0	45	15	60	1.5
TOTAL				**26**	**270**	**0**	**120**	**285**	**675**	**20**
	SKILL DEVELOPMENT									
9	UECV304	Skills for Industry Readiness II[$]	EEC	2		0	30	15	45	1
10	UECV305	Independent Research/Project Work I/GPP&	EEC	2		0	30	15	45	1

SEMESTER V					Teaching and Learning Scheme (per semester)					
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**TW & SL[#]**	**TH**	**C**
THEORY										
1	UEC3501	Digital Communication	PC	3	45	0	0	45	90	3
2	UEC3502	Electromagnetic Fields	PC	4	45	15	0	60	120	4
3	UEC3561	Communication Networks (TCP)	PC	5	45	0	30	45	120	4
4	UEC3503	Principles of VLSI Design	PC	3	45	0	0	45	90	3
5	UEC3504	Control Systems Engineering	PC	3	45	0	0	45	90	3
6		Open Elective I	OE	3	45	0	0	45	90	3
		PRACTICALS								
7	UEC3511	Analog and Digital Communication Laboratory	PC	3	0	0	45	15	60	1.5
8	UEC3512	VLSI Design Laboratory	PC	3	0	0	45	15	60	1.5
TOTAL				**27**	**270**	**15**	**120**	**315**	**720**	**23**
	SKILL DEVELOPMENT									
9	UECV306	Independent Research/Project Work II/GPP[&]	EEC	4	0	0	30	30	60	2

SEMESTER VI					Teaching and Learning Scheme (per semester)					
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**TW & SL #**	**TH**	**C**
THEORY										
1	UEC3601	Wireless Communication	PC	3	45	0	0	45	90	3
2	UEC3602	Transmission Lines and Waveguides	PC	3	45	0	0	45	90	3
3	UEC3603	System Design for IoT	PC	3	45	0	0	45	90	3
4		Professional Elective I	PE	3	45	0	0	45	90	3
5		Professional Elective II	PE	3	45	0	0	45	90	3
PRACTICAL										
6	UEC3611	Wireless Communication Laboratory	PC	3	0	0	45	15	60	1.5
7	UEC3612	System Design for IoT Laboratory	PC	3	0	0	45	15	60	1.5
8	UEC3617	Mini Project /GPP	EEC	6	0	0	60	30	90	3
TOTAL				**27**	**225**	**0**	**150**	**285**	**660**	**21**

SEMESTER VII					Teaching and Learning Scheme (per semester)					
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**TW&SL#**	**TH**	**C**
THEORY										
1	UEC3701	High Frequency Communication Systems	PC	3	45	0	0	45	90	3
2	UEC3702	Microwave and Antenna Engineering	PC	3	45	0	0	45	90	3
3		Professional Elective III	PE	3	45	0	0	45	90	3
4		Professional Elective IV	PE	3	45	0	0	45	90	3
5		Professional Elective V	PE	3	45	0	0	45	90	3
PRACTICAL										
6	UEC3711	Microwave and Antennas Laboratory	PC	2	0	0	30	15	45	1
7	UEC3718	Project Work Phase I/GPP	EEC	6	0	0	60	30	90	3
8	UEC3716	Industrial Training /Internship*	EEC	0	0	0	0	0	160	2
TOTAL				**23**	**225**	**0**	**90**	**270**	**745**	**21**

* The students will undergo 4 weeks of Industrial training / Internship during the previous vacation

SEMESTER VIII					Teaching and Learning Scheme (per semester)					
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**TW&SL#**	**TH**	**C**
THEORY										
1		Professional Elective VI	PE	3	45	0	0	45	90	3
2		Open Elective II	OE	3	45	0	0	45	90	3
PRACTICAL										
3	UEC3818	Project Work Phase II/GPP	EEC	16	0	0	195	45	240	8
TOTAL				**22**	**90**	**0**	**195**	**135**	**420**	**14**

$ Value added course – Credits will not be counted for CGPA Calculation.

TOTAL NO OF CREDITS: 170

TW&SL- Term work & Self learning

TH – Total learning hours

&- Offered only to students who opt for GPP.

DISTRIBUTION OF CREDITS

Semester	HS	BS	ES	PC	PE	OE	EEC	MC	TOTAL (R21)	Total (R24)
I	4	12	6				1$		23	22
II	4	4	14				1$	1	22	23
III	3	4	7.5	8.5			3+1$		23	26
IV		3		16			1&+1$	1	19	20
V				20		3	2&		22	23
VI				12	6		3		22	21
VII				7	9		5		19	21
VIII					3	3	8		14	14
Total (R21)	14	19.5	29	64.5	18	6	13	0	164	
Total (R24)	11	23	27.5	63.5	18	6	19	2	170	

$Value Added course not included in the CGPA

&Offered to students who will opt for GPP.

HS – Humanities and Social Sciences, **BS** – Basic Sciences, **ES** – Engineering Sciences, **PC** – Professional Core, **OE** – Open Elective, **EEC** – Employability Enhancement Courses, **MC** – Mandatory Courses

$ Value added course – Credits will not be counted for CGPA Calculation.

Professional Electives: Verticals*

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V	Vertical VI	Vertical VII	Vertical VIII
Communication	**Signal Processing**	**Circuits, Devices and Systems**	**RF and MEMS**	**Artificial Intelligence**	**IoT**	**Semiconductor chip design and Testing**	**Embedded Systems**
Information Theory and Coding	Statistical signal processing	Wide Bandgap Semiconductor Devices	Electrical properties of Materials	Machine Learning Algorithms	Wireless Sensor Network Design	ASIC design	Computer Architecture and Organization
Introduction to Radar and Satellite Communication	Speech Technology	Nanoelectronic Devices	Sensors, Actuators, and Interfaces	Natural Language Processing	IoT Architectures	System-on-Chip Design	Real-Time Embedded Programming
Communication Network Security	Digital Image & Video Processing	Low Power Circuit Design	Electromagnetic Interference and Compatibility	Soft computing and Optimization techniques	IoT Communication Technologies	Essentials of Electronic Testing	Embedded System Design using ARM Cortex-M
Advanced Wireless Communication	Introduction to Computer Vision	High speed electronics	Digital Signal Integrity	Deep learning techniques	Industrial IoT 4.0	VLSI Fabrication Technology	Advanced Embedded Processors
Optical Communication Networks	Detection and Estimation Theory	Wearable Devices	MEMS and NEMS	AI and its Applications	Smart IoT Systems	System Verilog for verification	Design of Real Time systems
5G Communication Networks	Array signal processing	Automotive electronics	RF and Microwave Circuit Design	Reinforcement Learning	Security and Privacy in IoT	Electronic System Packaging	Real Time Operating Systems
Project Work (3 credits) for Honours Course							

* For Honours degree, project work (3 credits) in anyone of the verticals is essential

HUMANITIES I-ELECTIVE (II-SEMESTER)

Course Code	COURSE TITLE	CONTACT PERIODS	L	T	P	TW &SL	TH	C
UEN3286	Psychology and Communication	3	30	0	15	45	90	3
UEN3287	Human Relations and Communication Skills	3	30	0	15	45	90	3
UEN3288	Communication Through Media	3	30	0	15	45	90	3
UEN3289	Technical Writing	3	30	0	15	45	90	3
UHS3286	German Beginner Level	3	30	0	15	45	90	3

L - Lecture periods per week, **T** - Tutorial periods per week, **P** - Practical periods per week,

EL - Experiential learning periods per week, **C** – Credits and **TCP** - Theory-cum Practical

Vertical I – Communication

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW & SL#	TH	C
1	UEC3621	Information Theory and Coding	PE	3	45	0	0	45	90	3
2	UEC3629	Introduction to Radar and Satellite Communication	PE	3	45	0	0	45	90	3
3	UEC3721	Communication Network Security	PE	3	45	0	0	45	90	3
4	UEC3729	Advanced Wireless Communication	PE	3	45	0	0	45	90	3
5	UEC3737	Optical Communication Networks	PE	3	45	0	0	45	90	3
6	UEC3821	5G Communication Networks	PE	3	45	0	0	45	90	3

Vertical II -Signal Processing

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW & SL#	TH	C
1	UEC3622	Statistical signal processing	PE	3	45	0	0	45	90	3
2	UEC3631	Speech Technology	PE	3	45	0	0	45	90	3
3	UEC3722	Digital Image & Video Processing	PE	3	45	0	0	45	90	3
4	UEC3730	Introduction to Computer Vision	PE	3	45	0	0	45	90	3
5	UEC3738	Detection and Estimation Theory	PE	3	45	0	0	45	90	3
6	UEC3822	Array signal processing	PE	3	45	0	0	45	90	3

Vertical III – Circuits, Devices and Systems

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW & SL#	TH	C
1	UEC3623	Wide Bandgap Semiconductor Devices	PE	3	45	0	0	45	90	3
2	UEC3632	Nanoelectronic Devices	PE	3	45	0	0	45	90	3
3	UEC3723	Low Power Circuit Design	PE	3	45	0	0	45	90	3
4	UEC3731	High speed electronics	PE	3	45	0	0	45	90	3
5	UEC3739	Wearable Devices	PE	3	45	0	0	45	90	3
6	UEE3876	Automotive electronics	PE	3	45	0	0	45	90	3

Vertical IV – RF and MEMS

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW & SL#	TH	C
1	UEC3624	Electrical properties of Materials	PE	3	45	0	0	45	90	3
2	UEC3633	Sensors, Actuators, and Interfaces	PE	3	45	0	0	45	90	3
3	UEC3724	Electromagnetic Interference and Compatibility	PE	3	45	0	0	45	90	3
4	UEC3732	Digital Signal Integrity	PE	3	45	0	0	45	90	3
5	UEC3740	MEMS and NEMS	PE	3	45	0	0	45	90	3
6	UEC3823	RF and Microwave Circuit Design	PE	3	45	0	0	45	90	3

Vertical V – Artificial Intelligence

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW & SL#	TH	C
1	UEC3625	Machine Learning Algorithms	PE	3	45	0	0	45	90	3
2	UEC3634	Natural Language Processing	PE	3	45	0	0	45	90	3
3	UEC3725	Soft computing and Optimization techniques	PE	3	45	0	0	45	90	3
4	UEC3733	Deep learning techniques	PE	3	45	0	0	45	90	3
5	UEC3791	AI and its Applications	PE	3	45	0	0	45	90	3
6	UEC3824	Reinforcement Learning	PE	3	45	0	0	45	90	3

Vertical VI – IoT

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW & SL#	T H	C
1	UEC3626	Wireless Sensor Network Design	PE	3	45	0	0	45	90	3
2	UEC3635	IoT Architectures	PE	3	45	0	0	45	90	3
3	UEC3726	IoT Communication Technologies	PE	3	45	0	0	45	90	3
4	UEC3734	Industrial IoT 4.0	PE	3	45	0	0	45	90	3
5	UEC3792	Smart IoT Systems	PE	3	45	0	0	45	90	3
6	UEC3825	Security and Privacy in IoT	PE	3	45	0	0	45	90	3

Vertical VII – Semiconductor chip design and Testing

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW & SL#	T H	C
1	UEC3627	ASIC design	PE	3	45	0	0	45	90	3
2	UEC3636	System-on-Chip Design	PE	3	45	0	0	45	90	3
3	UEC3727	Essentials of Electronic Testing	PE	3	45	0	0	45	90	3
4	UEC3735	VLSI Fabrication Technology	PE	3	45	0	0	45	90	3
5	UEC3793	System Verilog for verification	PE	3	45	0	0	45	90	3
6	UEC3826	Electronic System Packaging	PE	3	45	0	0	45	90	3

Vertical VIII – Embedded Systems

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW & SL#	T H	C
1	UEC3628	Computer Architecture and Organization	PE	3	45	0	0	45	90	3
2	UEC3637	Real-Time Embedded Programming	PE	3	45	0	0	45	90	3
3	UEC3728	Embedded System Design using ARM Cortex-M	PE	3	45	0	0	45	90	3
4	UEC3736	Advanced Embedded Processors	PE	3	45	0	0	45	90	3
5	UEC3794	Design of Real Time systems	PE	3	45	0	0	45	90	3
6	UEC3827	Real Time Operating Systems	PE	3	45	0	0	45	90	3

Minors: Semiconductor Technology

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW & SL#	T H	C
1	UEC3M21	Semiconductor Materials and Devices	PE	3	45	0	0	45	90	3
2	UEC3M22	Semiconductor Device Modelling	PE	3	45	0	0	45	90	3
3	UEC3M23	Semiconductor Fabrication Technology	PE	3	45	0	0	45	90	3
4	UEC3M24	Semiconductor Packaging and Assembly	PE	3	45	0	0	45	90	3
5	UEC3M25	Nanoelectronics: Materials and Devices	PE	3	45	0	0	45	90	3
6	UEC3M26	MEMS & NEMS	PE	3	45	0	0	45	90	3

Minors: IoT and embedded systems

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW & SL #	T H	C
1	UEC3M27	Fundamentals of communication networks	PE	3	45	0	0	45	90	3
2	UEC3M28	Introduction to Embedded Systems and Applications	PE	3	45	0	0	45	90	3
3	UEC3M29	Fundamentals of Internet of things	PE	3	45	0	0	45	90	3
4	UEC3M30	Introduction to IoT protocols	PE	3	45	0	0	45	90	3
5	UEC3M31	Embedded System Design with Arm Cortex-M Microcontrollers	PE	3	45	0	0	45	90	3
6	UEC3M32	Wearable Technology and Embedded Systems	PE	3	45	0	0	45	90	3

OPEN ELECTIVE - I (SEMESTER-V) – COMMON TO ALL DEPARTMENTS
(Offered by MBA to Other Departments)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	TW & SL	TH	C
1	UBA3941	Project Management and Planning	OE	45	0	0	45	90	3
2	UBA3942	Total Quality Management	OE	45	0	0	45	90	3
3	UBA3943	Work Ethics, Corporate Social Responsibility, and Governance	OE	45	0	0	45	90	3

Open Elective - I (V semester)

(Offered by Electronics and Communication Engineering to other departments)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW & SL #	TH	C
1	UEC3941	Introduction to Internet of Things	OE	3	45	0	0	45	90	3
2	UEC3942	Introduction to Sensors and Actuators	OE	3	45	0	0	45	90	3
3	UEC3943	Introduction to Bioelectricity	OE	3	45	0	0	45	90	3

Open Elective - II (VIII semester)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW& SL#	TH	C
1	UEC3041	Introduction to Human Computer Interaction	OE	3	45	0	0	45	90	3
2	UEC3042	Introduction to Wearable Technology	OE	3	45	0	0	45	90	3
3	UEC3043	Foundations of Automotive Electronics	OE	3	45	0	0	45	90	3

COURSE CODE	COURSE TITLE	L	T	P	TW& SL#	TH	C
UEN3186	COMMUNICATIVE ENGLISH (Common to all B.E./B.Tech. programs)	30	0	15	45	90	3.0

OBJECTIVES

The learners will be able to:

- Enhance conversation fluency and assertive communication in English
- Contribute efficiently to meetings and improve networking skills
- Participate and communicate meaningfully during group discussions
- Cultivate the ability to deliver structured and persuasive presentations
- Equip students with necessary skills to excel in job interviews

UNIT I CONVERSATION AND ASSERTIVENESS 9

Introducing yourself, peers and others. Conversation skills: starting a conversation; keeping the conversation going; closing the conversation; giving directions and instructions; learning functional language needed for everyday interactions. Imparting the basic language skills and techniques for telephonic conversations. Communication styles: passive, aggressive and assertive. Role-plays as a technique for practising conversation.

UNIT II MEETING SKILLS AND NETWORKING SKILLS 9

Setting up and holding meetings; organising and conducting effective meetings; learning the language used to lead a meeting; practising how to agree and disagree with ideas and people politely. Mock meetings. Making notes, summarising and reporting in meetings. Writing professional emails.

UNIT III GROUP DISCUSSION SKILLS AND TEAM SKILLS 9

Group discussion skills: Basic skills required for a GD; strategies for improving discussion skills; learning the language used for a GD; voicing an opinion and arguing a point effectively, leading a discussion; chairing a discussion; discussing to arrive at a consensus. Mock GDs for practice.

UNIT IV PRESENTATION SKILLS AND PERSUASIVE SKILLS 9

Making effective presentations: structure of a presentation; referring to visual data; describing visuals; non-verbal communication skills; examples of model presentations; and learning the language used to deliver effective and persuasive presentations. Developing cross-cultural communication skills. Mock presentations for practice.

UNIT V INTERVIEW SKILLS AND INTERPERSONAL SKILLS 9

Applying for jobs; writing resumes; and cover letters. Participating in job interviews and other interviews. Strategies for effective interviewing: preparing for the interview, during-the-interview and after-the-interview etiquette. Common interview questions and learning interviewing language skills. Mock interviews for practice.

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the learners will

1. Develop conversation skills and assertiveness in English
2. Cultivate proficiency in conducting meetings and networking
3. Articulate clearly and successfully during group discussions
4. Deliver engaging and professional presentations confidently
5. Communicate effectively during the interview process

TEXTBOOKS

1. Bovee, C. L.& Thill, J. V. (2016). *Business Communication Today, 15/e*. Pearson Education India.
2. Beebe, S. A., & Mottet, T. P. (2021). *Business and Professional Communication (3rd ed)*. Pearson Higher Education AU.
3. Herbert Hirsch. (2007). Essential Communication Strategies: For Scientists, Engineers, and Technology Professionals, 2nd edition. Wiley-IEEE Press.

REFERENCE BOOKS

1. Dodd, C. H. (2012). Managing business and professional communication (3rd ed). Allyn & Bacon/Pearson.
2. Dwyer, J. (2012). *Communication for Business and the Professions: Strategies and Skills* (7th ed). Pearson Higher Education AU.
3. Gill Hasson. (2012). Brilliant Communication Skills: What the Best Communicators Know, Do and Say. Ft Pr.
4. Jones, L., & Alexander, R. (2011). *New international business English updated edition student's book: Communication skills in English for business purposes* (Vol. 3). Cambridge university press.
5. Kerry Patterson, Joseph Grenny, Ron McMillan and Al Switzler. (2013). Crucial Conversations: Tools for Talking When Stakes Are High. Brilliance Audio.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1								1	3		1		
CO2								1	3		1		

CO3								1	3		1		
CO4								0	3		1		
CO5								0	3		1		

COURSE CODE	COURSE TITLE	L	T	P	TW & SL#	TH	C
UMA3176	ALGEBRA AND CALCULUS FOR ENGINEERS (Common to all B.E./B.Tech. programs)	45	15	0	60	120	4.0

OBJECTIVES

- To reduce quadratic to canonical form of a matrix and find the eigenvalues of a matrix numerically
- To study the concept of curvature, evolute and envelope
- Learn to find the extreme values for a function of two variables
- To compute area of closed surface and volume of solids using multiple integrals
- Learn to evaluate definite integrals numerically

UNIT I MATRICES 12

Characteristic equation - Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors, Cayley-Hamilton Theorem (simple problems only), Diagonalization of matrices – Similarity transformation - Quadratic form - Reduction of a quadratic form to canonical form by orthogonal transformation – Eigen values of matrices by Power method.

UNIT II DIFFERENTIAL CALCULUS AND ITS APPLICATIONS 12

Curvature, radius of curvature - Cartesian and parametric co-ordinates – Centre of curvature – Circle of curvature in Cartesian form, Evolutes, Envelopes (including two parameter family), Evolute as envelope of normal.

UNIT III FUNCTIONS OF SEVERAL VARIABLE 12

Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and its properties – Taylor's series for functions of two variables – Maxima and minima of functionsof two variables – Lagrange's method of undetermined multipliers.

UNIT IV MULTIPLE INTEGRALS 12

Double integrals in Cartesian and polar coordinates – Change of order of integration, Area enclosed by plane curves – Change of variables in double integrals, Triple integrals.

UNIT V NUMERICAL INTEGRATION 12

Single integral - Trapezoidal, Simpson's 1/3 rule, Gaussian quadrature 2 point and 3- point formula - Double integral – Trapezoidal rule, Simpson's rule 1/3 rule.

TOTAL PERIODS: 60

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

CO1 Compute the eigenvalues and eigenvectors and reduce quadratic form to canonical form

CO2 Compute evolute of a given curve and envelope of family of curves

CO3 Analyse the extrema of function of two variables

CO4 Calculate the area and volume using double and triple integrals

CO5 Evaluate single and double definite integrals numerically

CO6 Apply differential and integral calculus in real life problems and compute the extrema of functions

TEXTBOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publishers, 45th Edition, 2020.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10thEdition, 2020.

REFERENCE BOOKS

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Ninth Edition,Laxmi Publications Pvt Ltd., 2016.
2. James Stewart, Calculus: Early Transcendental, Cengage Learning, New Delhi, 7^{th} Edition, 2013.
3. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. ChandPrivate Ltd., 2011.
4. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford UniversityPress, 2015.

CO-PO-PSO MAPPING

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									
CO2	3	2									

CO3	3	2									
CO4	3	2									
CO5	3	2									
CO6	3	2									2

COURSE CODE	COURSE TITLE	L	T	P	TW& SL#	TH	C
UPH3186	ENGINEERING PHYSICS (Common to all B.E./B.Tech. programs)	45	0	15	60	120	4.0

OBJECTIVES

Enable the students to

- Comprehend and identify different crystal structures and their imperfections.
- Understand the elastic and thermal properties of materials and understand their significance in engineering materials.
- Provide an overview of the characteristics of sound, architectural acoustics and the production and applications of ultrasound.
- Develop an understanding of quantum mechanical phenomena and their applications.
- Understand the origin of laser action, production of laser, fibre optics and their applications.

UNIT I CRYSTAL PHYSICS 15

Single crystalline, polycrystalline and amorphous materials– single crystals - Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal Imperfections with Examples – Point, line (Edge and Screw dislocations –Burger vectors) Surface (stacking faults) and Volume defects.

LABORATORY EXPERIMENT

1. Determination of the band gap of a semiconductor crystal.

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 15

Properties of matter: Elasticity- Hooke's law - different elastic moduli (conceptual)- Relationship between the three moduli of elasticity– stress -strain diagram– Poisson's ratio –Factors affecting elasticity. cantilever: theory and experiment–Extension to non-uniform bending- uniform bending theory and experiment, -Applications- I-shaped girders.

Thermal Physics: Transfer of heat energy - thermal expansion of solids and liquids - expansion joints-bimetallic strips, Modes of heat transfer – thermal conduction, convection and radiation – Newton's law of cooling - thermal conductivity- Lee's disc method for bad conductor – Heat transfer through

compound media (series and parallel)-Applications -Heat Exchangers.

LABORATORY EXPERIMENTS

1. Determination of the Young's modulus of the material of the given beam by non-uniform bending method.
2. Determination of the rigidity modulus of the material of the given wire using torsion pendulum.
3. Determination of the coefficient of thermal conductivity of the given bad conductor using Lee's disc.

UNIT III ACOUSTICS AND ULTRASONICS 15

Acoustics: Classification and characteristics of Sound - decibel - Weber–Fechner law– Sabine's formula (conceptual) —factors affecting the acoustics of buildings and their remedies.

Ultrasonics: Production of ultrasonics by Magnetostriction and Piezoelectric methods – acoustic grating -Non-Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays- Phased Array Ultrasound and Time of Flight Diffraction techniques.

LABORATORY EXPERIMENTS

1. Determination of the velocity of sound in the given liquid and compressibility of the liquid using an Ultrasonic interferometer.

UNIT IV QUANTUM PHYSICS 15

Black body radiation – Planck's three-dimensional) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton Effect (Conceptual)– Photoelectric effect (conceptual)- Properties of Matter waves – wave particle duality - Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box and extension to three dimensional box – Degeneracy of electron energy states - Quantum tunneling (Qualitative)-Scanning tunneling microscopy.

LABORATORY EXPERIMENT

1. Determination of the Planck's constant and the work function using photoelectric effect.

UNIT V PHOTONICS AND FIBRE OPTICS 15

Photonics: Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients –Conditions for Laser action - Types of lasers (Qualitative) – Nd: YAG, Basics of diode lasers-Industrial and Medical Applications.

Fibre optics: Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Fibre Optical Communication system (Block diagram) - Active and passive fiber sensors - pressure and temperature- Applications.

LABORATORY EXPERIMENTS

1. Determination of the grating element/wavelength, and the particle size using a laser.
2. Determination of the Numerical Aperture and the acceptance angle of an optical fiber.

TOTAL PERIODS: 45L+30P

OTHER EXPERIMENTS

1. Determination of the wavelength of the characteristic lines of mercury spectrum using Spectrometer and grating. (Wave optics)
2. Determination of dispersive power of prism using Spectrometer. (Light/Optics)
3. Determination of thickness of a thin wire using interference fringes. (Light/Optics)
4. Determination of the coefficient of viscosity of the given liquid using Poiseuille's method. (Properties of Matter).

COURSE OUTCOMES:

At the end of this course, students will be able to

1. Analyze crystal structures and the influence of imperfections on their properties.
2. Demonstrate and explain the general concepts of elastic and thermal properties of materials used in various mechanical and civil structures.
3. Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
4. Comprehend the quantum mechanical principles to correlate with experimental results and their applications.
5. Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.

TEXTBOOKS:

1. Gaur, R.K., and Gupta, S.L., Engineering Physics, Dhanpat Rai Publishers, 2012.
2. S. Singaravadivelu and A. Chandrasekaran, Engineering Physics, Vedha Publications, Chennai, 2022
3. Serway, R.A., & Jewett, J.W., Physics for Scientists and Engineers, Cengage Learning, 2010.
4. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson, 2006

REFERENCE BOOKS

1. Halliday, D., Resnick, R. & Walker, J. Principles of Physics, Wiley, 2015.
2. Tipler, P.A. & Mosca, G. Physics for Scientists and Engineers with Modern Physics, WH Freeman, 2007.
3. Avadhanulu, M. N., Kshirsagar, P. G, A textbook of Engineering Physics, S. Chand &Co. Ltd., Ninth Revised Edition, 2012.
4. H.K. Malik and A. K. Singh, Engineering Physics, 2nd Edition, McGraw Hill, 2016
5. Pandey B.K., Chaturvedi.S. "Engineering Physics", Cengage Learning India Pvt. Ltd, 2012

CO-PO-PSO MAPPING

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2		1											
CO2	3	2		1						2					
CO3	3	2		1						2					
CO4	3	2		1											
CO5	3	2		1											
Average	**3**	**2**		**1**						**2**					

COURSE CODE	COURSE TITLE	L	T	P	TW & SL#	TH	C
UCY3186	**ENGINEERING CHEMISTRY (Common to all B.E./B.Tech. programs)**	45	0	15	60	120	4.0

OBJECTIVES

- To impart knowledge on various aspects of chemistry
- To improve the ability of students to think logically and solve the problems in industries and day-to-day life efficiently

UNIT I WATER AND ITS TREATMENT 15

Theory: Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical, Water quality parameters - WHO guidelines and BIS guidelines.

Industry water treatment - External treatment – Ion exchange process, zeolite process. Domestic water

treatment - Reverse Osmosis-Working of RO system – Advantages/limitations.

Practical:

Exp.1: Estimation of hardness of water

Exp.2: Hardness of different sources of water

Laboratory Demonstration:

Ion Exchange process

ELECTROCHEMISTRY **15**

UNIT II

Theory: Conductance- Conductometric titration and its applications -estimation of strong acid, estimation of mixture of strong and weak acids (numerical based on conductance).

Electrochemistry-redox reaction- types of Electrode-Ion selective electrodes –Glass electrodes-measurement of pH-potentiometry.

Energy systems for electric vehicles – Principle & Electrochemistry of a H2–O2 fuel cell, Li-ion battery, Na-ion battery, Green Hydrogen.

Practical:

Exp.3: Conductometric titrations- strength of mixture of acids

Exp.4: Estimation of strong acid-pH

Exp.5: Estimation of ferrous ion by potentiometry

UNIT III **CORROSION** **15**

Theory: Corrosion - Types of corrosion - wet corrosion – mechanism –galvanic corrosion -differential aeration- Rate of corrosion, Corrosion control –Cathodic protection-electroless plating (Printed Circuit Board), Corrosion in different industries –concrete (reinforcing steel in concrete), boilers, electronic components

Practical:

Exp.6: Rate of corrosion

Industrial visit:

Plating industry- Electroless plating

UNIT IV **POLYMERS IN EVERYDAY LIFE** **15**

Theory: Polymers and Polymerization: types of polymerization: addition and condensation – Properties: Crystallinity, Glass Transition temperature (Tg), Average Molecular weight-viscosity method &PDI, tacticity, polymer recycling-biodegradable polymers.

Practical:

Exp.7 : Molecular weight of water soluble polymer by viscosity method

Exp.8: Finding the Tg point of different polymer.

Laboratory Demonstration:

Chemical recycling of post consumed polymer

UNIT V ANALYTICAL TECHNIQUES 15

Theory: Spectroscopy: Beer-Lambert's law. Colorimetric estimation of Fe3+ , Principle, working and applications of IR, UV-Visible spectroscopy and Chromatography (TLC and column)

Practical:

Experiment 9: Colorimetric estimation of Fe3+ ions

Laboratory Demonstration:

Thin Layer Chromatography

TOTAL PERIODS: 45L+30P

COURSE OUTCOMES

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

CO1	Analyze the water samples, categorize based on the nature of impurities and suggest suitable method of treatment for domestic and industrial usage
CO2	Apply electrochemical knowledge to identify challenges and propose innovative solutions for improving fuel cell and battery technologies for zero-emission mobility.
CO3	Identify the type of corrosion and analyze different preventive methods of corrosion in various industries.
CO4	Examine the fundamental concepts of polymer chemistry, including structure, classification, and synthesis techniques and identify and evaluate renewable, biodegradable, and recyclable polymeric materials for sustainable future.
CO5	Apply analytical skills of techniques such as chromatography, spectroscopy to characterize materials to solve real life problems.
CO6	Investigate water quality and industrial effluents for chemical impurities using suitable analytical techniques and examine the conversion of post-consumed plastic waste into value-added products for a circular economy.

TEXTBOOKS

1. Jain P.C. and Monika Jain, 'Engineering Chemistry' 17th edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2023.
2. S.S.Dara, 'The Text Book of Engineering Chemistry, S.Chand & Co.Ltd,New Delhi, 2011.

REFERENCE BOOKS

1. N.F. Gray, 'Water Technology-An Introduction for Environmental Scientists and Engineers' Third Edition, Taylor & Francis, USA, 2010.

2. S. Glasstone,'An Introduction to Electrochemistry' East-West Press Pvt. Ltd., New Delhi, 2007.

3. Bengt Sundén, 'Hydrogen, Batteries and Fuel Cells' Academic Press Inc, USA, 2019

4. R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar, 'Polymer Science' New Age International (P) Ltd, New Delhi, reprint, 2005.

5. R. Gopalan, K. Rangarajan, P.S. Subramanian, "Elements of Analytical Chemistry" Sultan Chand & Sons, 2003.

6. B.Viswanath, B, P.S. Raghavan, 'Practical Physical Chemistry',.ViVa Books Pvt. Ltd, New Delhi, 2012.

CO-PO-PSO MAPPING

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3					3								
CO2	3					3								
CO3	3					2								
CO4	3					2								
CO5	3					2								
CO6	2		2		2	3		2	2		2			

COURSE CODE	COURSE TITLE	L	T	P	TW & SL#	T H	C
UGE3188	PROBLEM SOLVING AND PROGRAMMING USING PYTHON (Common to all B.E./B.Tech. programs)	15	0	30	45	90	3.0

OBJECTIVES

- To learn problem-solving strategies.
- To learn different types of statements in Python.
- To learn modularity in problem solving.
- To solve complex problems using sequenced data types and advanced constructs like dictionaries and files of Python.
- To develop simple software projects using Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 3

Logical Thinking – Algorithmic Thinking; Problem Solving and Decomposition: Defining a Problem – Devising a Solution – Decomposition; Effective building blocks: Basic Algorithmic Constructs (pseudo code, flow chart) – Program State.

UNIT II CONDITIONAL AND ITERATION 3

Introduction to Python – Functional abstraction – Defining simple functions – Data abstractions and objects, built-in objects, Expressions and operators (methods), Variables and Assignment, conditional (if), alternative (if-else), case analysis (if-elif-else), pattern matching – Iteration: while, for, break, continue, pass.

UNIT III FUNCTION AND STRINGS 3

Functions: Local and global scope, Methods of passing arguments, Recursion, Lambda functions; Strings: string slices, immutability, string functions and pattern matching.

UNIT IV LISTS AND TUPLES 3

Lists: Operations, Slices, Methods, Iteration, Mutability, Aliasing, Cloning, Parameters, Nested lists, List comprehension; Tuples: Operations, Assignments, Return value.

UNIT V DICTIONARIES AND FILES 3

Dictionaries: operations and methods, looping and dictionaries, reverse lookup, dictionaries and lists; Files: Text files, reading and writing files, format operator, file names and paths, CSV files.

THEORY PERIODS: 15

LABORATORY COMPONENT: (10 x 4 = 40 hours)

1. Practice session on using Linux shell commands, Python in interactive mode, and using an IDE (integrated development environment)
2. (a) Case study: Area of the geometric shapes and Simple calculator.
   (b) Develop programs using sequential statements (e.g. Temperature conversion, Currency conversion)
3. (a) Case study: Electricity bill generation.
   b) Develop programs using alternate statements (e.g. Counting people eligible to vote)
4. (a) Case study: Armstrong number, Prime number generation within a range and Pascal's triangle.
   b) Develop programs using iterative statements (e.g. n-way password verification problem)
5. (a) Case study: Finding square root.
   (b) Develop programs using functions (e.g. GPA calculation by considering internal and external marks)
6. (a) Case study: Fibonacci series and Palindrome.
   (b) Develop programs using recursion (e.g. Computation of sine series)
7. (a) Case study: Group anagrams.
   (b) Develop programs using strings without built-in functions (e.g. Finding longest common prefix among n strings)
8. (a) Case study: Sorting and Searching.
   (b) Develop programs using lists and tuples (e.g. Finding similarity between two documents by constructing one hot vectors)
9. (a) Case study: Top 'k' frequent words.
   (b) Develop simple programs using dictionaries (e.g. Constructing histogram)
10. (a) Case study: Exceptions and Assertions.
    (b) Develop programs using Files and exception handling (e.g. Finding top k most frequent words in a text file)

PROJECT COMPONENT (5 x 4 = 20 hours)

Software applications to be developed in teams using Python Graphical User Interface like Tkinter, QT for Python, PySimpleGUI, PyGame.

Sample Case Study: PACMAN GAME

Input: Maze, PacMan, Pellets, Ghosts

Output: Score display and lives display

Constraints:

- Pacman navigates through a maze, gobbling up pellets while avoiding the ghosts.
- The user plays in such a way that the Pacman consumes all the pellets scattered throughout the maze without being captured by ghosts.
- Automatic maze generation of different levels.
- Intelligence for enemies like Ghosts to move around the maze.
- Level progression.

PRACTICAL PERIODS: 60

TOTAL PERIODS: 15 + 60 = 75

COURSE OUTCOMES

On successful completion of this course, a student will be able to

CO1: Solve programming problems and express design solutions in pseudo code. (K3)

CO2: Apply sequential, alternate, and iterative approaches for solving problems. (K3)

CO3: Solve complex problems by using functions, strings, lists, tuples and dictionaries. (K3)

CO4: Apply files and exception handling concepts for handling large data. (K3)

CO5: Create simple software development projects in teams using best coding practices and communicate effectively through reflections, reports, and presentations. (K6)

TEXTBOOKS

1. Allen B. Downey, “Think Python”', 3rd edition, O'Reilly Media, 2024, Online Version: https://allendowney.github.io/ThinkPython/
2. Sridhar, Indumathi, Hariharan, “Python Programming”, Pearson, 2023.

REFERENCE BOOKS

1. Karl Beecher, “Computational Thinking – A beginner's Guide to Problem Solving and Programming”, British Computer Society (BCS), 2017.
2. John V Guttag, “Introduction to Computation and Programming Using Python”', 3rd edition, MIT Press, 2021.

3. Ashok Namdev Kamthane, Amit Ashok Kamthane, “Programming and Problem Solving with Python”, McGraw Hill Education (India) Private Limited, 2018.
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”", Pearson India Education Services Pvt. Ltd., 2016.
5. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.
6. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, 2nd Edition, CENGAGE Learning, 2018.
7. Alan D. Moore, “Python GUI programming with Tkinter”, Second Edition, Packt Publishing Ltd., 2021.
8. Joshua M. Willman, “Beginning PyQt: A hands-on approach to GUI programming with PyQt6”, Second Edition, APress, 2022.

CO-PO-PSO MAPPING

COs	**POs**											**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	3	2											
CO2	3												
CO3	3	2			2								
CO4	3	2			2								
CO5	3	3	3		2			2	2				
Average	3	3	3	3	2	2		2	2				

Course Code	Course Title	L	T	P	TW&SL#	TH	C
UGE3176	ENGINEERING GRAPHICS (Common to all B.E./B.Tech. programs)	15	0	30	45	90	3.0

Objectives:

- To develop graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.
- To visualize the job in three dimensions
- To draw 2D / 3D objects using computer drafting software

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATIONS)	1

Importance of Engineering Graphics in engineering applications - Drawing instruments and their uses, Types of lines, Lettering, General rules for dimensioning, Geometrical constructions using instruments.

Unit I	PROJECTION OF POINTS, LINES AND PLANES	14

Orthographic projection principle – Reference planes - Layout of views. Projections of points when they are situated in different quadrants. Projections of a line parallel to one of the reference planes and inclined to the other, line inclined to both the reference planes. Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating plane method.

Unit II	PROJECTION OF SOLIDS	15

Projections of solids like prisms, pyramids, cylinder and cone, whose axis is parallel to one of the reference planes and inclined to the other by rotating object method.

Unit III	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	15

Sectional planes – when the cutting plane is inclined to one of the principal planes and perpendicular to the other, Sectional views - Prism, pyramid, cylinder and cone, true shape of the section. Development of lateral surfaces of simple and truncated solids in vertical position– prisms, cylinders, pyramids, cones.

Unit IV	FREEHAND SKETCHING AND FUNDAMENTALS OF COMPUTER AIDED DRAFTING	15

Visualization concepts and Free Hand sketching: Visualization principles–Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects. Introduction to CAD, DRAW tools, MODIFY tools, TEXT, DIMENSION and practicing two-dimensional modelling of simple objects by any free computer drafting software. (Assessment only through Assignments - Not for examination)

Unit V	ISOMETRIC AND PERSPECTIVE PROJECTION	15

Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and practicing three-dimensional modelling of simple objects by any free CAD software (Assessment only through Assignment - Not for examination). Perspective projection of simple solids- Prisms, pyramids and cylinders by visual ray method.

Lecture	**15 periods**
Practical	**60 periods**
Term Work & Self-Learning	**15 periods**
Total	**90 periods**

Course Outcomes: Upon successful completion of the course, students will be able to
CO1: Construct the Orthographic projections of points, lines and plane surfaces.
CO2: Construct the Projection of solids.
CO3: Construct the details of an object through sectional views and development of surfaces.
CO4: Construct orthographic views of an object by free hand sketching.
CO5: Construct the three dimensional isometric view and perspective projection.
Textbooks:
1. Venugopal, K. and Prabhu Raja, V., Engineering Drawing + AutoCAD, New Age International (P) Limited, 2022 [ISBN: 788122472752].
2. Natarajan, K.V., A Textbook of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 33rd Edition, 2020. [ISBN: 9788190414089].
3. Ramesh babu. V, A Textbook on Engineering Graphics, VRB Publishers, Chennai, 2021. [ISBN: 9789389027211].
References:
1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House, 54th edition, 2023. [ISBN: 9789385039706].
2. Sham Tickoo, AutoCAD 2017 for Engineers & Designers, 23rd edition, Dreamtech Press, 2016 [ISBN: 9789351199465].
3. Agarwal, B., Agarwal C.M., Engineering Drawing, 3rd edition, McGraw Hill Education, 2019 [ISBN: 9789353167448].
4. Parthasarathy, N. S. and Vela Murali, Engineering Drawing, Oxford University Press, 2015 [ISBN: 9780199455393].

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3				1				3		1	1	1

CO2	3				1				3		1	1	1
CO3	3				1				3		1	1	1
CO4	3				1				3		1	1	1
CO5	3				1				3		1	1	1

COURSE CODE	COURSE TITLE	L	T	P	TW&SL#	TH	C
UGA3176	HERITAGE OF TAMILS (Common to all B.E./B.Tech. programs)	15	0	0	15	30	1.0

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as a Classical Language – ClassicalLiterature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry -Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of templecar making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - AncientCities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over theother parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL PERIODS: 15

TEXT – CUM – REFERENCE BOOKS

1. Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr. S.V. Subaramanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil NaduText Book and Educational Services Corporation, Tamil Nadu)
8. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

COURSE CODE	COURSE TITLE	L	T	P	TW& SL#	TH	C
UGEV301	SDG Experiential Laboratory I (Common to all B.E./B.Tech. programs)	0	0	15	15	30	1.0

PREAMBLE

Sustainable Development Goals (SDGs), an essential guide to understanding and engaging with the global framework designed to achieve a better and more sustainable future for all. In 2015, the United Nations adopted the 2030 Agenda for Sustainable Development, which includes 17 SDGs, recognizing that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests…

OBJECTIVES

- To understand the basics of 17 SDGs.
- To acquire knowledge of the target and indicators of all SDGs.

METHODOLOGY

Students shall study any external course on Introduction to SDG, on a Self-Learning mode. Will be assessed at the end by a Seminar presentation on a possible project proposal in SDG.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Understand the history, scope, and challenges of the SDGs.

CO2: Analyze the interlinkages and synergies between different goals.

CO3: Evaluate the progress made towards achieving the SDGs globally and locally.

CO4: Develop strategies to implement and monitor the SDGs in various contexts.

REFERENCE BOOKS

1.Hazra, Somnath., Bhukta, Anindya (2020) Sustainable Development Goals An Indian Perspective, Springer International Publishing, Switzerland

2. Ziai, Aram (2016) Development Discourse and Global History from colonialism to the sustainable development goals. Routledge, London & New York

3. OECD (2019), Sustainable Results in Development: Using the SDGs for Shared Results and Impact, OECD Publishing, Paris, https://doi.org/10.1787/368cf8b4-en.

4. Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., Woelm, F. 2020. The Sustainable Development Goals and COVID-19. Sustainable Development Report 2020. Cambridge: Cambridge University Press.

5. https://www.un.org/sustainabledevelopment

COURSE CODE	COURSE TITLE	L	T	P	TW & SL#	TH	C
UMA3276	CALCULUS OF VECTORS, COMPLEX FUNCTIONS AND LAPLACE TRANSFORMS (Common to all B.E./B.Tech. programs)	45	15	0	60	120	4.0

OBJECTIVES

- Solve second order ordinary differential equations
- Evaluate line, surface and volume integrals.
- Understand the concept of analytic functions and its construction and apply the same in evaluating contour integrals.
- Find the Laplace Transforms of standard functions.
- Find the Inverse Laplace Transform of standard functions and solve second order linear ordinary differential equations with constant coefficients.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 12

Solution of second and higher order linear differential equations with constant coefficients (RHS functions - $e^{mx}, sinmx, cosmx, x^n, x^n f(x),\ e^{mx} f(x)$), Application to harmonic oscillation of an undamped Mass-Spring system- Method of variation of parameters- Simultaneous linear differential equations with constant coefficients of first order.

UNIT II VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and curl – Irrotational and Solenoidal vector fields, Line integrals, Path independence of line integrals, Surface integral - Area of a curved surface, Volume integral. Green's theorem in the plane, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III CALCULUS OF COMPLEX FUNCTIONS 12

Complex functions – Limit and Continuity, Derivative, Analytic functions – necessary and sufficient conditions – Cauchy-Riemann equations in Cartesian form (with proof) – Properties - Harmonic functions, Construction of analytic function, Bilinear transformation.

Cauchy's integral theorem – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular

contour (except the poles on the real axis).

UNIT IV LAPLACE TRANSFORMS 12

Definition, properties, existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Shifting theorems – Transforms of derivatives and integrals – Initial and final value theorems, Evaluation of integrals by Laplace transforms, Periodic functions.

UNIT V INVERSE LAPLACE TRANSFORMS 12

Inverse transforms – Definition, Properties, Method of Partial Fractions, Inverse Laplace transforms of derivatives and integrals - Convolution theorem - Applications of Convolution theorem. Applications to solving linear second order ordinary differential equations with constant coefficients using Laplace Transform.

TOTAL PERIODS: 60

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

CO1 Solve ordinary differential equations with boundary conditions
CO2 Apply the concepts of vector calculus to evaluate line, surface and volume integrals
CO3 Construct analytic functions and apply the concepts of analytic functions in contour integrals
CO4 Obtain the Laplace Transforms of standard functions.
CO5 Apply the concepts of Laplace Transforms in solving differential equations
CO6 Construct ordinary differential equations to real life problems and solve using Laplace transform techniques

TEXTBOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publishers, 45th Edition, 2020.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10thEdition, 2020.

REFERENCE BOOKS

1. Bali, N.P., Goyal, M., Watkins, C., Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited, 2007.

2. Boyce, W.E., and DiPrima, R.C., Elementary Differential Equations and Boundary Value Problems, Wiley India, 2012.
3. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Thomas' Calculus: Early Transcendental, 13th Edition, Pearson Education, 2013.
4. O'Neil. P. V., Advanced Engineering Mathematics, 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
5. Howard Anton, Irl C. Bivens, Stephen Davis, Calculus Early Transcendentals, 11th Edition, John Wiley & Sons, Inc., 2016.
6. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 2015.
7. Srivastava, A.C., and Srivastava, P.K., Engineering Mathematics Volume I and II, PHI learning Pvt. Ltd, 2011.

CO-PO-PSO MAPPING

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									
CO2	3	2									
CO3	3	2									
CO4	3	2									
CO5	3	2									
CO6	3	2									2

COURSE CODE	COURSE TITLE	L	T	P	TW& SL#	TH	C
UEE3251	ELECTROMAGNETIC THEORY	45	0	0	45	90	3.0

OBJECTIVES:

- To understand the basic mathematical concepts related to electromagnetic vector fields
- To study the concepts of Electrostatic fields, electrical potential, energy density and their applications.
- To study the concepts of Magneto static fields, magnetic flux density, vector potential and its applications.
- To apply concepts related to electrostatics, magnetostatics and electrodynamics in obtaining Maxwell's equations.
- To understand Electromagnetic wave propagation and characterize the parameters

UNIT I	AC CIRCUITS	9

AC circuit: Waveforms and RMS value, concept of impedance, Inductance, Capacitance, Power, Power factor, Phasor diagram. Three phase power supply – Star connection – Delta connection – Balanced and Unbalanced Loads- Power equation – Star Delta Conversion – Three Phase Power Measurement - types of tariffs – power factor improvement.

UNIT II	TRANSFORMER	9

Introduction - Ideal Transformer – Accounting for Finite Permeability and Core Loss – Circuit Model of Transformer – Determination of Parameters of Circuit Model of Transformer – Voltage Regulation –Name plate rating – Efficiency – Three Phase Transformers - Auto Transformers.

UNIT III	DC MACHINES	9

Introduction – Constructional Features– Motoring and generation principle – EMF and Torque equation – Types and characteristics – Universal Motor – Stepper Motors – Brushless DC Motors.

UNIT IV	AC MACHINES	9

Three-phase induction motors – Construction - Working –Types – Torque Equation. Single phase Induction motors - Construction and Working – Types – starting methods. Alternator- working principle– EMF equation. Synchronous motors- working principle-starting methods – Torque equation.

UNIT V	MEASUREMENT AND INSTRUMENTATION	9

Static and Dynamic Characteristics of Measurement, Calibration – Errors in Measurement – Principles of Electrical Instruments – Ammeter, Voltmeter, Multimeter, Wattmeter (Electro dynamometer type). Transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Apply AC circuit laws and phasor analysis to determine electrical parameters in single-phase and three-phase systems.

CO2: Analyze transformer models to determine its parameters under different loading conditions.

CO3: Apply EMF and torque equations to analyze the characteristics of DC motors and generators.

CO4: Analyze the operation and torque characteristics of AC machines for specific application.

CO5: Apply measurement principles and transducer characteristics to select appropriate instruments.

CO6: Design and analyze efficient electrical systems for real-world applications

TEXT BOOKS:

1. Kothari D.P and Nagarath, I.J, Basic Electrical and Electronics Engineering, McGraw Hill Education (India) Private Limited, Third Reprint, 2016.
2. Giorgio Rizzoni, Principles and Applications of Electrical Engineering, McGraw Hill Education (India) Private Limited, 2010.
3. S. Salivahanan, R. Rengaraj and G.R. Venkatakrishnan, "Basic Electrical and Instrumentation Engineering" , McGraw Hill, 2017.

REFERENCE BOOKS:

1. Bhattacharya S.K, Basic Electrical and Electronics Engineering, Pearson India, 2011.
2. Del Toro, Electrical Engineering Fundamentals, Pearson Education, New Delhi, 2015.
3. Leonard S Bobrow, Foundations of Electrical Engineering, Oxford University Press,2013.
4. Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall of India, 2006.
5. Mittle, N, Basic Electrical Engineering, Tata McGraw Hill Edition, 24th Reprint, 2016.
6. Fitzgerald A.E, David E Higginbotham, and Arvin Grabel, Basic Electrical Engineering, McGraw Hill Education (India) Private Limited, 2009.

CO-PO-PSO MAPPING

COs	POs											PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	3	2										3	
CO2	3	2										3	
CO3	3											3	
CO4	3											3	
CO5	3											3	
CO6	3	3	3	2	3			2	2		2	3	
Average	**3**	**2.33**	**3**	**2**	**3**			**2**	**2**		**2**	**3**	

COURSE CODE	COURSE TITLE	L	T	P	TW& SL#	TH	C
UEC3286	FUNDAMENTALS OF ELECTRONIC DEVICES	30	0	15	75	120	4.0

PREAMBLE

Fundamentals of Electronic Devices is a foundation course on the development of electronic devices. This course provides a broad overview on the working of various PN devices, special semiconductor devices and opto-electronic devices. Moreover, the students will have a hands-on experience in designing simple electronic devices using discrete electronic devices.

OBJECTIVES

- To acquaint the semiconductor properties and formation of PN Junction diode and its characteristics
- To understand the operation and applications of BJT, FET and special PN devices
- To understand the concepts of biasing in BJT, JFET and MOSFET
- To provide exposure to the students with hands-on experience on various basic electronic devices.

UNIT I SEMICONDUCTOR THEORY AND PN JUNCTION DIODE 9

Semiconductor Materials – Energy levels – Intrinsic and Extrinsic semiconductor – Temperature dependence of semiconductor parameters - Theory of PN junction diode – contact potential – Depletion layer – VI characteristics of PN diode - Diode current equation –- Transition and diffusion capacitances - Breakdown in PN junction diodes – Switching characteristics of PN diode – Applications of PN diode – Rectifier, clipper

UNIT II BIPOLAR JUNCTION TRANSISTOR 9

Construction of BJT – Operation of NPN and PNP transistors – Current components in BJT – Types of configurations -CE,CB, CC – Breakdown in Transistors - Need for biasing - DC load line and Q-point - Thermal runaway - Stability factor (S) - Analysis of Self biasing circuits

UNIT III FIELD EFFECT TRANSISTORS 9

JFET - Construction and operation - Characteristic parameters - Expression for saturation drain current – MOSFET – Enhancement and Depletion type – VI Characteristics – Threshold voltage – Channel length modulation – Biasing of FET - Construction and operation of MESFET and FINFET

UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9

Operation and I-V Characteristics of Zener diode – Application: voltage regulator – Tunnel diode – Varactor diode – PIN Diode - Operation and I-V Characteristics of UJT – SCR – TRIAC - DIAC – Operation and construction of Light Dependent Resistors (LDR)

UNIT V OPTO-ELECTRONIC DEVICES 9

Theory of direct bandgap materials – Optical absorption - Photoluminescence and Electroluminescence - LED – Photodetectors - Laser diode – Photo voltaic cells – Opto-isolators – Opto-couplers

LIST OF PROBLEM STATEMENTS (Any one)

1. Design an automatic water level indicator and a motor control using BJT/FET.
2. Construct a mobile charging unit using silicon-controlled rectifier (SCR).
3. Using an LDR and relay circuit, construct an automatic street light controller.
4. Construct a LED flash circuit using UJT
5. Design a battery eliminator circuit using Zener diodes.
6. Design a shadow movement alarm using photodiodes.
7. Design and develop an alarm security system using BJT.
8. Design a RF filter using a variable capacitor.
9. Design a fire alarm system using LDR/BJT.

TOTAL PERIODS: 60

COURSE OUTCOMES :

On successful completion of this course, the student will be able to

CO1: Explain the basics of device physics and working principle of Semiconductors and PN Junction diode

CO2: Describe the construction, operation of BJT and apply the knowledge of biasing on BJT

CO3: Describe the construction, operation of FET and apply the knowledge of biasing on FET

CO4: Understand and describe the operation of special semiconductor devices

CO5: Understand and describe the operation of Opto-electronic devices

CO6: Design simple electronic systems using semiconductor devices and analyze its characteristics.

TEXT BOOK

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, Eleventh Edition, 2016.
2. Salivahanan S and Suresh Kumar N, Electronic Devices and Circuits, McGraw Hill Education, Fourth Edition, 2017.

REFERENCE BOOKS

1. Semiconductor Optoelectronic Devices 2nd Edition", P. Bhattacharya, Prentice Hall, ISBN 0134956567.
2. Millman J, Halkias C and Sathyabrada Jit, Electronic Devices and Circuits, McGraw Hill Education (India) Private Ltd., Fourth Edition, 2015.
3. Thomas L. Floyd, Electronic Devices, Pearson Education, Ninth Edition, 2017.
4. David A. Bell, Electronic Devices and Circuits, Oxford University Press, Fifth Edition, 2017.

CO-PO and PSO MAPPING

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2		3							2		3	
CO2	2	2		3							2		3	
CO3	2	2		3							2		3	
CO4	2	2		2							2		3	
CO5	2	2		3							2		3	
CO6	2	2		3							2		3	

COURSE CODE	COURSE TITLE	L	T	P	TW& SL#	TH	C
UCY3276	ENVIRONMENTAL SCIENCE (Common to all B.E./B.Tech. programs)	15	0	0	15	30	1.0*

OBJECTIVES

- To develop a better understanding of human relationship with environment
- To explain the importance of conservation of resources
- To create awareness on pollution and environmental degradation
- To acquire knowledge on sustainable development
- To apply technical skills for solving environmental problems

UNIT I FUNFAMENTALS OF ENVIRONMENTAL SCIENCE 9

Definition, scope and importance of environment and function of an ecosysytem-Terrestrial(Forest)-Aquatic(lake)-ecological succession – ecological pyramids – Biodiversity in the environment- Types and Values of biodiversity- hot-spots of biodiversity – threats to biodiversity-In-situ and ex-situ conservation of biodiversity.

Field Trip: Zoo/Botanical Garden

UNIT II NATURAL RESOURCES 9

Forest resources: deforestation– Water resources: over- utilization of surface water and, conflicts over water, dams-benefits and problems – Mineral resources: environmental effects of mining– Food resources: fertilizer-pesticide problems– Energy resources: Need for renewable energy sources, use of alternate energy sources (Wind, Solar, Geothermal)– Land resources: soil erosion and desertification.

UNIT III CURRENT ENVIRONMENTAL ISSUES 9

Planetary boundaries-Environmental issues– causes, effects and control measures of Pollution of (a) Air (Smog, acid rain, climate change, ozone layer depletion) (b) Water (waste water treatment) (c) Soil

Solid waste management -wasteland reclamation, Electronic waste management

Population explosion- Population growth among nations–- Disaster management

Case study-Air Pollution in Delhi, Cooum river pollution, Chennai municipal waste management

Field Trip: Wastewater Treatment Plant

UNIT IV SUSTAINABLE DEVELOPMENT 9

Origin, purpose, and importance of the SD- Key issues and challenges of Environmental sustainability-

2030 Agenda for Sustainable Development- Indicators and metrics for tracking progress of sustainable development- Circular economy Rainwater Harvesting--Principles - Green Buildings-Advantages of green buildings over conventional buildings-smart city-Electric and Hybrid Electric Vehicles (HEV)

UNIT V ENGINEERING INTERVENTIONS TO REDUCE ENVIRONMENTAL STRESSES **9**

Role of technology in environment studies and human health- Use of Artificial Intelligence and Internet of Things- Environment database management system. Real-time data collection and analysis- Environmental Modelling and Simulation- Geographical Information Systems (GIS)-Remote Sensing-satellites and sensors-Use of Drones of Aerial mapping and Surveying.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

CO1	Analyse the functioning of ecosystem and apply conservation strategies to protect biodiversity and ecosystem stability.
CO2	Acquire knowledge on natural resources and explore suitable conservational practices to achieve sustainability.
CO3	Analyse the impact of environmental pollution on ecosystem and implement possible strategies to maintain environmental sustainability.
CO4	Examine the challenges of achieving environment sustainability and integrate circular economy strategies, green technologies, and smart solutions for sustainable development.
CO5	Evaluate the role of technology in environmental studies and human health, and analyse the use of advanced tools like AI, IoT, GIS, and remote sensing for data-driven environmental monitoring and management.
CO6	Explore interdisciplinary approaches for mitigating environmental issues and provide comprehensive review of technology-based solutions for addressing current challenges.

TEXTBOOKS

1. Anubha Kaushik and Kaushik, C. P. "Environmental Science and Engineering", New Age International Publishers, 14thEdition, 2014.
2. Benny Joseph, ‘Environmental Science and Engineering’, Tata McGraw-Hill, New Delhi, 2006

REFERENCE BOOKS

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition,Pearson Education, 2004.
2. Tyler Miller G. , and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
3. M.H. Fulekar, Bhawana Pathak and R.K.Kale, 'Environment and Sustainable Development' Springer Nature, 2013.

CO-PO-PSO MAPPING

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1					3								
CO2	1					3	2							
CO3	1					3	2				1			
CO4	1					3	2				1			
CO5	1					3					1			
CO6	2					3		2	2		2			

COURSE CODE	COURSE TITLE	L	T	P	TW& SL#	TH	C
UEC3201	**Circuits and Network Analysis**	45	15	0	60	120	4.0

PREAMBLE :

Circuit and network analysis is fundamental in understanding and designing electrical and electronic

circuits. It involves studying the behaviour of electrical quantities like voltage, current, power, and impedance within a circuit. Electronic engineers must analyze electric circuits thoroughly to realize electrical and analogue electronic circuits. Understanding circuit principles allows engineers to create efficient and reliable devices, from simple resistive networks to complex integrated circuits. In this course, the fundamental laws governing the circuits are studied by developing the mathematical representation and the analysis of the circuits.

COURSE OBJECTIVES :

- To learn the basic concepts and behaviour of DC circuits
- To learn the basic concepts and behaviour of AC circuits
- To understand various methods of circuit/ network analysis using network theorems.
- To learn the concept of resonance and coupling in tuned circuits.
- To understand the transient and steady-state response of the circuits subjected to DC and pulse excitations and to characterize two-port networks in Z, Y, ABCD and h parameters.

Unit I **DC Analysis** **12**

Ohm's law - Kirchhoff's laws - Resistors, inductors and capacitors in series and parallel circuits - voltage division in resistors and capacitors, current division, source transformation - star delta conversion - Mesh and node analysis.

Unit II **AC Analysis** **12**

Sinusoids, average value and RMS values of waveforms, phasors, phasor arithmetic, phasor relationship for circuit elements - Impedance and admittance - Kirchhoff's laws - Series and parallel circuits - Voltage and current division-Phasor diagrams for RL, RC and RLC circuits - Source transformation - Star Delta conversion - Mesh current and node voltage method of analysis.

Unit III **Network Theorems for DC and AC Circuits** **1**

Superposition theorem - Thevenin's and Norton's theorems - Maximum power transfer theorem - Reciprocity theorem.

Unit IV **Resonance and Coupled Circuits** **12**

Resonance - Series and Parallel resonance - frequency response - Quality factor and Bandwidth - Self and Mutual inductance - Coefficient of coupling - Dot convention - Modeling of coupled circuits - Coupled inductors in series and parallel - Tuned circuits - Single tuned and Double tuned coupled circuits.

Unit V **Transient Analysis & Two Port Networks** **12**

Transient response of RL and RC circuits using Laplace transforms for DC and pulse excitations- Series and parallel RLC circuits using Laplace transform for DC excitations - Two- port networks, Characterization of two-port networks in terms of Z, Y, ABCD and h parameters, representation of one parameter in terms of other - Interconnection of two-port networks - Symmetry and Reciprocity.

COURSE OUTCOMES :

On successful completion of this course, the student will be able to:

CO1: Apply the basic concepts of circuit analysis, such as Kirchoff's laws and mesh current and node voltage methods, to analyze DC and AC circuits.

CO2: Apply the basic circuit analysis concepts and network theorems such as the superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, and Maximum power transfer theorem to DC and AC circuits.

CO3: Analyze the frequency response of parallel and series resonance circuits, the concept of inductance, coupling and apply it to single and double tuned circuits.

CO4: Analyze transient response for RC, RL and RLC circuits and two port networks in terms of Z, Y, ABCD and h parameters.

Textbooks:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill Science Engineering, Eighth Edition, 11th Reprint 2016.

References:

1. Joseph A. Edminister, Mahmood Nahvi, Electric circuits, Schaum's outline series, Tata McGraw-Hill Publishing Company, 6th edition, 2016.
2. Charles K. Alexander, Mathew N.O. Sadiku, Fundamentals of Electric Circuits, McGraw Hill, 6th edition, 2017.
3. J. David Irwin, R. Mark Nelms, Basic Engineering Circuit Analysis, John Wiley & Sons, 11th edition, 2015.
4. S. Salivahanan, "Circuit Theory: Analysis and Synthesis", Pearson Education, First edition, 2021.
5. Bruce A. Carlson, Circuits, Cengage Learning, India Edition, 2008.

CO-PO-PSO MAPPING

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	3				1		1		3		1
CO2	3	3	2	3	3				1		1		3		1
CO3	2	3	2	3	3				1		1		3		1
CO4	2	3	2	3	3				1		1		3		1

COURSE CODE	COURSE TITLE	L	T	P	TW& SL#	TH	C
UGA3276	**TAMILS AND TECHNOLOGY (Common to all B.E./B.Tech. programs)**	15	0	0	15	30	1.0

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries(BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)-Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold - Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stonetypes described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL PERIODS: 15

TEXT – CUM – REFERENCE BOOKS

1. Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL-(in print)
2. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr. S.V. Subaramanian, Dr. K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay)(Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil NaduText Book and Educational Services Corporation, Tamil Nadu)
8. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code	Course Title	L	T	P	TW& SL#	TH	C
UGE3297	DESIGN THINKING AND ENGINEERING PRACTICES LABORATORY (Common to all B.E./B.Tech. programs)	0	0	30	15	45	1.5

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.
- To train the students to dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model, and to assemble the different engineering components.

LIST OF EXPERIMENTS

GROUP A: (CIVIL & MECHANICAL ENGINEERING PRACTICE)

I CIVIL ENGINEERING PRACTICE

- Buildings:

Study of plumbing and carpentry components of residential and industrial buildings - Safety aspects. Plumbing Works:

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.
2. Preparation of plumbing line sketches for water supply and sewage works.
3. Hands-on-exercise:

- Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components.
- Plumbing with basic connections for washing basin and sink
- Carpentry using Power Tools only:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: Woodwork, joints by sawing, planning and cutting.
   (a) Fabrication of different models of pencil box and pen stand.
   (b) Fabrication of wooden wall shelf
3. Demonstration of wood working machinery

II MECHANICAL ENGINEERING PRACTICE

- Basic Machining:

- Drilling Practice (holes of various diameters - steel sheet metal, wood, hylam/plywood sheet)

Sheet Metal Work:

- Forming & Bending
- Different type of joints.
  - – Fabrication of mobile phone metal stand
  - – Fabrication of electrical control panel box
- Design thinking practices: To dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model, and to assemble the following components.
  - Pedestal Fan head swing mechanism - Reserve mechanism (Two-wheeler) - Tyre removal and mounting for four wheeler.
  - Flush tank container mechanism - Hand pump - washer Mechanism

GROUP B (ELECTRICAL & ELECTRONICS ENGINEERING PRACTICE)

1. Residential house wiring, staircase wiring and tube light wiring with single phase AC two wire system.
2. Energy measurement with RLC Load.
3. Earth resistance measurement.
4. Measurement of AC parameters using CRO and half wave and Full wave rectifier.
5. Study of logic gates AND, OR, EX-OR & NOT.
6. Soldering practice – Components Devices and Circuits – Using PCB.

- **Design thinking practices:**

1. Assemble a single phase 3 wire circuit for connecting household appliances and explain through schematic diagram.
2. Measure the energy consumed by the household appliances and verify it theoretically.
3. Analyze the fault occurring in electrical appliances.
4. Design, assemble and test a cell phone charger.
5. Design, assemble and test relay logic to control electrical appliances.
6. Design, assemble and test a dc power supply using PCB.

Practical		**45 periods**
Term Work & Self-Learning		**15 periods**
Total		**60 periods**

COURSE OUTCOMES : Upon successful completion of the course, students will be able to

CO1: Draw pipeline plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common

household woodwork.
CO2: Practice machining to make holes on different materials; fabricate sheet metal components.
CO3: Dismantle, understand the functional/aesthetic aspects of the product, prepare the part functional model of various components.
CO4: Construct domestic electrical circuits and verify their output parameters.
CO5: Construct electronics circuits and verify their output.
REFERENCES :
1. S Gowri, T Jeyapoovan, Engineering Practices Laboratory Manual, 5th Edition, Vikas Publishing, 2016 [ISBN: 9788125949657].
2. V Ramesh Babu, Engineering Practices Laboratory, VRB Publications, 2006 [ISBN: 978819359938].
3. Willis H Wagner, Howard Bud Smith, Mark W Huth, Modern Carpentry, 12th Edition, Goodheart-Willcox Pub, 2015 [ISBN: 9781631260834].
4. P C Sharma, A Textbook of Production Technology (Manufacturing Processes), S Chand publisher, 2006 [ISBN: 9788121911146].
5. Robert W Messler, Jr., Reverse Engineering: Mechanisms, Structures, Systems and Materials, Illustrated Edition, McGraw-Hill Professional Pub, 2013 [ISBN: 9780071825160].
6. David W Rongey, A Complete Guide to Home Electrical Wiring, 2013 [ISBN: 9780989042703].

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						2	2	2	2		2		
CO2						2	2	2	2		2		
CO3						2	2	2	2		2		
CO4						2	2	2	2		2		
CO5						2	2	2	2		2		

Course Code	Course Title	L	T	P	TW& SL#	TH	C
UEC3211	CIRCUITS AND DEVICES LABORATORY	0	0	30	15	45	1.5

Course Objectives:

- To gain hands on experience in selected network theorems
- To understand the working of resonant circuits
- To learn the VI characteristics of basic semiconductor electronic devices

LIST OF EXPERIMENTS

Part 1 Circuits Experiments

10. Verification of Kirchhoff's Voltage Law and Kirchhoff's Current Law.
11. Verification of Thevenin and Norton theorem.
12. Verification of Superposition theorem.
13. Verification of Maximum Power Transfer and Reciprocity theorem.
14. Determination of Resonance Frequency of Series and Parallel RLC Circuits.

Part 2 Electronic Devices Experiments

1. VI Characteristics of PN Junction diode.
2. Zener diode Characteristics & voltage Regulation using Zener diode.
3. Input and Output Characteristics of BJT in CB configuration.
4. VI Characteristics of JFET.
5. VI characteristics of SCR.

TOTAL PERIODS: 45

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Verify network theorems and estimate the resonant behaviour of RLC circuits.

CO2: Analyze the characteristics of basic electronic devices.

CO – PO & PSO MAPPING

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3		3				3	2		1			
CO2	3	2	2	3				3	2		1			

COURSE CODE	COURSE TITLE	L	T	P	TW& SL#	TH	C
UGEV302	**SDG Experiential Laboratory II (Common to all B.E./B.Tech. programs)**	0	0	15	15	30	1.0

PREAMBLE

This course explores the principles and practices of sustainability within the context of a college campus. Through hands-on projects and collaboration with campus facilities, students will identify, design, and implement sustainability initiatives aimed at improving the environmental, social, and economic health of the campus community. The "Live in Lab" approach provides students with the opportunity to apply theoretical knowledge in real-world settings, working directly with campus stakeholders to achieve measurable sustainability outcomes.

OBJECTIVES

By the end of this course, students will:

1. Understand the principles of sustainability and their application to campus environments.
2. Analyze the current sustainability practices of the campus.
3. Develop and implement projects aimed at enhancing campus sustainability.
4. Collaborate with campus stakeholders to achieve project goals.
5. Evaluate the impact of sustainability initiatives on the campus community.

METHODOLOGY

Students shall work in teams of not more than four, on a project related to the SDG theme. Teams will be guided by faculty. assessment at the end of the semester will be on a project evaluation mode

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

CO1	Apply sustainability principles to analyze and evaluate societal and environmental aspects that are relevant to economy, health, safety , culture and environment (WK1)
CO2	Conduct sustainability assessments of the campus facilities and operations by implementing multi-disciplinary team projects in collaboration with campus stakeholders using the available resources in relevance to the societal and environmental aspects (WK1, WK7, WK8, WK9)
CO3	Monitor and report the project results of the sustainability initiatives to diverse audiences.

List of Experiments/activities/projects

1. **Sustainability Tours** – Visit to Solar Farms, Substation and Power plant Lakes, and wells in and around the campus
2. **Sustainability Project ideas**

   Priority Areas: Projects support - priority framework areas ensuring a climate-ready, liveable planet, in terms of health and wellbeing of people, for global prosperity, and supporting our academic mission and purpose.

   Choose a sustainability project/ propose a sustainability project/ adopt a sustainability project'

   Sample list of Projects

   - Social Media campaign for student climate action
   - Campus Metabolism – (Energy)
   - Social media Campaign for student Purchase Behaviour
   - SSN Waste Stationeries/ Data Management
   - Energy Management and control system Portal for SSN
   - Sustainable Design of Future SSN Campus – Carbon neutrality
   - Creating a Campus Sustainability Map
   - Tree survey on the Campus

- Alternative Transportation ideas for students, Faculty
- Study the Department wise waste generation pattern in the Campus
- Ideas to Recycle the waste generated on the campus
- Ideas to upcycle the waste generated on the campus
- Design new Recycling signage suitable for the campus
- Creating awareness of Recycling and waste reduction on the campus beyond or the no-waste campaign
- Create a sustainable low-impact event plan
- Green Skilling – working with sustainable agriculture collaborate Choose a sustainability project/ propose a sustainability project/ adopt a sustainability project'

CO-PO-PSO MAPPING

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2					2								
CO2	1					2		2	2		1			
CO3	1							1	3		1			

HUMANITIES I-ELECTIVE (II-SEMESTER)

COURSE CODE	COURSE TITLE	L	T	P	TW &SL	TH	C
UEN3286	PSYCHOLOGY AND COMMUNICATION (Common to all B.E./B.Tech. programs)	30	0	15	45	90	3

OBJECTIVES

The learners will be able to:

- Recall, recognize, and regulate their emotions effectively, and understand the various factors that motivate human behaviour
- Articulate and understand the underlying principles of social psychology, group work and leadership skills
- Demonstrate and apply the principles of personality, learning, memory and thinking
- Discuss and analyse the concepts of developmental psychology and stress management
- Describe and differentiate between various psychological disorders - personality disorders and clinical disorders

UNIT I EMOTION AND MOTIVATION 9

Recognizing emotions - Emotions, feelings, and behaviour - Regulating Emotions - Emotional intelligence - Motivation - Basic definitions - different types of motivation - Intrinsic and Extrinsic motivation - Defence Mechanisms - Self-actualization and Maslow's hierarchy of needs

UNIT II SOCIAL PSYCHOLOGY 9

Psychology and social behaviour - Forming and maintaining relationships - Liking and attachment - Social Life - Communicating one to one - Communicating in a group - Stages of group formation - Team building - Factors that affect group performance: Social loafing, Polarisation and Groupthink - Attitudes, Prejudice, and stereotypes - Booting group performances - Leadership skills and traits - transformational and transactional leadership

UNIT III PERSONALITY AND LEARNING 9

Personality -- Freud's psychoanalytic theory - Personality traits – The Big Five - Self-esteem, self-confidence, and self-efficacy - -- Conditioning and learning – Classical and operant conditioning - Building memory - Types of memory - Types of thinking – Problem solving, making good and bad decisions - Creative thinking

UNIT IV DEVELOPMENTAL PSYCHOLOGY 9

The lifespan - Infancy and Childhood - Attachment - insecure-avoidant, anxious-ambivalent and secure - Adolescent - Types of Love: intimacy, passion, and commitment - Adulthood - Cognitive development, moral development, and social development - Sex, gender and sexuality - Stress - Coping with stress - Managing stress - Happiness

UNIT V PSYCHOLOGICAL DISORDERS 9

Personality disorders: antisocial; avoidant; borderline; dependent; histrionic; narcissistic; obsessive compulsive; paranoid; schizoid; schizotypal - Clinical disorders: Anxiety disorders, Disorders of mood, Schizophrenia, Dissociative Identity Disorder (DID) - Self-help - Therapeutic help

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the learners will learn to:

1. Communicate and apply the psychological theories of emotion and motivation to their everyday lives effectively
2. Summarise and practice the principles of social psychology to improve interpersonal relationships, group dynamics and leadership roles with confidence and ease
3. Articulate and demonstrate a comprehensive understanding of personality, learning, memory and thinking
4. Discuss and interpret developmental psychology principles and effective stress management technique to handle life's challenges
5. Debate and realise the impact of psychological disorders in an individual's life, and the effectiveness of available treatment options

TEXTBOOKS

1. Myers, D. G. & DeWall, C. N. (2020). *Psychology in everyday life*. (5 eds). Macmillan.
2. Strongman, K. T. (2006). *Applying psychology to everyday life: A beginner's guide*. John Wiley & Sons.

REFERENCES

1. Morgan, C., King, R., Weisz, J., Schopler, J. *Introduction to Psychology.* McGraw Hill Education, 7th edition
2. Ralls, E., & Riggs, C. (2021). *The Little Book of Psychology: An Introduction to the Key Psychologists and Theories You Need to Know*. Simon and Schuster.

CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1								1	3		2		
CO2								2	3		2		
CO3								1	3		1		
CO4								1	3		1		
CO5								1	3		1		

COURSE CODE	COURSE TITLE	L	T	P	TW &SL	T H	C
UEN3287	HUMAN RELATIONS AND COMMUNICATION SKILLS (Common to all B.E./B.Tech. programs)	30	0	15	45	90	3

OBJECTIVES

The learners will be able to:

- Describe and understand the impact of personality, attitudes, self-esteem, perception, emotional intelligence and stress on human relations
- Explain and recognize the importance of motivation, teamwork and communication strategies in career development
- Demonstrate and gain insights into decision-making processes and ethical considerations at the workplace
- Communicate and learn conflict management styles and negotiation strategies for effective workplace interactions
- Discuss and analyse leadership management styles to manage career growth opportunities

UNIT I MANAGING YOURSELF 9

The importance of human relations - Personality and Attitude - Perception skills - Self-Esteem and Self-confidence - Emotional intelligence - Goal setting - Continuous learning - Managing stress - Types of stress - Symptoms of stress - Sources of stress - Reducing stress

UNIT II MANAGING TEAMS 9

Communication strategies - Verbal and non-verbal communication strategies - Human motivation at work - Strategies used to increase motivation - Work effectively in groups - Types of groups - Group development process - Group member roles - Positive and negative roles - Team building skills

UNIT III MANAGING DECISION MAKING 9

Making good decisions - Understanding decision - Making faulty decision - Decision making in groups - Ethics at work - An Ethics framework - Making ethical decisions - Social responsibility

UNIT IV MANAGING CONFLICT AND NEGOTIATION 9

Handling conflict and negotiation - Understanding conflict - Causes and outcomes of conflict - Conflict management - Negotiations - Ethical and cross-cultural negotiations - Managing diversity at work - Diversity and Multiculturalism

UNIT V MANAGING CAREER 9

Leadership and management skills - Leadership styles - Career growth - Power positioning and power sources - Behaviour and change - Impression management - Personality and strategies

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the learners will learn to:

1. Explain and recognise how personality, attitudes, self-esteem, perception, emotional intelligence, and stress influence human relations
2. Discuss and apply motivation, teamwork, and communication strategies to enhance career development
3. Express and evaluate decision-making processes and ethical standards in professional settings
4. Defend and practice conflict management styles and negotiation tactics in academic settings
5. Debate and develop leadership abilities and career management skills

TEXTBOOKS

1. Laura Portolese Dias (2012). *Human Relations*. Saylor Foundation. https://open.umn.edu/opentextbooks/textbooks/132

REFERENCES

1. DuBrin, A. J. (2011). *Human relations for career and personal success: Concepts, applications, and skills*. Prentice Hall/Pearson.
2. McCann, V. (2016). *Human relations: The art and science of building effective relationships*. Pearson.

CO – PO/PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1							0	1	3		1		
CO2							0	3	3		1		
CO3							1	1	3		1		
CO4							1	1	3		1		
CO5							0	1	3		1		

COURSE CODE	COURSE TITLE	L	T	P	TW &SL	TH	C
UEN3288	COMMUNICATION THROUGH MEDIA (Common to all B.E./B.Tech. programs)	30	0	15	45	90	3

OBJECTIVES

The learners will be able to:

- Describe the developments in the history of films over the centuries
- Comprehend the basic film terminologies and theories to understand the structure and components of films
- Examine the role of regional and global films in reflecting the various aspects of society
- Acquire the necessary writing skills to analyze and critically appreciate films as a creative art form
- Learn the art of storytelling through films, from crafting short and long narratives to producing and presenting a compelling short film

UNIT I HISTORY OF FILMS 9

- Origins, contribution of Lumiere brothers, Cinema Verite
- Early cinema: Silent Films
- Evolution from Motion Pictures to Feature Films
- Social and political context of films
- The Indian Film Industry and the Hollywood

UNIT II STRUCTURE AND COMPONENTS OF FILMS 9

- Basic film vocabulary: story, plot, character, tagline, logline, dramatic question
- Three Act Structure
- Film Theory: Auteur's Theory, Realist Theory
- Components of cinematography: Camera angle, Shots, Movements, Equipment, Film Technology
- Process and People in Film Making: Cast, Production, Distributor, Director, Editor

UNIT III FILM AND SOCIETY 9

- Films and their influence on the language of people
- Aspects of gender in films
- Regional cinema and global cinema
- Cultural impact of films in society: Case studies from Indian cinema
- Film as tool of social criticism

UNIT IV FILM APPRECIATION 9

- Film Genres, Types, Documentaries
- Creating character profiles
- Mise-en-scene
- Web Series, OTT: sample case studies
- Writing film Reviews

UNIT V FILM AS CREATIVE EXPRESSION 9

- Creating short stories 250 words
- Creating long stories 700 words
- Designing storyboard / screenplay
- Types of scripts, creating film script
- Producing and presenting a short film (5 to 10 minutes)

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the students will:

1. Read and comprehend resources that trace the history and evolution of films in the global context over the centuries
2. Listen to lectures and study materials to understand and apply basic film vocabulary and film theory
3. Speak effectively on the larger impact of the role of films in the society
4. Write film reviews, stories and film scripts by learning to appreciate the various nuances and aspects involved in the filmmaking process
5. Present their artistic abilities by creating their own short films based on the takeaways from the course

TEXTBOOKS

1. *Film Studies: An Introduction* - Ed Sikov
2. *Understanding the Film: An Introduction to Film Appreciation* - Jan Bone and Ron Johnson

REFERENCE BOOKS

1. *Bollywood: A Guidebook to Popular Hindi Cinema* - Tejaswini Ganti
2. *Introduction to Film Studies* - Jill Nelmes
3. *The 5 C's of Cinematography: Motion Picture Filming Techniques* - Joseph V. Mascelli
4. *The Film Book: A Complete Guide to the World of Film* - Ronald Bergan

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1							1	0	3		1		
CO2							0	0	3		1		
CO3							1	0	3		1		
CO4							0	1	3		1		
CO5							0	1	3		1		

COURSE CODE	COURSE TITLE	L	T	P	TW &SL	TH	C
UEN3289	TECHNICAL WRITING (Common to all B.E./B.Tech. programs)	30	0	15	45	90	3

OBJECTIVES

The learners will be able to:

1. Prepare effective instructions, checklists and emails
2. Write different kinds of paragraphs and argumentative essays
3. Develop and revise effective resumes, cover letters and SOPs
4. Document and organise various kinds of reports, case studies and white papers
5. Create well-structured proposals and press releases

UNIT I WRITING INSTRUCTIONS, CHECKLISTS AND EMAILS 9

Writing instructions and checklists; using bulleted lists and numbered lists. Writing professional emails: appropriate greetings, subject line, writing three-body paragraphs – introduction, body, and closing paragraph; discussion of samples.

Language skills: Tenses – present and past

UNIT II WRITING ARGUMENTATIVE PARAGRAPHS AND ESSAYS 9

Writing paragraphs. Structure of a paragraph: basic, compare and contrast. Product descriptions and process descriptions. Interpreting charts and graphs. Writing argumentative essays; handling three types of arguments: Classical, Rogerian, Toulmin; structure of an argumentative essay: introduction, building the thesis, body paragraphs with three arguments or claims and supporting evidence, conclusion. Sample essays.

Language skills: Connectors and definitions

UNIT III WRITING JOB APPLICATIONS AND SUMMARIES 9

Writing job applications; resumes and cover letters. Writing the statement of purpose (SOP): Outline – professional narrative, previous experience, research interests, and career goals. Writing summaries: reading the text; identifying the main ideas and supporting details. Writing paraphrases: step by step paraphrasing; text comparison; sentence analysis.

Language skills: subject-verb agreements

UNIT IV WRITING REPORTS, CASE STUDIES AND WHITE PAPERS 9

Writing datasheets: outline – descriptions, graphics, benefits, features and specifications, requirements, and contact information. Writing abstracts. Writing technical reports; practising IMRAD structure; Engineering reports & Feasibility reports. Writing case studies and white papers: main components of an issue case study – problems, search for solutions, implementation of the solution and results.

Language skills: Active voice, passive voice

UNIT V WRITING PROPOSALS AND PRESS RELEASES 9

Writing business proposals: format -- title page, table of contents, executive summary, project details, deliverables and milestones, budget, conclusion. Writing for Websites: Inverted pyramid style; headings and subheading; bulleted lists; short paragraphs with one idea. Writing press releases: outline – headline, date of publication, contact information, summary, intro paragraph, detail paragraphs, and about section.

Language skills: Correction of errors, proofreading and editing

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the learners will be able to:

1. Write instructions, checklists and emails with clarity and readability
2. Compose paragraphs, and structure an argumentative essay effectively
3. Create and edit resumes, cover letters and SOPs concisely
4. Document well-structured reports, case studies and white papers
5. Develop effective proposals and press releases

TEXTBOOKS

1. Laplante, P. A. (2018). *Technical writing: A practical guide for engineers, scientists, and nontechnical professionals*. CRC Press.
2. David Bonamy. (2013) Technical English Level 2 Course Book. Pearson

REFERENCE BOOKS

1. Kmiec, D., & Longo, B. (2017). *The IEEE guide to writing in the engineering and technical fields*. John Wiley & Sons.
2. Lewis Lansford; Peter Astley. (2013). Oxford English for Careers: Engineering 1: Student's Book. Oxford University Press.
3. Mark Ibbotson. (2008). Cambridge English for Engineering, 2008, Cambridge University Press.
4. Rubens, P. (2002). *Science and technical writing: A manual of style*. Routledge.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1								0	3		1		
CO2								0	3		1		
CO3								0	3		1		
CO4								1	3		2		
CO5								1	3		2		

COURSE CODE	COURSE TITLE	L	T	P	TW &SL	TH	C
UHS3286	GERMAN BEGINNER LEVEL (Common to all) B.E./B.Tech. programs)	30	0	15	45	90	3

OBJECTIVES

1. Introduce students to the fundamentals of German language.
2. Develop basic language skills: listening, speaking, reading, and writing.
3. Equip students to achieve A1 level language proficiency certification.
4. Cultivate intercultural understanding and appreciation for diverse linguistic and cultural perspectives.
5. Understand the Grammatical structure of the German language.

UNIT I LANGUAGE AND CULTURE 9

Greetings – Self Introduction – Numbers and Alphabets – Names Of Countries And Continents

UNIT II BASIC GRAMMAR 9

Definite And Indefinite Articles – Simple Verbs and Conjugation – Pronouns – Possessive Pronoun – W Questions

UNIT III READING SKILLS 9

Reading Simple Passages – Context-Based Learning – Professions – Language and Country – Freetime Activities – Daily Routine

UNIT IV LISTENING SKILLS 9

Comprehending Real-Time Situation-Based Dialogues – Travel Announcements – Supermarket – Plans For Vacations – Dialogues At Work

UNIT V WRITING AND SPEAKING SKILLS 9

Introducing Self – Describing Daily Routine – At the Café, Restaurant – Ordering Food – Weather and Clothing - Family

TOTAL PERIODS: 45

COURSE OUTCOMES

By the end of this course, learners will be able to:

1. Understand the Relationship Between Language and Culture
2. Apply Basic Grammar Rules
3. Develop Effective Reading Skills
4. Enhance Listening Skills
5. Communicate Effectively in Writing and Speaking

TEXTBOOKS

1. Netzwerk a1 deutsch als fremdsprache by stephanie dengler (2012)
2. Studio d a1 deutsch als fremdsprache by hermann funk (2011)

REFERENCES

1. Password Deutsch 1 By Ulrike Albrecht

CO-PO-PSO Mapping

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1						1			1	3		1			
CO2						1			1	3		1			
CO3						1			1	3		1			
CO4						1			1	3		1			
CO5						1			1	3		1			
Average						**1**			**1**	**3**		**1**			

COURSE CODE	COURSE TITLE	L	T	P	TW &S L	TH	C
UMA3362	PROBABILITY THEORY AND STOCHASTIC PROCESSES (TCP)	30	15	30	45	120	4

OBJECTIVES

- To provide a strong foundation in probability theory and random processes,
- To Enable students to model and analyse uncertainty in engineering systems using concepts such as random variables, distributions, random processes, and spectral analysis.

UNIT I PROBABILITY 9

Sample Space- Events -Probability - Axioms of probability – Types of events – Probability rules (addition and multiplication) - Conditional probability -Baye's theorem

UNIT II RANDOM VARIABLES 9

Discrete and Continuous random variables - Moments - Moment generating functions - Binomial, Poisson, Uniform, Exponential, Normal distributions - Functions of a random variable.

UNIT III TWO-DIMENSIONAL RANDOM VARIABLES 9

Joint distributions - Marginal and Conditional distributions –Covariance - Correlation and Linear regression - Transformation of random variables - Central limit theorem (for independent and identically distributed random variables).

UNIT IV RANDOM PROCESSES 9

Classification - Stationary process - Poisson process -Markov process - Discrete parameter Markov chain - Chapman Kolmogorov equation - Limiting distributions.

UNIT V POWER SPECTRAL DENSITIES 9

Auto-correlation functions - Cross-correlation functions : Properties - Power spectral density - Cross power spectral density: Properties - Wiener Khintchine theorem- Linear time invariant system - System transfer function - Linear systems with random inputs - Auto-correlation and cross-correlation functions of input and output of LTI systems.

LIST OF EXPERIMENTS:

1. To understand variables, constants, arithmetic operations, matrix operations, vector operations, calculating expression, polynomials.
2. To generate and plot different functions like unit step function, sinusoidal functions, square, triangular and saw tooth function in various intervals. To plot data in two and three dimensions.
3. To generate a sample of random variables with the binomial, Poisson, geometric, uniform, exponential and normal distributions. Calculate their cumulative distribution functions and plot them.
4. To capture a signal in the form of a discrete sequence by sampling it and to compute the

auto correlation function for different lags.

5. Define a class of functions in the finite interval like, the function f(x) = |x| over the interval – 1< x <1. Compute its Fourier transform and plot it.
6. Simulate a discrete time Markov chain with given transition probabilities and characterize its states and obtain its transition diagram. Find the stationary distribution of the Markov chain.
7. Generate two signals and calculate the cross correlation between them. Use cross correlation to align two signals that are shifted versions of each other. Use cross correlation to detect a known pattern in a signal.
8. Given a signal calculate its auto correlation function and use the Weiner Khinchine theorem to find its power spectral density. Use a signal with a known PSD to verify the WKT.

Lecture	**: 30 Periods**
Tutorial	**: 15 Periods**
Practical	**: 30 Periods**
Term work & Self-Learning	**: 45 Periods**
Total	**: 120 Periods**

OUTCOMES

On successful completion of this course, the student will be able to

CO1: utilize probability concepts, including event types, probability rules, conditional probability, and Bayes' theorem, to solve problems.

CO2: apply standard probability distributions in solving engineering problems.

CO3: analyze two-dimensional random variables to determine joint distributions, expectations, and correlation measures.

CO4: solve problems involving stationarity, Poisson processes, and Markov chains.

CO5: use the Wiener-Khintchine theorem to relate autocorrelation functions with power spectral densities.

CO6: apply the principles of probability, random variables, and random processes to model, analyze, and interpret real-world engineering problems and systems under uncertainty.

TEXT BOOKS:

1. Ibe O.C, Fundamentals of Applied Probability and Random Processes, 2nd Indian Reprint, Elsevier, 2014.
2. Peebles P.Z, Probability, Random Variables and Random Signal Principles, Tata McGraw Hill, 4th Edition, New Delhi,2014.

REFERENCE BOOKS:

1. Cooper G.R and McGillem C.D, Probabilistic Methods of Signal and System Analysis, Oxford University Press, New Delhi, 3rd Indian Edition,2012.
2. Hwei Hsu and Schaum's, Outline of Theory and Problems of Probability, Random Variables and Random Processes , Tata McGraw Hill Edition, New Delhi,2017.

3. Stark. H and Woods. J.W, Probability and Random Processes with Applications to Signal Processing, Pearson Education, Asia, 3rd Edition,2002.
4. Edward B. Magrab, Shapour Azarm, Balakumar Balachandran, James Duncan, Keith Herold, Gregory Walsh, An Engineer's Guide to MATLAB, 3e: with Applications from Mechanical, Aerospace, Electrical, and Civil Engineering, Prentice Hall, 2011.

CO-PO Mapping

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2												
CO2	3	2												
CO3	3	2			2									
CO4	3	2			2									
CO5	3	2			2									
CO6	3	2			2						2			

COURSE CODE	COURSE TITLE	L	T	P	TW + SL	TH	C
UHS3386	**UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY (Common to all B.E./B.Tech. programs)**	30	0	30	30	90	3

OBJECTIVES

- To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education
- To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
- To help students understand the meaning of happiness and prosperity for a human being
- To facilitate the students to understand harmony at all the levels of human living and live accordingly.
- To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life course

UNIT I INTRODUCTION TO VALUE EDUCATION 9

Value Education - Need, Basic Guidelines, Content and Process, Self-Exploration - meaning, importance and process, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities - the basic requirements, Understanding Happiness and Prosperity - A critical appraisal of the current scenario, Method to fulfill the above human aspirations - understanding and living in harmony at various levels.

UNIT II HARMONY IN THE HUMAN BEING 9

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT III HARMONY IN THE FAMILY AND SOCIETY 9

Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human to human relationship; Understanding Trust the foundational value in relationship, Difference between intention and competence, Understanding Respect - as the right evaluation, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society - comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order - from family to world family!

UNIT IV HARMONY IN THE NATURE AND EXISTENCE 9

Understanding the harmony in the Nature, Interconnectedness, self-regulation and mutual fulfilment among the four orders of nature- recyclability, Understanding Existence as Co- existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS 9

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics - augmenting universal human order, the scope and characteristics of people- friendly and eco-friendly, Holistic Technologies, production systems and management models - Case studies, Strategy for transition from the present state to Universal Human Order - At the level of individual: as socially and ecologically responsible engineers, technologists and managers, At the level of society: as mutually enriching institutions and organizations.

Lecture hours	**: 30 Periods**
Practical hours)	**: 30 Periods**
Term work & Self-Learning hours	**: 30 Periods**
Total hours	**: 90 Periods**

OUTCOMES:

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

CO1 - Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.

CO2 - Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.

CO3 - Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.

CO4 - Understand the harmony in nature and existence and work out their mutually fulfilling participation in the nature.

CO5 - Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

TEXTBOOKS

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2nd Revised Edition, 2019

REFERENCES

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

CO-PO-PSO Mapping

COs	**POs**											**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1							3	2	3		1			
CO2							3	2	3		1			
CO3							3	3	3		1			
CO4							3	2	3		1			
CO5							3	2	3		1			
Average							**3**	**2**	**3**		**1**			

COURSE CODE	COURSE TITLE	L	T	P	TW& SL	T H	C
UEC3301	ELECTRONIC CIRCUITS	45	0	0	45	90	3

PREAMBLE:

Electronic circuits delve deeper into the practical applications of transistors in modern electronic systems. This course emphasizes the design and optimization of amplifiers, signal generators, and related circuits, using both Bipolar Junction Transistors (BJTs) and Field-Effect Transistors (FETs). The curriculum is tailored to equip learners with the skills to apply transistor technologies effectively in communication systems, signal processing, and industrial electronics, fostering innovation in circuit design.

OBJECTIVES:

- To analyse the frequency response of small signal amplifiers
- To design and analyse single and multi-stage amplifiers.
- To acquire proficiency in tuned and power amplifiers.
- To expertise the concept of feedback amplifiers
- To construct transistor-based waveform generators

UNIT I BJT AND FET SINGLE-STAGE AMPLIFIERS 9

Small signal hybrid-π equivalent circuit of BJT and FET - Frequency response of amplifier circuit – Miller effect - –- Midband analysis of CE, CC and CB amplifiers – Midband analysis of CS, CD and CG amplifiers

UNIT II MULTI-STAGE AND DIFFERENTIAL AMPLIFIERS 9

Introduction to Multi-stage amplifiers - Bootstrapping Technique - Darlington amplifier- Cascade and Cascode amplifier using BJT – Analysis of Differential amplifier using BJT and FET

UNIT III TUNED AND POWER AMPLIFIERS 9

Tuned amplifiers - Single tuned amplifiers – Gain and frequency response – Power Amplifiers: classification – efficiency - Class A, Class B, Class AB, Class C Amplifiers - Amplifier Distortion
- Power Transistor Heat Sinking

UNIT IV TRANSISTOR FEEDBACK AMPLIFIERS 9

Concept of feedback in amplifiers - Advantages of negative feedback – General characteristics of negative feedback – Feedback topologies - voltage / current, series/shunt feedback - Analysis of feedback amplifiers

UNIT V TRANSISTOR SIGNAL GENERATORS 9

Basic principles of sinusoidal oscillators - Condition for oscillation - RC phase shift oscillator, Wien Bridge Oscillator - Hartley, Colpitts - Crystal Oscillators - Multivibrators: Collector coupled
- Bistable, Monostable and Astable multivibrators.

Lecture : 45 Periods
Term work & Self-Learning : 45 Periods
Total : 90 Periods

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Apply theoretical concepts to analyze the frequency response of small-signal amplifiers.
CO2: Derive and interpret the transfer function of single and multi-stage amplifiers. CO3: Design and analyse the theoretical concepts of tuned and power amplifiers.
CO4: Apply the concept of feedback in the design of amplifiers and oscillators.

CO5: Design and construct transistor-based waveform generators.

TEXT BOOK:

1. Donald.A.Neaman, Electronic circuit Analysis and Design – 2nd Edition, Tata Mc Graw Hill. 2009
2. Jacob Millman, Microelectronics, McGraw Hill, 2nd Edition, Reprinted, 2009.
3. Salivahanan S and Suresh Kumar N, Electronic Devices and Circuits, McGraw Hill Education, Fourth Edition, 2017.

REFERENCE BOOKS

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, Eleventh Edition, 2016.
2. David A. Bell, Electronic Devices and Circuits, Oxford University Press, Fifth Edition, 2017.
3. Sedra and Smith, ―Micro Electronic Circuits; Sixth Edition, Oxford University Press, 2011.
4. Millman J, Halkias C and Sathyabrada Jit, Electronic Devices and Circuits, McGraw Hill Education (India) Private Ltd., Fourth Edition, 2015.

CO – PO AND PSO MAPPING

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2		3							2	3		
CO2	2	2		3							2	3		
CO3	2	2		3							2	3		
CO4	2	2		2							2	3	2	
CO5	2	2		3							2	3	2	

COURSE CODE	COURSE TITLE	L	T	P	TW& SL	TH	C
UEC3361	DIGITAL SYSTEM DESIGN	45	0	30	45	120	4

PREAMBLE:
In today's world of computers and electronics, digital systems are the foundation of nearly every advancement in technology. Digital systems are important with respect to the innovations that shape our world. Digital system design is a course that provides a foundational understanding of the principles, methodologies, and tools used to conceptualize, analyze, and construct digital circuits and systems. This course helps you to explore both combinational and sequential logic, finite state machines, and hardware description language (Verilog) thereby, equipping you to gain the skills necessary to design robust, scalable, and optimized digital architectures. This course is a prerequisite for the course VLSI Design.

OBJECTIVES:

- To understand the fundamentals of digital system design and the theoretical aspects of Boolean algebra.
- To apply the fundamental concepts of digital systems, such as binary numbers, Boolean algebra, minimization techniques to obtain Boolean expressions.
- To analyze and design combinational & sequential circuits.
- To design combinational & sequential logic circuits and verify its functionality using Verilog HDL.

UNIT I DIGITAL FUNDAMENTALS 9

Analog versus Digital, Number systems: Binary, Octal, Decimal, Hexadecimal, Number-Base Conversions, complement of a number, Binary Codes, Boolean Algebra: Switching algebra, axioms and theorems, Logic gates: AND, OR, NOT, NAND, NOR, EXOR, EXNOR, Fan-In, Fan- Out, propagation delay, power dissipation, Noise Margin, Canonical and Standard Forms.

UNIT II MINIMIZATION TECHNIQUES AND COMBINATIONAL CIRCUIT DESIGN

9

Logic minimization: Karnaugh's map - 3 variables, 4 variables and 5 variables, Quine Mc-Cluskey method - 4 variables, Arithmetic operations: Half adder, full adder, ripple carry adder, carry lookahead adder, subtractor, binary multiplier, magnitude comparator, Selection logic: Multiplexer, De-multiplexer, decoder, encoder, priority encoder.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN 9

Latches and Flip flops: SR, JK, T and D, setup time and hold time, excitation tables and excitation equations, Analysis of clocked sequential circuits, Synchronous FSM: Mealy and Moore Models, Design procedure, Counters: Ripple counters, Synchronous counters - up/down counters, counters with control input, modulo counters, ring counters, Design of sequence detector, Shift registers: SISO, SIPO, PISO, PIPO, Universal shift registers.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN 9

Asynchronous FSM: Analysis Procedure, Circuit with Latches, race conditions and cycles, Design procedure, Reduction of Flow tables, Race free assignment, Hazards, Design examples.

UNIT V HARDWARE DESCRIPTIVE LANGUAGE: **Verilog** **9**

Introduction to Verilog, Lexical conventions, Data types, Modules and Ports, Modeling using Verilog, Design of combinational logic blocks: multibit adder, selection logic, encoder, decoder, comparator, Design of sequential logic blocks: counters, shift registers, finite state machines and sequence detector.

LIST OF EXPERIMENTS 30

Using trainer kits

1. Design & Implementation of half/full adders and subtractors using basic gates.
2. Design & implementation of 4-bit magnitude comparator using IC7485.
3. Implementation of 3-bit binary ripple counter.

HDL Simulation and hardware implementation (Any one)

4. Design a Digital logic processor to perform at least two arithmetic and two logical operations.
5. Given a sequence of input bits, design a sequence detector using flip-flops to identify a specific sequence (given by the instructor) of bits in the input sequence.
6. Design an EVM (electronic voting machine) using registers and counters for a given scenario to display the final results for each candidate.
7. Design a traffic light controller for smooth and safer traffic flow at the Kelambakkam- Vandalur junction.
8. Design a password protected lock system for your home door.

Lecture	**: 45 Periods**
Practical	**: 30 Periods**
Term work & Self-Learning	**: 45 Periods**
Total	**: 120 Periods**

OUTCOMES:

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

CO1: Apply the fundamental concepts of digital system design to obtain the Boolean expressions.

CO2: Design and implement combinational circuits such as arithmetic circuits, selection logic circuits, magnitude comparators.

CO3: Design sequential circuits by grasping the operation of latches, and flip-flops.

CO4: Apply methods for flow table reduction, race-free state assignments and design of hazard free circuits.

CO5: Model combinational and sequential circuits using Verilog HDL.

CO6: Work as a team to design and implement digital systems.

TEXTBOOKS:

1. M. Morris Mano and Michael D. Ciletti, Digital Design Pearson, Sixth Edition, 2018.

REFERENCES:

1. Salivahanan S and Arivazhagan S, Digital Circuits and Design, Oxford University Press, Fifth Edition, 2017.
2. John F. Wakerly, Digital Design Principles and Practices, Prentice Hall, Fourth Edition, 2012.
3. Charles H. Roth and Larry L. Kenney Fundamentals of Logic Design, Cengage learning, Seventh Edition, 2018.
4. Donald D. Givone, Digital Principles and Design, Tata McGraw Hill, 2003.
5. Samir Palnitkar, Verilog HDL A guide to digital design and synthesis, Pearson, 2nd edition, 2003.

CO – PO AND PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3											2		2
CO2	3	2	2		2							3	2	3
CO3	3	2	2		2						3	3		3
CO4	3											2		
CO5	2	2	2		3						3	3		3
CO6		2	3	3	3	3		3	3	3				3

COURSE CODE	COURSE TITLE	L	T	P	TW& SL	TH	C
UEC3302	**OOPS AND DATA STRUCTURES**	**45**	**0**	**0**	**45**	**90**	**3**

PREAMBLE:
This course introduces core concepts of Object-Oriented Programming and fundamental Data Structures, essential for efficient problem solving. Prior programming experience is helpful to grasp the principles effectively. It forms the foundation for advanced subjects like Java Programming, Computer Networks, and Machine Learning. The course enhances logical thinking and prepares students for real-world computing challenges.

OBJECTIVES:

- To understand the object-oriented programming concepts, using C++.
- To apply object-oriented programming principles in modelling data structures.
- To use linear and non-linear data structures in various applications

UNIT I BASICS 8

Getting Started: Simple C++ program – Input/Output; Variables and Basic Types: Primitive built- in types – Variables – Compound types; Expressions: arithmetic – logical and relational –Assignment – Increment and decrement operators; Statements: Conditional – Iterative – Jump; Strings, Vectors and Arrays: Library string type – Library vector type – Iterators – Arrays.

UNIT II OOP CONCEPTS 10

Functions: Basics – Argument passing – Return types and return statements – Overloaded functions; Classes: Defining abstract data types – Access control and encapsulation – Constructors – Static class members; Exception handling; Overloaded Operations: Arithmetic and relational operators; Object Oriented Programming: Defining base and derived classes – Access control and inheritance.

UNIT III LINEAR DATA STRUCTURES 10

List ADT: Array implementation of list – Linked list – Applications: Polynomial addition; Stack ADT: Stack model – Implementation of stacks – Applications: Postfix expressions – Infix to postfix conversion; Queue ADT: Queue model – Array implementation of queue – Circular Queues - Applications of queues.

UNIT IV NON-LINEAR DATA STRUCTURES 9

Trees: Preliminaries – Binary trees – Traversals – Binary search tree ADT; Graphs: Definitions – Representation of graphs – Graph Traversal – Shortest-Path Algorithm: Dijkstra's algorithm; Minimum Spanning Tree: Prim's algorithm.

UNIT V PRIORITY QUEUE, SORTING 8

Priority Queues: Model, Binary heap; Sorting: Insertion sort – Quick Sort - Heapsort – Merge sort – External sorting: Multiway merge

Lecture : 45 Periods
Term work & Self-Learning : 45 Periods
Total : 90 Periods

OUTCOMES:

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

CO1: To make use appropriate control structures of C++ to build various applications.
CO2: To use object-oriented principles in problem solving.
CO3: To identify and use suitable linear data structures for different problem solutions.
CO4: To apply non-linear data structures to various Problems.
CO5: To demonstrate the use of various sorting algorithms in real-world applications.
CO6: To solve complex engineering problems using principles of object-oriented programming and data structures.

TEXTBOOKS:

1. Stanley B. Lippman, Jose Lajoie, and Barbara E. Moo. 2012. C++ Primer, 5th edition. Addison-Wesley Professional.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Pearson Education, 2007

REFERENCES:

1. Deitel and Deitel, "C++, How To Program", Fifth Edition, Pearson Education, 2005.
2. Bhushan Trivedi, "Programming with ANSI C++, A Step – By – Step approach", Oxford University Press, 2010.
3. Bjarne Stroustrup, "The C++ Programming Language", 3rd Edition, Pearson Education, 2007.
4. Herb Schildt. 2002. C++: The Complete Reference, 4th Edition (4 ed.). McGraw- Hill, Inc., New York, NY, USA
5. Goodrich, Michael T., Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", 7th Edition, Wiley. 2004.

CO – PO AND PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	1		1										
CO2	3	1		1										
CO3	3	2	1	2								1		

CO4	3	2	1	2								1		
CO5	3	1	1	1										
CO6	3	2	2	2	2						1	1		

COURSE CODE	COURSE TITLE	L	T	P	TW & SL	TH	C
UEC3303	**SIGNALS AND SYSTEMS**	**45**	**0**	**0**	**45**	**90**	**3**

PREAMBLE:

Signals and Systems play a vital role in many fields such as communication systems, speech & image processing, biomedical systems etc., Signals are mostly continuous in nature and can be converted into a discrete form for further processing. Systems respond to signals, process them to provide required outputs. This course provides the basic knowledge required for processing and analysis of signals and systems for any application.

OBJECTIVES:

- To understand the fundamentals of signal & systems and its classification
- To learn Fourier Series, Transform & Laplace transform and their properties.
- To understand Z transform & DTFT and their properties
- To characterize LTI systems in the time and transform domain.

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Continuous-Time signals (CT) and Discrete-Time signals (DT) – Impulse, Step, Ramp, Pulse, Sinc and Exponential, Operations on signals – dependant and independent variables – shifting, scaling

and reflection - Classification of CT and DT signals - periodic and aperiodic, even and odd, energy and power - CT and DT systems – linear and non-linear, time invariant and variant, causal, static and dynamic.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series analysis (Exponential only) - Parseval's Theorem in Fourier series, Gibb's phenomenon. Fourier Transform and its properties - Linearity, Time shift, Time scaling, Frequency shift, Duality, Differentiation in time and frequency, Convolution, Multiplication and Parseval's Theorem. – Inverse Fourier Transform.

UNIT III LINEAR TIME INVARIANT – CONTINUOUS TIME SYSTEMS 9

Review of Laplace Transforms – Region of Convergence (ROC) - Inverse Laplace Transform- Linear Time Invariant (LTI) CT systems – Representing LTI-CT system using differential equations – Convolution Integral – Analysis using Laplace transforms – Impulse response, System Function – Causality and Stability - Analysing Electrical Circuits using Laplace Transform in MATLAB/Simulink

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Sampling of CT signals, Frequency domain representation of sampling, Reconstruction of a band- limited signals from its samples, Z-transform, Properties of Z-transform - Linearity, Time shift, Time Reversal, Convolution – Inverse Z-transform (Partial fraction method). Discrete-Time Fourier Transform (DTFT) - Periodicity and Inverse DTFT.

UNIT V LINEAR TIME INVARIANT - DISCRETE TIME SYSTEMS 9

LTI – DT systems – Representing LTI-DT system using difference equations, Convolution sum – Analysis using Z transforms - Impulse response, System function, Causality and Stability. Analysing LTI DT systems using Z Transforms in MATLAB/Simulink.

Lecture	**: 45 Periods**
Term work & Self-Learning	**: 45 Periods**
Total	**: 90 Periods**

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Summarize the properties of CT and DT signals and their representation.

CO2: Classify CT and DT systems using their properties.

CO3: Apply Fourier series, Laplace transform, Z-transform and DTFT in signal analysis.

CO4: Analyze LTI CT systems using Fourier and Laplace Transforms

CO5: Analyze LTI DT systems using Z-transform and DTFT.

CO6: Design, analyze and interpret CT and DT signals and systems using computational tools to solve real-world signal processing challenges with constraints and uncertainties.

TEXT BOOK:

1. Oppenheim A.V, Wilsky S and Nawab S.H, Signals and Systems, Prentice-Hall International, Second Edition, 2016. (Unit I to V)
2. Lathi B.P, Principles of Linear Systems and Signals, Oxford, Second Edition, 2009.

REFERENCE BOOKS:

1. P. Ramesh Babu and R. Ananda Natarajan, "Signals and Systems", Vijay Nicole Imprints Pvt Ltd, Fifth Edition, 2022.
2. Zeimer R.E, Tranter, W, H and Fannin, R,D, Signals & Systems-Continuous and Discrete, Prentice-Hall, Fourth Edition, 1998.
3. Salivahanan.S, Signals and Systems, Tata-McGraw Hill, First Edition 2018.
4. John G. Proakis, Dimitris G. Manolakis, Digital signal processing - principles, algorithms and applications, Pearson Education, Fourth Edition, 2007.
5. Roberts M.J, Signals & Systems Analysis using Transform Methods & MATLAB, Tata- McGraw Hill, First Edition, 2003.
6. OktayAlkin, Signals and Systems: A MATLAB® Integrated Approach, CRC Press, First Edition, 2017.

CO – PO AND PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	2											2		
CO2	2											2		
CO3	3	2										2		
CO4		2		2								3	2	
CO5		2		2								3	2	
CO6			2	2	3						2	3	2	

COURSE CODE	COURSE TITLE	L	T	P	TW + SL	TH	C
UGE3386	**DESIGN THINKING, INNOVATION AND ENTERPRENEURSHIP (Common to all B.E./B.Tech. programs)**	**15**	**0**	**60**	**15**	**90**	**3**

OBJECTIVES

- Learn to identify problems, frame challenges, and apply human-centered design methodologies for creative problem-solving.
- Utilize brainstorming techniques, rapid prototyping, and user feedback to refine and test ideas effectively.
- Understand business model frameworks, customer segmentation, and strategies to create scalable and sustainable startups.
- Learn startup funding options, financial planning, pricing strategies, and revenue models to support business expansion.
- Explore different types of innovation, emerging technologies, and industry trends to drive competitive advantage. Offer hands-on experience in prototyping

UNIT I FUNDAMENTALS OF DESIGN THINKING 9

A primer on design thinking – Design thinking vs Traditional Approach - Human centered design approach - Five Stage of Design thinking process – Identifying and defining clear and actionable problem statement. SL: Case Study on application of design thinking on product development by leading companies. Use "How Might We" (HMW) questions to explore solutions by redefining problems Activity hands-on: Conduct user interviews and create empathy maps, Product design challenge in short sprint covering all phases of Design thinking principles.

UNIT II DESIGN THINKING PROCESS AND PROTOTYPING 9

Principles of Divergent and Convergent thinking - Ideation Techniques – Rapid prototyping and Wireframing - Low fidelity – Mid fidelity and High-Fidelity Prototypes - Google design Sprint Method - User Testing and Feedback SL & Activity hands-on: Develop a low fidelity prototype with respect to your domain, develop of physical prototype for a product, Work in teams in a 3- day design sprint, Submit Video Diary summarizing Sprint learnings, Conduct User testing, document feedback and propose three design changes.

UNIT III FOUNDATIONS OF ENTERPRENURSHIP 9

Characteristics of Entrepreneur - Types of Entrepreneurships - Entrepreneurial Mindset – Business Model – Business Model Canvas - Types of Startup Business Models - Unique Selling Proposition SL: Elements of Pitch Deck – Registering a business – Risk Assessment and Decision Making - Art of Leadership, Minimum Viable Product.

Activity hands-on: Develop and Submit a 1-minute elevator pitch, develop a business canvas model for a product, Submit a case study on assessing the characteristics of an entrepreneur.

UNIT IV ENTREPRENEURIAL FINANCE 9

Source of Funding for Startups, bootstrapping vs. Debt Financing, Profit & Loss Statement, Balance sheet, Managing Burn rate and Runway - Business Expansion Models – Scaling SL: Break even analysis - Pricing Strategy & Revenue Models – Revenue Projections Activity hands- on: Prepare a Basic Finance plan for an imaginary product, Prepare a presentation compare and analyzing pricing model of a product , Simulate a Mock Investment Pitch

UNIT V INNOVATION MANAGEMENT AND FUTURE TRENDS IN INNOVATION

9

Difference between Innovation, Invention and Improvement - Types of Innovation – Disruptive Vs Incremental Innovation - Emerging Technologies & Their Impact on Entrepreneurship SL: Technology Driven Business Models, Emerging start up Trends – Green Innovation Activity Session: Analyze a disruptive innovation case study, develop an innovation roadmap for a chosen industry, Record a One Minute Story on a product in the promising emerging markets, Identify a company that failed due to lack of innovation and analyze the reasons.

Lecture hours	**: 15 Periods**
Practical hours	**: 30 Periods**
Term work & Self-Learning hours	**: 45 Periods**
Total hours	**: 90 Periods**

OUTCOMES:

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

CO1 - Understand and implement design thinking methodologies to identify user needs, frame challenges, and develop innovative solutions.

CO2 - Utilize brainstorming, rapid prototyping, and user testing to refine ideas and create viable product concepts.

CO3 - Develop a business model canvas, identify revenue streams, and validate the feasibility of an idea using lean startup principles.

CO4 - Develop a financial plan, analyze different pricing models, and participate in a mock investment pitch to refine startup strategy and fundraising skills

CO5 - Identify the difference between invention, innovation, and improvement, analyze types of innovation, and explore how emerging technologies impact startups and business growth

TEXTBOOKS

1. Tim Brown, How design thinking transforms organizations and inspires innovation change by design, Harper Business, 2013.
2. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business, New York, 2011. ISBN: 978-0- 307-88789-4.
3. Christensen, Clayton M. The Innovator’s Dilemma: When New Technologies Cause Great Firms to Fail. Harvard Business Review Press, Boston, 1997. ISBN: 978-1-63369-178-0.

REFERENCES

1. IDEO, Human Centered Design Tool Kit, 2nd edition (July 1, 2011) Human Values,

A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

2. J. Berengueres, The brown book of design thinking, UAE university College, Al Ain, First edition, November 16, 2013, ISBN 978-1-63041-059-9
3. Tom Kelly, The art of innovation - Lessons in Creativity from IDEO, America's Leading Design Firm, Profile Books; Main edition, 2016
4. Reddy, N. Krishniah. Innovation Management: Strategies, Concepts, and Tools for Growth and Profit. Tata McGraw-Hill, New Delhi, 2009. ISBN: 978-0-070-15084-3.
5. Thiel, Peter, and Masters, Blake. Zero to One: Notes on Startups, or How to Build the Future. Crown Business, New York, 2014. ISBN: 978-0-8041-3929-8.
6. Osterwalder, Alexander, Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Wiley, New Jersey, 2010. ISBN: 978-0- 470-87641-1.

CO-PO-PSO Mapping

COs	POs											PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1		2	3											
CO2		2	3											
CO3			2							3				
CO4										3				
CO5		1	2							3	2			
Average		**2**	**3**							**3**	**2**			

COURSE CODE	COURSE TITLE	L	T	P	TW& SL	TH	C
UEC3311	**ELECTRONIC CIRCUITS LABORATORY**	**0**	**0**	**45**	**45**	**90**	**1.5**

PREAMBLE:

Electronic Circuits Laboratory is designed to provide hands-on experience to students to work with electronic circuits constructed using BJT and FET. The Laboratory enables the students to apply the knowledge and skills in analysing the electronic circuits particularly amplifier and oscillators.

OBJECTIVES:

- To gain hands on experience in designing electronic circuits like amplifiers and oscillators

- To Investigate various feedback topologies for amplifiers and oscillators

LIST OF EXPERIMENTS:

1. Study of PSpice software for circuit simulation
2. Analysis of biasing circuits for BJT and JFET.
3. Frequency response analysis of Common Emitter amplifier circuit.
4. Analysis of Emitter-Follower amplifier circuit.
5. Design of two stage RC Coupled amplifier.
6. Analysis and design of cascode amplifier.
7. Frequency response analysis of Common Source amplifier.
8. Analysis of Shunt-Shunt feedback amplifier.
9. Analysis and design of RC phase shift oscillator.
10. Analysis and design of Hartley oscillator circuit.

Mini Project:

Analysis and implementation of a suitable Oscillator/Amplifier circuit for any signal processing application.

Practical Lab	**: 45 Periods**
Term work & Self-Learning	**: 45 Periods**
Total	**: 90 Periods**

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Design amplifiers and analyse amplifier characteristics.
CO2: Examine how multi-stage amplification influences the frequency response characteristics of amplifiers.
CO3: Investigate the concept of feedback in amplifiers and oscillator.

LABORATORY REQUIREMENTS FOR A BATCH OF 30 STUDENTS (3 STUDENTS /EXPERIMENT)

S. No.	Description of Equipment / Software	Quantity Required
1	CRO/DSO (30MHz)	30
2	Signal Generator /Function Generators (3 MHz)	15
3	Dual Regulated Power Supplies (0 – 30V)	15
4	Standalone desktop PCs with SPICE software	15
5	Transistor/FET (BJT-NPN-PNP and NMOS/PMOS)	30
6	Components and Accessories: Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers.	

CO – PO AND PSO MAPPING

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**

CO1	2	2	3	3	3				2	2		3		
CO2	2	2	3	3	3				2	2		3		
CO3	2	2	3	3	3				2	2		3		

COURSE CODE	COURSE TITLE	L	T	P	TW& SL	TH	C
UEC3312	OOPS AND DATA STRUCTURES LABORATORY	0	0	45	15	60	1.5

PREAMBLE:

This laboratory course introduces implementation ideas of Object-Oriented Programming and fundamental Data Structures, essential for efficient problem solving. Prior programming experience is helpful to grasp the implementation effectively. It forms the foundation for implementing advanced subjects like Java Programming. The course enhances logical thinking and prepares students for real-world computing challenges.

OBJECTIVES:

- Utilize C++ to implement object-oriented principles for effective problem-solving.
- Learn to implement both linear and non-linear data structures.
- Identify and apply appropriate data structures for different problem scenarios.

LIST OF EXPERIMENTS:

1. Basic programs using control structures in C++
2. Programs using arrays and vectors
3. Programs using classes
4. Programs using function & operator overloading
5. Programs using exception handling
6. Programs using inheritance
7. Linked list implementation of List ADT
8. Application of Stack ADT
9. Circular Queue ADT implementation
10. Implementation of Binary Search Tree and its traversals
11. Implementation of Dijkstra's algorithm
12. Implementation of Binary heaps
13. Sorting algorithms – Insertion sort, Quick sort, Merge sort

Lab hours : 45 Periods
Term work & Self-Learning : 15 Periods
Total : 60 Periods

LABORATORY REQUIREMENTS FOR A BATCH OF 30 STUDENTS

S.No	Description of Equipment / Software	Quantity
1	Desktop machine	30
2	Dev C++ software – IDE for C++	

OUTCOMES:

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

CO1: Apply object-oriented principles in problem solving.

CO2: To identify and use appropriate linear data structures in problem solving.

CO3: To identify and use appropriate non-linear data structures in problem solving.

CO4: To apply oops and data structures to complex engineering real world problems

CO – PO AND PSO MAPPING

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**		**PSO 2**	**PSO 3**
CO1	3	1		1											
CO2	3	2	1	2								1			
CO3	3	2	1	2								1			
CO4	3	2	2	2	2						1	1			

COURSE CODE	COURSE TITLE	L	T	P	TW & SL	TH	C
UMA3451	LINEAR ALGEBRA AND OPTIMIZATION	30	15	0	45	90	3

OBJECTIVES

- To enable the student with a foundational understanding of linear algebra, including vector spaces, linear transformations, and matrix decompositions.
- To develop skills in solving linear systems, performing matrix operations, and applying techniques like gradient descent, preparing them for applications in various scientific and technological fields.

UNIT I VECTOR SPACE 9

Vector space – Subspaces – Linear combinations and system of Linear equations – Linear independence and Linear dependence – Bases and Dimension

UNIT II LINEAR TRANSFORMATIONS 9

Linear transformations – Null and Range space – Dimension Theorem - Matrix representation of linear transformation – Eigenvalues, Eigenvectors and Diagonalization.

UNIT III INNER PRODUCT SPACE 9

Inner product and norms - Gram Schmidt orthonormalization process - QR decomposition - Orthogonal Complement - Least squares approximation.

UNIT IV MATRIX DECOMPOSITION 9

Solution of linear system of equations – Crout's method, Cholesky decomposition method - Singular value decomposition, Generalized inverse of a matrix – Generalized Eigen vectors.

UNIT V OPTIMIZATION FOR MACHINE LEARNING APPLICATIONS 9

Basics of optimization – univariate optimization – bivariate optimization – gradient descent method – logistic regression.

Lecture : 30 Periods
Tutorial : 15 Periods
Term work & Self-Learning : 45 Periods
Total : 90 Periods

OUTCOMES

On successful completion of this course, the student will be able to

CO1: solve the problems in vector spaces, subspaces.
CO2: compute the matrix of linear transformation and diagonalize by finding the eigenvalues
CO3: apply Gram-Schmidt's orthogonalization process to decompose a given matrix CO4: compute matrix decomposition using different methods such as Cholesky and SVD CO5: apply optimization techniques

including gradient descent and logistic regression
in solving engineering problems.

TEXT BOOKS

1. Friedberg A.H, Insel A.J. and Spence L, Linear Algebra, Prentice Hall of India, 4th Edition, New Delhi, 2014.
2. Charu. C. A, Linear algebra and optimization for machine learning, Springer, 1st edition, 2020

REFERENCE BOOKS

1. Kumaresan S, Linear Algebra – A geometric approach, Prentice Hall of India, New Delhi, Reprint, 2010.
2. Strang G, Linear Algebra and its applications, 4th Edition, Brooks/Cole (Thomson Publications), New Delhi, 2005.
3. Bernard Kolman, David R. Hill, Introductory Linear Algebra: An Applied First Course, Pearson Education, New Delhi, 8th Edition, 2005.
4. Richard Branson, Matrix Operations, Schaum's outline series, McGraw Hill, 1988.

CO-PO Mapping

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2												
CO2	3	2												
CO3	3	2												
CO4	3	2												
CO5	3	2												

COURSE CODE	COURSE TITLE	L	T	P	TW& SL	TH	C
UEC3401	MICROPROCESSOR AND MICROCONTROLLERS	45	0	0	45	90	3

PREAMBLE:

Microprocessors and microcontrollers are fundamental components in digital electronics design. It is essential for students to grasp the architecture of a microprocessor and its interfacing with various modules. Microprocessors and microcontrollers have a wide range of applications, including consumer electronics, embedded systems, industrial automation, medical equipment, aerospace, and communication. This course offers an in-depth exploration of the 8086 microprocessor and 8051 microcontroller and ARM processor architecture and programming also covering their assembly language programming, interfacing methods, and practical industrial applications.

OBJECTIVES:

- To analyze the architecture of 8086 microprocessor and develop skills in writing assembly language programs for 8086 microprocessors.
- To design and develop the interface of I/O devices with the 8086 microprocessors.
- To examine the internal architecture of the 8051 microcontroller and build proficiency in writing assembly language programs for it.
- To design and implement interfaces between I/O devices and the 8051 microcontroller.
- To explore the architecture of the ARM processor and gain expertise in developing assembly language programs for it.

UNIT I **THE 8086 MICROPROCESSOR** **9**

Introduction to 8086 – Microprocessor Architecture – Addressing modes - Instruction Set – Assembly Language Programming - Interrupts and Interrupt Service Routines.

UNIT II I/O INTERFACING **9**

Memory Interfacing and I/O Interfacing - Parallel Communication Interface – Serial Communication Interface – D/A and A/D Interface - Timer – Keyboard /Display Controller – Interrupt controller – DMA controller.

UNIT III THE 8051 MICROCONTROLLER ARCHITECTURE 9

8051 Microcontroller Architecture – Memory organization – Register Banks- Bit addressable area in memory - SFR – working registers - Addressing Modes - Instruction Set - Instruction Timing, Data transfer - Arithmetic – logic - compare instructions - Assembly language programming.

UNIT IV 8051 TIMER AND IO INTERFACING 9

Time delay for various 8051 chips - machine cycle - delay calculation – Timer module - Programming 8051 timers and counters - Keyboard Interfacing – ADC, DAC and Sensor Interfacing – Stepper Motor Interfacing - DC Motor Interfacing and PWM.

UNIT V ARM ARCHITECTURE 9

The programmer's model of ARM Architecture – ARM instruction set – Data transfer instructions, Data processing instructions, control flow instructions. 3- stage pipeline ARM organization - 3- stage pipeline ARM organization – ARM instruction execution.

Lecture	**: 45 Periods**
Term work & Self-Learning	**: 45 Periods**
Total	**: 90 Periods**

OUTCOMES:

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

CO1: Analyze the architecture and instruction set of the 8086 microprocessor and develop assembly language programs.
CO2: Design and implement interface circuits for connecting and controlling peripheral devices with the 8086 microprocessor.
CO3: Analyze the 8051 microcontroller architecture and develop the assembly language programs.
CO4: Apply knowledge to design and develop circuits for interfacing diverse peripherals with the 8051 microcontroller.
CO5: Analyse the special features and architecture and instruction set of ARM processor.

TEXTBOOKS:

1. Yu-Cheng Liu, Glenn A. Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture,

Programming and Design", Prentice Hall of India, Second Edition, 2015.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson education, Second Edition, 2013.
3. Steve Furber, ARM System – On – Chip architecture, Addision Wesley, 2000.

REFERENCES:

1. Doughlas V Hall, "Microprocessors and Interfacing, Programming and Hardware", Tata McGraw Hill, 2012.
2. Walter A Triebel and Avatar Singh, "The 8088 and 8086 Microprocessors – Programming, Interfacing, Software, Hardware and Applications", Pearson, Fourth Edition, 2002.
3. Scott MacKenzie, Raphael Chung-Wei Phan, "The 8051 Microcontroller", Pearson Education, Fourth Edition, 2007.
4. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM system Developer's Guide, Designing and optimizing system software", Morgan Kaufmann Publishers, 2004.
5. Ray K & Bhurchandi K.M, "Advanced Microprocessors and Peripherals: Architecture, Programming and Interface", 3rd Edition, McGraw Hill, New Delhi, 2012.

CO – PO AND PSO MAPPING

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2		2	2						2	3		3
CO2	3	2		2	2						2	3		3
CO3	3	3		3	2						2	3		3
CO4	3	3		3	2						2	3		3
CO5	3	2		2	2						2	3		3

COURSE CODE	COURSE TITLE	L	T	P	TW + SL	TH	C
UGA3476	INDIAN CONSTITUTION (Mandatory Course)	45	0	0	30	75	1

OBJECTIVES

- To teach the history and philosophy of the Indian constitution.
- To summarize the powers and functions of the Indian government.
- To explain the structure and functions of local administration.
- To demonstrate the organization and working of the Judiciary.
- To discuss financial power and emergency provisions.

UNIT I INTRODUCTION 9

Historical background Government of India act Indian councils act Making of the constitution - Philosophy of the Indian constitution Preamble.

UNIT II GOVERNMENT OF THE UNION 9

Powers and Functions of President and Prime Minister - Council of Ministers President in relation to his council - Legislature structure and functions of Lok Sabha and Rajya Sabha Speaker.

UNIT III GOVERNMENTS OF THE STATES AND LOCAL GOVERNMENT 9

The state executive: General structure Governor Council of ministers State legislature. Local government - Panchayat Municipality Power authority and responsibilities municipalities.

UNIT IV THE JUDICATURE 9

Organization and Composition of Judiciary Constitution Appointment Qualifications Powers and functions of the supreme court High courts Control over subordinate courts.

UNIT V THE FEDERAL SYSTEM 9

Distribution of financial powers: Need, principles-Underlaying distribution of tax revenues- Distribution of legislative power Interstate relation - Emergency provisions.

Lecture hours : 45 Periods
Term work & Self-Learning hours : 30 Periods
Total hours : 75 Periods

OUTCOMES:

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

CO1 - Understand the history and philosophy of the Indian constitution

CO2 - Realize the powers and functions of the Indian government.

CO3 - Acquire awareness of the structure and functions of local administration.

CO4 - Enhance knowledge about the organization and composition of the judiciary.

CO5 - Explore the distribution of financial powers and emergency provisions.

TEXTBOOKS

1. Basu D.D, “Introduction to Indian Constitution”, Prevtice Hall of India, New Delhi, 2015.
2. Gupta D.C, “Indian Government and Politics”, Vikas Publishing House, New Delhi, 2010.

REFERENCES

1. Pylee M.V, “Introduction to the Constitution of India”, Vikas Publishing House, New Delhi, 2011.
2. Kashyap S, “Our Constitution”, National Book Trust, New Delhi, 2010.
3. “The Constitution of India, 1950 (Bare Act)”, Government Publication.
4. Jain M.P, “Indian Constitution Law”, 7th Edition, Lexis Nexis, 2014.
5. Busi S.N, Ambedkar B.R, “Framing of Indian Constitution”, 1st Edition, 2015.

CO-PO-PSO Mapping

COs	**POs**											**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1						2		2	2	2				
CO2						2		2	2	2				
CO3						2		2	2	2				
CO4						2		2	2	2				
CO5						2		2	2	2				
Average						**2**		**2**	**2**	**2**				

COURSE CODE	COURSE TITLE	L	T	P	TW& SL	TH	C
UEC3402	DIGITAL SIGNAL PROCESSING	45	0	0	45	90	3

PREAMBLE:

Digital Signal Processing (DSP) is a core course for Electronics and Communication Engineering, forming the foundation for many advanced subjects. The course covers frequency analysis techniques, filter design, hardware implementation challenges, and multi-rate signal processing. These concepts are essential for applications in communication systems, audio signal processing, biomedical signal processing, and modern DSP systems.

OBJECTIVES:

- To learn signal transform techniques to analyze the frequency content of discrete-time signals.
- To design frequency-selective filters for signal processing applications.
- To analyze practical issues encountered in implementing discrete-time systems on hardware platforms.
- To learn multi-rate signal processing techniques and understand their relevance in multi- rate system design.

UNIT I DISCRETE FOURIER TRANSFORM 9

Frequency-domain sampling, The Discrete Fourier Transform (DFT), DFT as a linear transformation. Properties of DFT - periodicity, linearity, time-reversal, symmetry, circular convolution. Linear filtering using DFT - filtering long data sequences - overlap save and overlap add method. Compute the DFT using DIF-FFT and DIT-FFT and validate the results using MATLAB or any other appropriate tool.

UNIT II DESIGN OF FIR FILTERS 9

Ideal filter characteristics, causality and its implications, characteristics of practical frequency selective filters. Design of FIR filters - Symmetric FIR filters, design of linear-phase FIR filters using windows: rectangular window, Hamming window. Design of linear-phase FIR filters using Frequency sampling method. Compare the performance of FIR filters of different lengths using MATLAB or any other appropriate tool.

UNIT III DESIGN OF IIR FILTERS 9

Design of analog IIR filters - Butterworth and Chebyshev (Type I) filter. Design of digital IIR lowpass filter from analog filters - impulse invariance and bilinear transformation method. Compare the performance of IIR filters of different orders using MATLAB or any other appropriate tool.

UNIT IV IMPLEMENTATION OF DISCRETE-TIME SYSTEMS 9

Structures for FIR systems - direct-form, cascade-form, Structures of IIR systems - Direct Form- I and Direct Form-II - Cascade and Parallel forms. Effects of quantization of FIR filter coefficients. Round-off effects in IIR filters - limit cycle oscillations, scaling to prevent overflow.

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9

The basic sample rate alteration devices – Time domain characterization, Frequency domain characterization. Cascade equivalences, filters in sampling rate alteration systems. Multistage design of decimator and interpolator.

Lecture : 45 Periods
Term work & Self-Learning : 45 Periods
Total : 90 Periods

OUTCOMES:

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

CO1: Apply DFT to analyze and interpret the frequency content of discrete-time signals. CO2: Design and

implement FIR filters to meet specific signal processing requirements, ensuring desired frequency response.

CO3: Develop IIR filters for various signal processing applications, addressing stability and performance considerations.

CO4: Analyze and resolve practical challenges such as computational complexity, numerical precision, and real-time constraints in implementing DT systems on hardware platforms.

CO5: Apply multi-rate signal processing techniques, including decimation and interpolation, to design efficient multi-rate systems for real-world applications.

TEXTBOOKS:

1. John G. Proakis, Dimitris G. Manolakis, Digital signal processing - principles, algorithms and applications, Pearson Education, Fourth Edition, 2007 (Unit I to IV)
2. Sanjit K. Mitra, Digital Signal Processing: A computer-based approach, McGraw Hill, Second Edition, 2000 (Unit V)

REFERENCES:

1. Alan V. Oppenheim, Ronald W. Schaffer and John R. Buck, Discrete time signal Processing, Prentice Hall, Third Edition, 2009
2. Vinay K. Ingle and John G. Proakis, Digital Signal Processing using MATLABORATORY, Cengage learning, Third Edition, 2011
3. Ashok Ambardar, Digital Signal Processing: A modern introduction, Cengage Learning First Edition, 2006
4. P. P. Vadyanathan, Multirate Systems and Filter Banks, Prentice Hall, 1993.
5. S Salivahanan, Digital Signal Processing, McGraw Hill Education (India) Pvt. Ltd., Fourth Edition, 2019.

CO – PO AND PSO MAPPING

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3			2	3								3	
CO2	3		3	3	3							3	3	

CO3	3		3	3	3						3	3	
CO4	2	2	3	2	3						2	2	
CO5	3		3	2							3	3	

Course Code	Course Title	L	T	P	TW& SL#	C
UEC3403	**ANALOG COMMUNICATION SYSTEMS**	**45**	**0**	**0**	**45**	**3**

PREAMBLE:

This course provides an in-depth exploration of analog and digital communication principles, focusing on key modulation techniques, noise analysis and pulse modulation techniques. It is designed to equip students with both theoretical knowledge and practical insights into the design, implementation, and analysis of modern communication systems.

OBJECTIVES:

- To introduce the concept of analog modulation techniques and their spectral characteristics.
- To examine the behaviour of analog modulation schemes in the presence of noise.
- To impart knowledge on the principles of pulse modulation techniques.
- To develop practical skills through case studies and simulations of communication systems

UNIT I AMPLITUDE MODULATION 9

Need for modulation-Amplitude Modulation- Double-Sideband Suppressed-Carrier AM, Conventional AM, Single-Sideband AM, Vestigial Side-band AM – Implementation of AM Modulators and Demodulators – Power Law Modulation, Balance Modulator, Envelope Detector, Demodulation of DSBSC, SSB signals - Superheterodyne Receiver- Case study: Simulation of AM communication system for voice signal transmission.

UNIT II ANGLE MODULATION 9

Angle Modulation - Representation of FM and PM signals, Spectral Characteristics of Angle Modulated Signals - Angle Modulation by a sinusoidal signal - Angle Modulation by an arbitrary message signal – Implementation of Angle Modulators and Demodulators – Varactor diode modulation – Indirect generation - balanced discrimination of angle modulation- Case study: Simulation of FM communication system for audio signal transmission.

UNIT III EFFECT OF NOISE ON AMPLITUDE MODULATION SYSTEMS 9

Effect of Transmission Losses and Noise in Analog Modulation – Characterization of Thermal Noise Sources, Effective Noise Temperature and Noise Figure - Transmission Losses. Effect of Noise on Amplitude Modulation

Systems – Baseband System, DSB-SC AM, SSB-AM, Conventional AM -Case study: Simulation - Comparative analysis of noise effects on AM and SSB system.

UNIT IV EFFECT OF NOISE ON ANGLE MODULATION SYSTEMS 9

Effect of Noise on Angle Modulation - Threshold effect, Pre-emphasis and de-emphasis, Calculation of figure of merit for analog modulation systems, Comparison of Analog Modulation Systems, Carrier Phase Estimation using PLL-Effect of additive noise on carrier phase estimation, Case study: Simulation of FM communication system for noisy speech signal.

UNIT V PULSE MODULATION 9

Low pass sampling – Aliasing- Signal Reconstruction-Pulse Amplitude Modulation- Generation and Detection-Pulse Time Modulation- Generation and Detection of PTM Signals- Pulse position modulation– Performance of pulse modulation systems- Multiplexing – Time division multiplexing-Frequency division multiplexing.

Lecture	**: 45 Periods**
Term work & Self-Learning	**: 45 Periods**
Total	**: 90 Periods**

COURSE OUTCOMES:

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

CO1 Apply amplitude modulation techniques to real-world communication systems.

CO2 Demonstrate the use of angle modulation techniques to design a basic communication system.

CO3 Analyse the performance of amplitude modulation schemes under noisy conditions to improve system performance and present the solution through structured report and demonstration.

CO4 Analyse the behaviour of angle modulation systems in the presence of noise.

CO5 Apply the principles of pulse modulation and multiplexing techniques

TEXTBOOKS:

1. Proakis J. G, Salehi M, Fundamentals of Communication Systems, Pearson Education Second edition, 2006.

REFERENCES:

1. Haykin.S, Communication Systems, John Wiley, Second Edition, 2005
2. Lathi B.P, Modern Digital and Analog Communication Systems, Oxford University Press, Third Edition, 2007.
3. Roody D, Coolen.J, Electronic Communications, PHI, Fourth Edition, 2006
4. Berbard Sklar and Fredric J. Harris, Digital Communications: Fundamentals and Applications - Prentice Hall Communications, Third Edition, Pearson, 2020.
5. Hsu H.P, Schaum Outline Series - Analog and Digital Communications, TM

CO – PO AND PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3								3	
CO2	3	3	3	3	3								3	
CO3	3	3	3	3	3			2	2		3		3	
CO4	3	3	3	3	3								3	
CO5	3	2	2	2									3	

COURSE CODE	COURSE TITLE	L	T	P	TW& SL	TH	C
UEC3461	LINEAR INTEGRATED CIRCUITS	45		30	45	120	4

PREAMBLE:

Linear integrated circuits course is designed to provide a comprehensive understanding of operational amplifiers and their diverse applications in analog electronic circuits. It is structured to cover fundamental concepts, practical applications, and advanced topics, ensuring a solid foundation for students pursuing careers in electronics and communication. Through hands-on experimentation, students will develop the skills required to design, analyze, and troubleshoot analog circuits effectively. This syllabus aims to equip learners with the critical thinking and technical expertise necessary for innovation and problem-solving in the dynamic field of electronics.

OBJECTIVES:

- To understand the fundamentals of Operational Amplifiers
- To design circuits using operational amplifiers, analog multiplier and PLL
- To understand the basic principles and operation of analog-to-digital (A/D) and digital- to-analog (D/A) converters.
- To design circuits to generate waveforms and special functions using ICs.

UNIT I BASICS OF OPERATIONAL AMPLIFIERS 9

Current mirror and current sources, Current sources as active loads, BJT Differential amplifier with active loads, Ideal Operational Amplifier, General operational amplifier stages, DC and AC characteristics, Open and closed loop configurations.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Adder, Subtractor, Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, Instrumentation amplifier, Integrator, Differentiator, Log and Antilog amplifier, Comparators, Schmitt trigger, Precision rectifier, Low-pass, high-pass, and band-pass filters.

UNIT III ANALOG MULTIPLIER AND PLL 9

Analog Multiplier using Emitter Coupled Transistor Pair, four quadrant Gilbert Multiplier, analog multiplier ICs and their applications, Operation of PLL, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM and FM detection.

UNIT IV ANALOG-TO-DIGITAL AND DIGITAL-TO-ANALOG CONVERTERS 9

A/D Converter, Flash type, Successive Approximation type, Single Slope type and Dual Slope type, Over-sampling A/D Converters, Sigma–Delta converters. D/A converter, weighted resistor type, R-2R Ladder type, high speed sample-and-hold circuits. DAC/ADC specifications.

UNIT V WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs 9

Sine wave generators, Multivibrators and Triangular wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – fixed and adjustable voltage regulators, Audio Power amplifier, Video Amplifier, Isolation Amplifier.

LIST OF EXPERIMENTS 30

1. Design and test inverting and non-inverting amplifiers using operational amplifier for signal conditioning in an audio system.
2. Design and test integrator and differentiator circuits using operational amplifiers for real-time signal processing.
3. Design and test active low-pass and high-pass filters using operational amplifiers for signal conditioning in communication systems and analyse its frequency response.
4. Design and test a Schmitt trigger circuit using operational amplifiers for zero crossing detection application.
5. Design and test an astable multivibrator circuit using the NE555 timer for generating continuous square waves in timing and pulse generation applications

Mini Project: Students may choose any one topic for implementation using PSPICE.

6. Conduct a literature survey on regulated power supply circuits. Design and test voltage regulated power supply for RF circuits using IC723.
7. Conduct a literature review on DTMF tone generation. Generate DTMF (Dual tone multi- frequency) tones used in telecommunication systems.
8. Conduct a survey on frequency divider circuit. Construct a frequency divider circuit for digital clocks using IC565.

Lecture	**: 45 Periods**
Practical	**: 30 Periods**
Term work & Self-Learning	**: 45 Periods**
Total	**: 120 Periods**

OUTCOMES:

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

CO1: Demonstrate the basics of operational amplifiers.

CO2: Design linear and nonlinear applications using Op-amps.

CO3: Analyse and develop applications using analog multipliers and PLL.

CO4: Apply knowledge of A/D and D/A conversion techniques to design simple data acquisition and signal processing systems.

CO5: Design and implement circuits using Op-amps and special function ICs and prepare laboratory reports on interpretation of experimental and simulation results.

TEXTBOOKS:

1. Roy Choudhry D, Shail Jain, Linear Integrated Circuits, New Age International, Fourth Edition, 2012.
2. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Tata Mc Graw-Hill, Third Edition, 2007.
3. Ramakant A. Gayakwad, OP-AMP and Linear ICs, Prentice Hall, Fourth Edition, 2001.

REFERENCES:

1. Salivahanan S and Kanchana Bhaaskaran V S, Linear Integrated Circuits, McGraw Hill Education, Third Edition, 2018.
2. Sonde B.S., System design using Integrated Circuits, New Age International, Second Edition, 2001
3. Gray and Meyer, Analysis and Design of Analog Integrated Circuits, Wiley International, Fifth Edition, 2009.
4. William D. Stanley, Operational Amplifiers with Linear Integrated Circuits, Pearson Education, 2004.

CO – PO AND PSO MAPPING

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2										2		
CO2	3	3	3									3		
CO3	3	3	2									2		
CO4	3	3	3									3		
CO5	3	3	3	3	3				3		3	3		

COURSE CODE	COURSE TITLE	L	T	P	TW& SL	TH	C
UEC3411	MICROPROCESSOR AND MICROCONTROLLERS LAB	0	0	45	15	60	1.5

PREAMBLE:

Microprocessor and Microcontrollers laboratory course helps the students to develop their knowledge on processor architecture and the programming skills. This laboratory course provides hands-on experience to interface I/O devices, perform A/D and D/A conversions, design traffic light etc. Through structured experiments and projects, this lab enhances problem-solving skills, logical thinking, and proficiency in embedded system development. It bridges theoretical knowledge with real-world applications, preparing students for careers in embedded systems, IoT, robotics, industrial automation and empowering students to develop innovative solutions for engineering and technology challenges.

OBJECTIVES:

- To develop assembly language and analyze the addressing modes and instruction set of the 8086 microprocessors.
- To develop and analyze assembly language programs with a focus on the addressing modes and instruction set of the 8051 microcontrollers.
- To explore the design and implementation of input/output interfacing techniques for the 8086 microprocessors.
- To design and implement interfaces between input/output devices and the 8051 microcontrollers.

LIST OF EXPERIMENTS:

8086 PROGRAMS USING KIT AND MASM

1. Develop programs for multi-precision arithmetic computations, including addition, subtraction, multiplication, and division, along with logical operations for data processing and manipulation.
2. Apply control instructions for operations such as incrementing, decrementing, sorting in ascending/descending order, and identifying maximum/minimum values.
3. Perform hexadecimal, ASCII, and BCD code conversions to enhance interoperability between systems.
4. Implement string operations, including copying, determining string length, and reversing a string for efficient text processing.

8086 PERIPHERALS AND INTERFACING EXPERIMENTS

1. Develop and execute stepper motor interfacing using the 8086 microprocessor for precise motion control applications.
2. Interface a Digital-to-Analog Converter (DAC) to generate and analyze waveforms of varying frequencies.
3. Design and implement a traffic light control mechanism using the 8086 microprocessor for real-world traffic management applications.

8051 PROGRAMS USING KITS AND EDSIM51

1. Implement basic data processing techniques for efficient computation.
2. Develop programs for converting between hexadecimal and decimal number systems and decimal to hexadecimal number.
3. Execute logical instructions for data evaluation and decision-making processes.
4. Implement block data transfer and exchange operations for optimized memory management.
5. Apply techniques for data organization, including sorting, exchanging, and identifying key elements in an array.

8051 PERIPHERALS AND INTERFACING EXPERIMENTS

1. Develop and implement stepper motor interfacing for precise motion control applications.
2. Interface a Digital-to-Analog Converter (DAC) with the 8051 microcontroller to generate waveforms of specific frequencies.
3. Design and implement a microcontroller-based traffic light control system for real-time traffic management.

Practical : 45 Periods
Term work & Self-Learning : 15 Periods Total : 60 Periods

OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Develop and analyze assembly language programs using 8086 microprocessor. CO2: Develop and analyze assembly language programs using 8051 microcontrollers.
CO3: Design and develop ALP to interface different peripherals with 8086 microprocessor.
CO4: Design and develop ALP to interface different peripherals with 8051microcontroller.
CO5: Design and develop 8086 microprocessor and 8051 microcontroller-based systems for real-time applications.

LABORATORY REQUIREMENTS FOR A BATCH OF 30 STUDENTS (3 STUDENTS /EXPERIMENT)

S.No	Description of Equipment / Software	Quantity
1	Interfacing Units - ADC interface, DAC interface, Traffic light interface, stepper motor control interface, Keyboard interface	3 Each
2	8086 Trainer kits	15
3	8051 Trainer kits	15
4	Desktop Computers with MASM(8086) and Edsim51 Simulators (8051)	15

CO – PO AND PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3				2		2	3		3
CO2	3	3	3	3	3				2		2	3		3
CO3	3	3	3	3	3				2		2	3		3

CO4	3	3	3	3	3				2		2	3		3
CO5	3	3	3	3	3				2		2	3		3

COURSE CODE	COURSE TITLE	L	T	P	TW& SL	TH	C
UEC3412	DIGITAL SIGNAL PROCESSING LABORATORY	0	0	45	15	60	1.5

PREAMBLE:

The Digital Signal Processing Laboratory provides hands-on experience in analyzing and designing signal processing systems. Students will implement and evaluate various DSP techniques, including spectral analysis, filter design, and sampling rate conversion, with applications in speech/audio, biomedical, industrial, and IoT domains.

OBJECTIVES:

- To generate and analyze discrete-time deterministic and random signals for real-world applications.
- To perform spectral analysis on signals from different domains, such as pure tones, industrial vibrations, and biomedical signals, for fault detection and interference removal.
- To design and implement FIR and IIR filters for noise reduction, interference suppression, and signal enhancement in speech, biomedical, and environmental recordings.
- To explore the effects of quantization on filter performance and implement sampling rate conversion techniques for data synchronization in IoT applications.

LIST OF EXPERIMENTS

1. Generation of Discrete-Time (Deterministic & Random) signals
2. Perform spectral analysis on pure tone and composite sinusoidal signal.
3. Perform spectral analysis on vibration signals from industrial equipment to detect faults such as imbalance or misalignment.
4. Design an FIR low-pass filter to remove high-frequency noise from a speech/audio signal. Evaluate the performance of the filter in preserving the desired speech/audio quality while suppressing noise.
5. Design a notch FIR filter to remove 50 Hz or 60 Hz power line interference from biomedical signals, such as EEG or ECG. Analyze the effectiveness of the filter in retaining signal integrity while eliminating interference.
6. Design an IIR filter to remove background noise from environmental recordings while retaining signals of interest, such as bird calls or machinery vibrations.
7. Analyze the impact of quantizing FIR/IIR filter coefficients on frequency response and performance for a low-pass filter at different quantization levels.
8. Implement a sampling rate alteration system to synchronize data streams with varying sampling rates in an IoT network. For example, temperature sensor data sampled at 1 Hz and pressure sensor data sampled at 10 Hz could be synchronized to a common rate of 5 Hz.
9. Mini project incorporating concepts learned from previous experiments.

Practical Lab : 45 Periods Term work & Self-Learning : 15 Periods
Total : 60 Periods

OUTCOMES:

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

CO1:Generate and characterize discrete-time deterministic and random signals, understanding their statistical and

spectral properties.

CO2: Conduct frequency-domain analysis of pure tones, composite sinusoidal signals, and industrial vibration signals to detect faults like imbalance or misalignment.

CO3: Develop FIR and IIR filters for noise removal in speech, biomedical, and environmental signals, evaluating their effectiveness in preserving signal integrity.

CO4: Analyze how quantization affects FIR/IIR filter coefficients, frequency response, and overall system performance.

CO5: Develop and evaluate sampling rate alteration techniques for synchronizing multi-rate sensor data in signal processing applications.

CO6: Work as a team to design and implement signal processing systems with report and presentation.

LABORATORY REQUIREMENTS FOR A BATCH OF 30 STUDENTS (3 STUDENTS /EXPERIMENT)

S. No.	Description of Equipment / Software	Quantity Required
1	Desktop Computer with MATLAB/Simulink or Other Equivalent Software	30
2	Microphone and Speakers	10

CO – PO AND PSO MAPPING

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3				3				2					
CO2	3			3	3				2					
CO3	3	3	3	3	3				2				3	
CO4	3			3	3				2				3	
CO5	3		3		3				2				3	
CO6	3	3	3	3	3			3	3			3	3	

COURSE CODE	COURSE TITLE	L	T	P	TW &SL	TH	C
UBA3942	TOTAL QUALITY MANAGEMENT	45	0	0	45	90	3

Objectives:

- To introduce principles of total quality management (TQM) and impart knowledge in TQM Tools, techniques and quality systems.

UNIT I INTRODUCTION 9

Introduction – Need for quality – Evolution of quality – Definitions of quality – Dimensions of product and service quality-Basic concepts of TQM-TQM Framework Contributions of Deming Juran and Crosby – Barriers to TQM – Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, and Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership – Strategic quality planning, Quality Councils – Employee involvement – Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal- Continuous process improvement – PDCA cycle, 5S, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality – new management tools – Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to benchmark, Bench marking process – FMEA – Stages, Types

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts – Process Capability – Concepts of Six Sigma – Quality Function Development (QFD)- Taguchi quality loss function – TPM – Concepts, improvement needs – Performance Measures.

UNIT V QUALITY MANAGEMENT SYSTEMS 9

Need for ISO 9000 – ISO 9001-2008 Quality System – Elements, Documentation, Quality Auditing – QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Guidelines for Safety and Hazard (OHSAS).

TOTAL PERIODS45

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO1: Analyze TQM concepts for improving Quality in an Engineering System.

CO2: Utilize TQM principles for continuous process improvement

CO3: Apply TQM Tools like Six Sigma, Benchmarking and FMEA to improve manufacturing process

CO4: Apply Taguchi's Quality Loss Function, QFD and TPM to improve Performance Measures

CO5: Apply QMS in any organization system for improving overall quality

CO6: Design and Implement TQM principles and tools into any Electrical Engineering Systems to improve quality and performance measures.

TEXT BOOKS

1. Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield, Mary Besterfield-Sacre,Hemant Urdhwareshe, Rashmi Urdhwareshe, "Total quality Management", Revised Third Edition, Pearson Education Asia, 2011.

2. Kannan S M, Jayabalan V, "Total Quality Management", RKR Publications, 2005.

REFERENCE BOOKS

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality",8th Edition, First Indian Edition, Cengage Learning, 2012.

2. Suganthi. L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt.Ltd,2006.

3. Janakiraman. B and Gopal. R. K., "Total Quality Management Text and Cases", Prentice Hall l(India), 2005.

4. Sharma D D, "Total Quality Management", Sultan Chand and Sons, 2011.

CO-PO-PSO Mapping

Cos	Pos											PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1					2	3					2		
CO2					2	3					2		
CO3					2	3					2		
CO4					2	3					2		
CO5					2	3		2	3		2		
CO6					2	3		3	2	3	2		
Average					**2**	**3**		**2.5**	**2.5**	**3**	**2**		

*3 – Strong, 2 – Moderate, 1 – Low

COURSE CODE	COURSE TITLE	L	T	P	TW&SL	TH	C
UBA3943	WORK ETHICS, CORPORATE SOCIAL RESPONSIBILITY AND GOVERNANCE	45	0	0	45	90	3

Objectives:

- To impart the value of professional practices with code of conduct and ethical values
- Discuss the various outlooks of roles and responsibilities with work ethics.
- Introduce the Indian constitutional statutes for ethical practices by citizens
- Analyze the ethical commitments to be hold by industry with protecting the environment.
- Insist on corporate and social responsibilities through Governance practices and regulation

UNIT I INTRODUCTION 9

Ethics - Definition & nature, Characteristics, Attributes of Ethics - Business Ethics; Ethical theories; Causes of Unethical Behavior; Ethical abuses; Work ethics; Code of conduct; Public good

UNIT II ETHICS THEORY AND BEYOND 9

Management of Ethics - Ethics analysis [Hosmer model]; Ethical dilemma; Ethics in practice – ethics for managers; Role and function of ethical managers- Comparative ethical behaviour of managers; Code of ethics; Competitiveness, organizational size, profitability and ethics; Cost of ethics in corporate ethics evaluation

UNIT III LEGAL ASPECTS OF ETHICS 9

Political – legal environment; Provisions of the Indian constitution pertaining to Business; Political setup – major characteristics and their implications for business; Prominent features of MRTP &FERA. Social – cultural environment and their impact on business operations, Salient features of Indian culture and values.

UNIT IV ENVIRONMENTAL ETHICS 9

Economic Environment; Philosophy of economic growth and its implications for business, Main features of Economic Planning with respect to business; Industrial policy and framework of government contract over Business; Role of chamber of commerce and confederation of Indian Industries.

UNIT V CORPORATE SOCIAL RESPONSIBILITY AND GOVERNANCE 9

Definition- Evolution- Need for CSR; Theoretical perspectives; Corporate citizenship; Business practices; Strategies for CSR; Challenges and implementation; Evolution of corporate governance; Governance practices and regulation; Structure and development of boards; Role of capital market and government; Governance ratings; Future of governance-innovative practices; Case studies with lessons learnt.

TOTAL PERIODS 45

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO1: Analyze ethical issues in the workplace and code of conduct for mutual understanding and respect, inclusive attitudes and public good

CO2: Apply ethical theories in practice for evaluating corporate ethics

CO3: Discuss the legal aspects of ethics for protection of societal values.

CO4: Apply environmental ethics in economic development for protection of environment

CO5: Analyze corporate social responsibility for evaluating social responsibilities of corporates

CO6: Design and implement ethical governance in legal, environmental and social aspects in an Infrastructure project

TEXT BOOKS

1. Sherlekar S K, “Ethics in Management”, Himalaya Publishing House, 2009.
2. William B. Werther and David B. Chandler, “Strategic corporate social responsibility”, Sage Publications Inc., 2011

REFERENCE BOOKS

1. Shaw V W H, “Business Ethics”, Cengage Learning, 2007.

2. Beeslory, Michel and Evens, “Corporate Social Responsibility”, Taylor and Francis, 1978.
3. Philip Kotler and Nancy Lee, “Corporate social responsibility: doing the most good for company and your cause”, Wiley, 2005.
4. Subhabrata Bobby Banerjee, “Corporate social responsibility: the good, the bad and the ugly”, Edward Elgar Publishing, 2007.
5. Satheesh kumar, “Corporate governance”, Oxford University, Press, 2010

CO-PO-PSO Mapping

	POs											**PSOs**	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1							3				2		
CO2							3				2		
CO3						3	3				2		
CO4						3	3			3	2		
CO5						3		3		3	2		
CO6						3	3	2	2	3	2		
Average						**3**	**3**	**2.5**	**2**	**3**	**2**		

*3 – Strong, 2 – Moderate, 1 – Low