Kolhapur Institute of Technology's

COLLEGE OF ENGINEERING (AUTONOMOUS)

Gokul Shirgaon, Kolhapur

KOLHAPUR INSTITUTE
OF TECHNOLOGY'S
COLLEGE OF
ENGINEERING
(AUTONOMOUS),
KOLHAPUR

Curriculum Structure

(As Per NEP guidelines)

For

B. Tech E&TC Engineering

Academic Year 2024-2025

Under Graduate Programme

Dept. of Electronics & Telecommunication

24/07/24

Dr. Y. M. Patil
Head of Department

24/07/2024

Dr. A. R. Thorvat
Dean Academics

B. Tech. in Electronics &Telecommunication Engg.

w.e.f. A.Y: 2024-25 (S.Y.B. Tech)

SEMESTER-III

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component	Marks		
										Max	Min. for passing	
1	PC	UETPC0301	Analog Circuits	3	1	-	4	4	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
2	PC	UETPC0302	Differential Equations and Integral Transforms	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
3	PC	UETPC0303	Digital System Design	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
4	PC	UETPC0304	Electronics Instrumentation & Measurement	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
5	VE	UETVE0305	Environmental Studies	2	-	-	2	2	ISE	50	20	20
6	HSSM	UETEM0306	Engineering Management	2	-	-	2	2	ESE	50	20	20
7	PC	UETPC0331	Analog Circuits Laboratory	-	-	2	2	1	ISE	25	10	
									ESE(POE)	50	20	
8	PC	UETPC0332	Digital System Design Laboratory	-	-	2	2	1	ISE	25	10	
									ESE(POE)	25	10	
9	PC	UETPC0333	Electronics Instrumentation & Measurement- Laboratory	-	-	2	2	1	ISE	25	10	
10	OJT	UETIL0371	Mini Project-I	-	-	2	2	1	ISE	50	20	
11	MM	UETMM03**	Multidisciplinary Minor-I	2	-	-	2	2	ESE	100	40	
						Total:	27	23	Total Marks: 800 Total Credit: 23			

SEMESTER-IV

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component	Marks		
										Max	Min for Passing	
1	PC	UETPC0401	Network Analysis	2	-	-	2	2	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
2	PC	UETPC0402	Signals and Systems	2	-	-	2	2	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
3	PC	UETPC0403	Analog & Digital Communication	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
4	PC	UETPC0404	Linear Integrated Circuits	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
5	PC	UETPC0405	Electromagnetic Engineering	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
6	VE	UETVE0406	Constitution of India	2	-	-	2	2	ISE	50	20	
7	PC	UETPC0431	Analog & Digital Communication Laboratory	-	-	-	2	1	ISE	25	10	
									ESE(POE)	25	10	
8	PC	UETPC0432	Linear Integrated Circuits Laboratory	-	-	2	2	1	ISE	25	10	
									ESE(POE)	25	10	
9	OJT	UETIL0471	Mini Project-II	-	-	2	2	1	ISE	25	10	
10	VS	UETVS0433	Electronics Computer Aided Design (E-CAD)	-	-	2	2	1	ISE	25	10	
11	CC	UETCC0434	Co-Curricular Activities-II	-	-	2	2	1	ISE	50	20	
12	MM	UETMM04**	Multidisciplinary Minor-II	3	-	-	3	3	ESE	100	40	
						Total:	28	23	Total Marks: 850 Total Credit: 23			

*: Program Elective, ~: Open Elective

B. Tech. Electronics &Telecommunication Engg.

AY: 2025-26 (TY B. Tech)

SEMESTER-V

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component	Marks		
										Max	Min for passing	
1	PC	UETPC0501	Microcontrollers	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
2	PC	UETPC0502	Control Systems	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
3	PC	UETPC0503	Digital Signal Processing	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
4	PEC	UETPE05*	Program Elective-I	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
5	OE	UETOE05~	Open Elective-I	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
6	AE	UETAE0531	Business Communication and Value Science	-	-	2	2	1	ISE	50	20	
7	PC	UETPC0532	Microcontrollers Laboratory	-	-	2	2	1	ISE	25	10	
									ESE(POE)	25	10	
8	PC	UETPC0533	Digital Signal Processing Laboratory	-	-	2	2	1	ISE	25	10	
									ESE(OE)	25	10	
9	VS	UETVS0534	Model Based Design Laboratory	-	-	2	2	1	ISE	25	10	
10	CEP	UETIL0571	Community Engineering Project	-	-	2	2	1	ISE	25	10	
11	MM	UETMM05**	Multidisciplinary Minor-III	3	-	-	3	3	ESE	100	40	
						Total:	28	23	Total Marks: 800 Total Credit: 23			

*: Program Elective, ~: Open Elective

SEMESTER-VI

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component	Marks		
										Max	Min for Passing	
1	PC	UETPC0601	Embedded System	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
2	PC	UETPC0602	VLSI Design	2	-	-	2	2	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
3	PC	UETPC0603	Computer Networks	2	-	-	2	2	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
4	PEC	UETPE06*	Program Elective-II	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
5	OE	UETOE06~	Open Elective-II	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
6	HSSM	UETEM0604	Advanced Data Structure	2	-	-	2	2	ESE	50	20	
7	PC	UETPC0631	Embedded System Laboratory	-	-	2	2	1	ISE	25	10	
									ESE(POE)	25	10	
8	PC	UETPC0632	VLSI Design Laboratory	-	-	2	2	1	ISE	25	10	
									ESE(OE)	25	10	
9	PC	UETPC0633	Computer Networks Laboratory	-	-	2	2	1	ISE	25	10	
10	FP	UETIL0671	Industrial Automation	-	-	2	2	1	ISE	25	10	
11	CC	UETCC0634	Co-Curricular Activities-III	-	-	2	2	1	ISE	50	20	
12	MM	UETMM06**	Multidisciplinary Minor-IV	3	-	-	3	3	ESE	100	40	
						Total:	28	23	Total Marks: 850 Total Credit: 23			

*: Program Elective, ~: Open Elective

B. Tech. Electronics &Telecommunication Engg.

AY: 2026-27 (Final Year B. Tech)

SEMESTER-VII

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component	Marks		
										Max	Min for Passing	
1	PC	UETPC0701	Mobile Communication Network	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
2	PC	UETPC0702	Power Electronics	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
3	PC	UETPC0703	RF & Microwave Engineering	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
4	PEC	UETPE07*	Program Elective-III	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
5	OE	UETOE07~	Open Elective-III	2	-	-	2	2	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
6	PC	UETPC0731	RF &Microwave Engineering Laboratory	-	-	2	2	1	ISE	25	10	
									ESE(OE)	25	10	
7	PC	UETPC0732	Power Electronics Laboratory	-	-	2	2	1	ISE	25	10	
									ESE(POE)	25	10	
8	RM	UETIL0771	Project-I	-	-	8	8	4	ISE	50	20	
									ESE(OE)	50	20	
9	MM	UETMM07**	Multidisciplinary Minor-V	3	-	-	3	3	ESE	100	40	
						Total:	29	23	Total Marks: 800 Total Credit: 23			

*: Program Elective, ~: Open Elective

SEMESTER-VIII

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component	Marks		
										Max	Min for Passing	
1	PEC	UETPE08*	Program Elective-IV	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
2	PEC	UETPE08*	Program Elective-V	3	-	-	3	3	ISE1	10		40
									MSE	30		
									ISE2	10		
									ESE	50	20	
3	OJT	UETIL0871	Internship	-	-	12	12	6	ISE-I	75	30	
									ISE-II	75	30	
4	RM	UETIL0872	Project -II	-	-	8	8	4	ISE	50	20	
									ESE(OE)	50	20	
5	CC	UETCC0831	Co-Curricular Activities-IV	-	-	2	2	1	ISE	50	20	
						Total:	28	17	Total Marks: 500 Total Credit: 17			

*: Program Elective, ~: Open Elective

***Program Electives:**

PROGRAM ELECTIVE-I

Sr. No.	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1	UETPE0511	Antenna and Wave Propagation	3	0	0	3	3
2	UETPE0512	Probability Theory and Stochastic Processes	3	0	0	3	3
3	UETPE0513	Electronic System Design	3	0	0	3	3
4	UETPE0514	Computer Architecture & Organization	3	0	0	3	3

PROGRAM ELECTIVE -II

Sr. No.	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1	UETPE0611	Operating System	3	0	0	3	3
2	UETPE0612	Automotive Electronics	3	0	0	3	3
3	UETPE0613	Biomedical Instrumentation	3	0	0	3	3
4	UETPE0614	Embedded Linux	3	0	0	3	3

PROGRAM ELECTIVE -III

Sr. No.	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1	UETPE0711	Information Theory & coding	3	0	0	3	3
2	UETPE0712	Mechatronics	3	0	0	3	3
3	UETPE0713	Multimedia Engineering	3	0	0	3	3
4	UETPE0714	Optical Fiber communication	3	0	0	3	3
5	UETPE0715	Digital TV and Multimedia	3	0	0	3	3

PROGRAM ELECTIVE- IV

Sr. No.	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1	UETPE0811	Digital Image Processing	3	0	0	3	3
2	UETPE0812	Cyber security	3	0	0	3	3
3	UETPE0813	CMOS VLSI	3	0	0	3	3
4	UETPE0814	Real Time Systems	3	0	0	3	3

PROGRAM ELECTIVE- V

Sr. No.	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1	UETPE0815	System on Chip	3	0	0	3	3
2	UETPE0817	Cryptography & Network Security	3	0	0	3	3
3	UETPE0818	Machine Learning	3	0	0	3	3

~ Open Elective Courses

OPEN ELECTIVE -I

Sr. No.	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1	UILOE0522	Global Marketing Management	3	-	-	3	3
2	UILOE0531	Ethics in Engg practices	3	-	-	3	3
					Total:	6	6

OPEN ELECTIVE-II

Sr. No.	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1	UILOE0622	Engineering Econometrics	3	-	-	3	3
					Total:	3	3

OPEN ELECTIVE-III

Sr. No.	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1	UILOE0724	Industrial Instrumentation	2	-	-	2	2
					Total:	2	2

A. Bucket-I: Multidisciplinary Minor in Cyber Security

**Multi disc. minor							
Sr. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1	UETMM0341	Information Theory for Cyber Security	2	-	-	2	2
2	UETMM0441	Data Encryption	3	-	-	3	3
3	UETMM0541	Steganography & Digital Watermarking	3	-	-	3	3
4	UETMM0641	Security Assessment & Risk Analysis	3	-	-	3	3
5	UETMM0741	Database security & Access Control	3	-	-	3	3
					Total:	14	14

B. Bucket-II: Multidisciplinary Minor in Computer Vision

**Multi disc. minor							
Sr. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1	UETMM0342	Computer Graphics	2	-	-	2	2
2	UETMM0442	Machine Learning	3	-	-	3	3
3	UETMM0542	Deep Learning	3	-	-	3	3
4	UETMM0642	Image Processing	3	-	-	3	3
5	UETMM0742	Pattern Recognition & Computer Vision	3	-	-	3	3
					Total:	14	14

C. Bucket-III: Multidisciplinary Minor in Robotics & Automation

**Multi disc. minor							
Sr. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1	UELMM0341	Introduction to Robotics & Automation	2	-	-	2	2
2	UELMM0441	Sensors in Automation	3	-	-	3	3
3	UELMM0541	Microprocessor & Real Time Embedded Systems	3	-	-	3	3
4	UELMM0641	Artificial Intelligence in Robotics	3	-	-	3	3
5	UELMM0741	Applications of Robotics & Automation	3	-	-	3	3
					Total:	14	14

D. Emerging Minor in Sensor Technology

Emerging area minor							
Sr. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1	UETMN0361	Sensor Technology : Physics, Fabrication and Circuits	3	1	-	4	4
2	UETMN0461	Micro-sensor circuits	3	1	-	4	4
3	UETMN0561	Sensors & Sensor Circuits	3	1	-	4	4
4	UETMN0661	Electric Vehicle Sensors	3	1	-	4	4
5	UETMN0761	Industrial Sensors	2	-	-	2	2
					Total:	18	18

E. B.Tech. (Hons) in IOT.

Emerging specialization minor							
Sr. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1	UETHN0351	DBMS in Cloud	3	1	-	4	04
2	UETHN0451	Python for Cloud Computing	3	1	-	4	04
3	UETHN0551	IOT Architecture and Protocols	3	-	-	3	03
4	UETHN0651	Design of IOT Devices	3	1	-	4	04
5	UETHN0751	Data Analytics and Security of IOT	3	-	-	3	03
					Total:	**18**	**18**

Exit Courses

A. After First Year:

The candidate should pass any two suitable skill based courses to qualify for Certification.

Sr. No.	Course Code	Course Name		L	T	P	Hrs. / Week	Credits
1	UETEX0291	Consumer Electronics	**(Any one course)**	4	-	-	4	4
	UETEX0292	Radio Engineering		4	-	-	4	4
2	UETEX0293	Electronics Servicing and Maintenance of photo copy machine		4	-	-	4	4
3	UETEX0294	Electronic Materials & Components		4	-	-	4	4
			Total:					12

B. After Second Year:

The candidate should pass following skill based courses to qualify for Diploma.

Sr. No.	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1	UETEX0491	Data Communication and Networking	3	-	-	3	3
2	UETEX0492	Electronics Servicing and Maintenance	3	-	-	3	3
3	UETEX0493	Industrial Training	2	-	-	2	2
		Total:					8

C. After Third Year:

The candidate should pass following skill based courses to qualify for B. Voc

Sr. No.	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1	UETEX0691	Advanced Mobile Communication	3	-	-	3	3
2	UETEX0692	Cyber Security	3	-	-	3	3
3	UETEX0693	Internship	2	-	-	2	2
		Total:					8

KIT's College of Engineering Kolhapur (Empowered Autonomous)

Department: Electronics & Telecommunication Engineering

Final Year B.Tech. (Under NEP) Syllabus implemented from A.Y.2026-27

Title of the Course: Mobile Communication Network	**L**	**T**	**P**	**Credit**
Course Code: UETPC0701	**3**	**-**	**-**	**3**

Course Pre-Requisite: Basics of communication Systems.

Course Description:
This Course is to expose the students to the most recent technological developments in wireless communication systems. The Course considers the basic concepts of cellular system. The Course provides various multiple access techniques and Standards in Cellular mobile Communication.

Course Objectives:
The course aims to:

1. Focus on basic fundamentals of wireless communication.
2. Explain large- & small-scale radio wave propagation
3. Understand basic mobile communication and its multiple access techniques.
4. Understand mobile network and its connectivity.

Course Learning Outcomes:
Upon successful completion of this course, a student will be able to:

CO	After the completion of the course the student should be able to	Bloom's Taxonomy	
		level	Descriptor
CO1	List the basic fundamentals of wireless communication.	I	Remembering
CO2	Explain multiple access techniques to mobile communication	II	Understanding
CO3	Explain mobile network.	II	Understanding

CO-PO Mapping:

CO	**PO**												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**PSO 1**	**PSO2**
1	2	-	**-**	**-**	-	**-**	-	**-**	-	**-**	**-**	-	1
2	2	2	**-**	**-**	-	**-**	-	**-**	-	**-**	**-**	-	1
3	2	2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-	1

Assessments:
Teacher Assessment:
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20% 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:	**Hr.**
UNIT I: INTRODUCTION OF WIRELESS COMMUNICATION: Challenges in wireless networking, Wireless communications standards Overview, evolution of cellular system, Cellular system architecture & operation, Performance criteria. Multiple access schemes for wireless communication - TDMA, FDMA, CDMA, SDMA, **4G and 5G.**	6
UNIT II: WIRELESS NETWORK PLANNING AND OPERATION: Frequencies management, channel assignments, frequency reuse, System capacity& its improvement, Handoffs & its types, roaming, co channel & adjacent channel interference.	7
UNIT III: DIGITAL CELLULAR NETWORKS: GSM architecture& interfaces, signal processing in GSM, frame structure of GSM, Channels used in GSM.	5
UNIT IV: WIRELESS LAN TECHNOLOGY: Overview, WLAN technologies, infrared LANs, Spread Spectrum LANs Narrowband Microwave LANs IEEE 802.11- Architecture, protocols, MAC layer .MAC frame, MAC management	5
UNIT V: BLUETOOTH: Overview, Radio specification, Base band specification, Link manager specification, logical link control & adaptation protocol.	4
UNIT VI: MOBILE DATA NETWORKS: Introduction, Data oriented CDPD networks, GPRS, Wireless Access Protocol, WAP architecture, Wireless Datagram, Wireless Transport layer security, Wireless transaction, Wireless Session, Wireless Application	**7**

Textbooks:

1. William C.Y.Lee," Mobile communication Engg" , Tata Mc-Grraw Hill Publications.
2. T.S.Rappaport," Wireless Communication, principles & practice" Pearson Education.
3. Schiller,"Mobile communication", IInd Edition, Pearson Education.

Reference Books:

1. William Stalling,**"** Wireless Communication & Networking".
2.Rampantly," Mobile communication".
3.Kamilo Feher," Wireless digital communication", PHI, 1999.
4.Kavesh Pahlavan & P.Krishna Murthy," Principles of Wireless networks".

Title of the Course: Power Electronics Course Code: UETPC0702	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Analog Electronics, Network theory

Course Description:
The course covers the fundamentals of power electronic converters such as rectifiers, inverters, DC-DC and AC-AC converters, as well as the characteristics and operation of power semiconductor devices (like diodes, thyristors, IGBTs, and MOSFETs).

Course Objectives:
1. To introduce students with the basic theory of power semiconductor devices, their practical application in power electronics.
2. To familiarize the operating principle of AC-DC, DC-DC, DC-AC conversion circuits and their applications.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Describe the characteristics of switching devices.	II	Describe
CO2	Describe turn on and turn off methods of SCR.	II	Describe
CO3	Analyze AC- DC, DC-DC, AC-AC and DC-AC converters.	III	Analyzing
CO4	To compare and analyze electric and hybrid vehicle powertrains and energy storage systems, distinguish architectures, evaluating battery and fuel cell technologies.	II	Analyzing

CO-PO Mapping:

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

Assessments:

Teacher Assessment:
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE1	10
MSE	30
ISE2	10
ESE	50

ISE1 and ISE2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

UNIT I: --- Power Semiconductor Devices: Construction, V-I Characteristics, Dynamic Characteristics during, turn on & turn off, gate triggering Characteristics of SCR, two transistor analogy of SCR, Construction, working, & V-I Characteristics of Diac, Triac, GTO, MOSFET, IGBT	8 Hrs

UNIT II: -- Firing and Commutation Circuits of SCR Turn On methods of SCR: R triggering circuit RC triggering circuit, UJT triggering circuit with design, Cosine based firing circuit and microprocessor-based firing circuit for bridge-controlled converter. SCR Turn off method: Class A, Class B, Class C, Class D, Class E, & Class F	5 Hrs
UNIT III: -- AC-DC Converters (1-Phase & 3-Phase Controlled Rectifiers) Review of uncontrolled converters, Phase controlled converters: Single-Phase and Three-Phase full converters, semi-converters, Half-controlled converters (continuous and discontinuous current mode of operation). Numerical based on performance parameters of above all converters.	8Hrs
UNIT IV: --- DC-AC Converters (Inverters) Single phase inverter – Principle and operation of half bridge and full bridge inverters. Voltage control techniques of single-phase inverters: Single PWM, Multiple PWM and sinusoidal PWM Three Phase inverters – 180 & 120 degree conduction mode of operation. Harmonic reduction techniques of inverter.	7 Hrs
UNIT V: --- DC-DC Converters (Choppers) and AC-AC Converters Chopper Circuits Introduction to Choppers. Step down chopper with R & RL load. Step up chopper with R & RL load. Classification and quadrant operation of chopper (class A to class F). Voltage control technique of Chopper (frequency modulation & TRC.), AC Voltage Controllers	6Hrs
UNIT VI: --- Fundamentals of Electric vehicles Introduction of ICEV – power train operation and the need of gears and clutch. EV power train, Introduction to HEV, comparison between ICEV, HEV, EV, Vehicle terminology and architectures. Energy Storage for Electric vehicles: Battery performance parameters and design of battery pack. Li ion cell- structure, varietie of Li ion battery and comparison between them, other advanced batteries for EV structure and working of Fuel Cell energy storage, Super Capacitor, Necessity of hybridization of energy sources.	8Hrs

Textbooks:

1. M.H. Rashid, "Power Electronics-Circuits, Devices and Applications", 3rd Edition, Pearson.
2. M.D. Singh, K.B. Khanchandani, "Power Electronics", 2nd Edition, Tata- McGraw Hill.
3. Ned Mohan, Tore M. Undeland, William P. Robbins "Power Electronics Converters, Applications, and Design", 3rd Edition Wiley India Pvt Ltd

Reference Books:

1. P.C.Sen, "Power Electronics", Tata McGraw-Hill Education.
2. Dr. P. S. Bhimbra "Power Electronics" Khanna Publications.

Unit wise Measurable Students Learning Outcomes:

1. Explain the construction and V-I characteristics of devices such as SCR, Diac, Triac, GTO, MOSFET, and IGBT.
2. Explain and compare different turn-on methods for SCRs in controlled converters.
3. Solve numerical problems involving semi-converters, full converters, and half-controlled converters.
4. Explain and compare the operation of single-phase and three-phase inverters.
5. Interpret and analyze different chopper circuit topologies and quadrant operations (Class A-F).
   Distinguish between ICEV, HEV, and EV power train architectures and vehicle terminology.

Title of the Course: RF & Microwave Engineering	L	T	P	Credit
Course Code: UETPC0703	3	-	-	3

Course Pre-Requisite: Electromagnetic Field Theory. Transmission lines & Wave guides.

Course Description: Course deals with how microwave signal is transmitted using different microwave junctions. Course discusses different types of Microwave devices and Components. Also it deals with applications of Microwave and measurement of different microwave parameters.

Course Objectives:

The course aims to:

1 Make students aware of the fundamentals of microwave engineering to reach the desire industry skills sets.

2. Introduce the students about various microwave Devices, amplifiers and oscillators to know their applications in various domains.

3. Introduce different microwave junctions and use them to measure some parameters.

4. Aware students about different types of Microwave Hazards.

5. Study manufacturing techniques of MMIC.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Illustrate different modes of propagation in waveguides	II	Understanding
CO2	Classify microwave components for various applications.	II	Understanding
CO3	Illustrate different microwave devices.	II	Understanding
CO4	Select different devices for microwave measurement techniques	III	Applying

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	2	-	2	-	-	-	-	-	2	-	1	1	-
CO2	1	2	-	2	-	-	-	-	2	-	1	1	-
CO3	-	2	-	2	-	-	-	-	2	-	1	1	-
CO4	-	2	-	-	-	-	-	-	2	-	1	1	-

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

UNIT I: --- Microwave Wave Guides.

Rectangular and Circular waveguides: TE, TM and TEM modes in waveguides,

power transmission in waveguide, power losses in wave guide, excitation modes in wave guide, Characteristics of standard wave guides.	09 Hrs
UNIT II: --- Microwave Components. Scattering parameters, microwave cavities, microwave hybrid circuits, directional coupler, two-hole directional coupler, circulators, isolators, faraday rotation, Gyrator, microwave attenuators (fixed and Variable Type), slotted lines, parallel, coplanar & shielded micro strip lines. (Operating principle & S-parameter equations of above-mentioned microwave components.)	9 Hrs
UNIT III: --- Microwave Tubes. Linear beam: Klystrons, Reflex Klystrons, TWTs. Magnetrons (Operating principle, construction & analytical treatment of above-mentioned microwave tube. Working of Microwave Oven.	7 Hrs
UNIT IV: --- Microwave Solid State Devices. Microwave tunnel diodes, microwave FETs, Gunn effect diodes, RWH Theory, LSA diodes, InP diodes, CdTe diodes, PIN diodes, MESFETs and HEMT. (Operating principle, construction & analytical treatment of above mentioned microwave devices.)	8Hrs
UNIT V: --- Microwave Measurements and Microwave Applications. Detection of microwave power: measurement of microwave, power bridge circuit, thermistor parameters, and waveguide thermister mounts, barreters, theory of operation of barreters, direct reading barreters bridges, Measurement of Impedance, Transmission cavity wavemeter & reaction wavemeter, measurement of VSWR, measurements of Attenuation, free space attenuation, Antenna Gain, Measurement of Q of cavity resonator. ISM Applications.	8Hrs
UNIT VI: --- Monolithic Microwave Integrated Circuits & Hazards. Materials: substrate, conductor dielectric & resistive MMIC growth, thin film formation, IC fabrication Techniques, Microwave hazards: HERO, HERF & HERP.	5Hrs
Textbooks: 1) Microwave Engineering: Sushrut Das, Oxford Publication 2) Microwave Devices and Circuit – Samul Liao (Prentice hall of India) 3) Microwave Engineering-Annapurna Das ,TMH Publication	
References Books: 1) Foundation for Microwave Engg. – R.E.Collin, Wiley Publications 2) Microwave Engineering-David M. Pozer., Wiley Publications 3) Techniques of Microwave Measurement-Carol G. Montgomery 4) Microwave Active Devices vacuum and solid state – M.L. Sisodia 5) Basic laboratory microwave techniques- Manual, Sisodia and Raghuvanshi Wiley 6) Microwave Engineering: Dr.K.T. Mathews Wiley Publications	
Unit wise Measurable students Learning Outcomes: After the completion of the course the student should be able to 1) Distinguish various TE and TM modes in Waveguides. 2) Distinguish various Microwave components. 3) Describe various types of Microwave Tubes. 4) Illustrate various types of Microwave Solid state devices. 5) Demonstrate different types of Microwave measurement techniques. 6) Describe MMIC fabrication techniques & various microwave hazards.	

Title of the Course: RF & Microwave Engineering Lab Course Code: UETPC0731	L	T	P	Credit
	-	-	2	1

Course Pre-Requisite: Basic knowledge of Maxwells equations.

Course Description: Course deals with different types of Microwave tubes. Different types of waveguides and modes. Also, we discuss different microwave measurements techniques.

Course Objectives:

The course aims to:

1. Introduce the students about various microwave Devices, amplifiers and oscillators to know theirapplications in various domains.
2. Introduce different microwave junctions and use them to measure some parameters.

Course Outcomes:

CO	After the completion of the course the student should be able to	Blooms Taxonomy	
		level	Descriptor
CO1	Illustrate different microwave devices.	II	Understanding
CO2	Select different devices for microwave measurement techniques.	III	Applying
CO3	Classify microwave components for various applications.	II	Understanding

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	2	1	2	2	-	-	-	1	1	-	1	2	-
CO2	1	1	2	-	-	-	-	1	1	-	1	2	-
CO3	1	-	-	2	-	-	-	1	1	-	1	-	-

Assessments:

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE)having 50%, and 50% weights respectively.

ISE are based on practical performances/ Quiz/ Mini-Project assigned/ Presentation/ GroupDiscussion/ Internal oral etc.

ESE assessment is based on oral examination

Assessment	Marks
ISE	25
ESE-OE	25

Lab Contents:

Experiment No. 1:--- Aim: Experiment on studying different microwave components. Objectives: Understand analysis and working of each component. Outcomes: S- matrix analysis. Theoretical Background: Properties of S-matrix. Experimentation: Results and Discussions: Conclusion: We discuss different types of components with properties of S-matrix.	02 Hrs.
Experiment No. 2:---	02 Hrs.
Aim: Experiment on characteristics of Klystron Tube. Objectives: Understand working of Klystron tube. Outcomes: Plotting characteristics. Theoretical Background: Working of Bunching Process. Experimentation: Results and Discussions: We study Applegate diagram. Conclusion: We understand bunching process.	
Experiment No. 3:--- Aim: Experiment on studying E-plane Tee. Objectives: Demonstrate working of E-plane Tee. Outcomes: Show how it works as Subtractive Tee. Theoretical Background: Properties of S-matrix. Experimentation: Results and Discussions: To see how S-matrix of E-Plane Tee works. Conclusion: We observed output as in opposite phase.	02 Hrs.
Experiment No. 4:--- Aim: Experiment on studying H-plane Tee. Objectives: Demonstrate working of H-plane Tee. Outcomes: Show how it works as Additive Tee. Theoretical Background: Properties of S-matrix. Experimentation: Results and Discussions: To see how S-matrix of H-Plane Tee works. Conclusion: We observed output as in phase.	02Hrs.
Experiment No. 5:--- Aim : Experiment on studying Magic Tee. Objectives: Demonstrate working of Magic Tee. Outcomes: Show how it works as Additive and Subtractive Tee. Theoretical Background: Properties of S-matrix. Experimentation: Results and Discussions: To see how S-matrix of Magic Tee works. Conclusion: We observed output as in phase and out of opposite phase.	02 Hrs.
Experiment No. 6:--- Aim: Experiment on char. of Gunn diode. Objectives: Demonstrate working of Gunn diode. Outcomes: Observed output of Gunn Diode. Experimentation: Results and Discussions: Conclusion: In this, by observing output characteristics, we study Gunn Diode.	02Hrs.
Experiment No. 7:--- Aim: Experiment on HFSS. Objectives: Demonstrate FSS software. Outcomes: Design rectangular waveguide. Theoretical Background: Working of Waveguides.Experimentation: Results and Discussions: Conclusion: We design rectangular waveguide.	02Hrs.
Experiment No. 8:--- Aim: Observe and plot characteristics of Reflex Klystron using Virtual lab. Objectives: Demonstrate characteristics of Reflex Klystron using Virtual lab. Outcomes: Observed the characteristics.	02Hrs.

Background: Working of Reflex Klystron. Conclusion: We plot the characteristics of Reflex Klystron.	
Experiment No. 9:--- Aim: Observe and plot the characteristics of basic properties of E-plane Tee, H-plane Tee and Magic Tee using Virtual lab. Objectives: Demonstrate characteristics of basic properties of E-plane Tee, H-plane Tee and Magic Tee using Virtual lab.. Outcomes: Observed the characteristics. Background: Working of E-plane Tee, H-plane Tee and Magic Tee Conclusion: We plot the characteristics of E-plane Tee, H-plane Tee and Magic Tee	02Hrs.
Experiment No. 10:--- Aim:To measure isolation and coupling factor of a three port circulators using Virtual lab. Objectives: Demonstrate working of Circulator using Virtual lab.. Outcomes: Observed the characteristics. Background: Working of Circulator. Conclusion: We measure isolation and coupling factor of a three port circulators using Virtual lab.	02Hrs.
Experiment No. 11:--- Aim: Observing field pattern of various modes inside a rectangular waveguide using Virtual Lab. Objectives: Demonstrate generation of various modes in rectangular waveguide using Virtual lab.. Outcomes: Observed the different modes. Background: Working of Waveguides. Conclusion: We observe different modes in rectangular waveguide using Virtual lab.	02Hrs.
Experiment No. 12:--- Study of TICRA to design Antenna..	02 Hrs.
Textbooks: 1) Microwave Engineering: Sushrut Das, Oxford Publication 2) Microwave Devices and Circuit – Samul Liao (Prentice Hall of India) Microwave Engineering-Annapurna Das ,TMH Publication	
Reference Books: 1) Foundation for Microwave Engg. – R.E.Collin, Wiley Publications 2) Microwave Engineering-David M. Pozer., Wiley Publications 3) Techniques of Microwave Measurement-Carol G. Montgomery 4) Microwave Active Devices vaccum and solid state – M.L. Sisodia 5) Basic laboratory microwave techniques- Manual, Sisodia and Raghuvanshi Wiley Microwave Engineering:Dr.K.T.MathewsWiley Publications	
Experiment wise Measurable students Learning Outcomes: After the completion of Lab the student should be able to:	
1) Understand different microwave components.	
2) Understand working of Klystron Tube.	
3) Understand how E- Plane Tee works as Subtractive Tee.	
4) Understand how H- Plane Tee works as Additive Tee.	
5) Understand how Magic Tee works as Subtractive and Additive Tee.	

6) Understand working of Gunn Diode.	
7) Understand design of Rectangular Waveguide using H.F.S.S.	
8)Understand working Reflex Klystron using Virtual lab.	
9) Observe and plot the characteristics of basic properties of E-plane Tee, H-plane Tee and Magic Tee using Virtual lab.	
10) Measure isolation and coupling factor of a three port circulators using Virtual lab.	
11) Observe the field pattern of various modes inside a rectangular waveguide using Virtual Lab.	

Title of the Course: Power Electronics Laboratory	L	T	P	Credit
Course Code: UETPC0732	-	-	2	1

Course Pre-Requisite:
Analog Electronics, Network theory

Course Description:
The course covers the fundamentals of power electronic converters such as rectifiers, inverters, DC-DC and AC-AC converters, as well as the characteristics and operation of power semiconductor devices (like diodes, thyristors, IGBTs, and MOSFETs).

Course Objectives:
This course aims to
1. To introduce students with the basic theory of power semiconductor, their practical application in power electronics.
2. To familiarize the operating principle of AC-DC, DC-DC, DC-AC conversion circuits and their applications.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	level	Descriptor
CO1	Demonstrate Power Electronic circuits.	II	Understanding
CO2	Develop practical skills in analysis of phase controlled converters, Choppers and Inverters.	III	Applying
CO3	Understand the basics of battery management system	II	Understanding
CO4	To test the simulation of choppers and inverters	IV	Analyzing

CO-PO Mapping:

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

Assessments:
Teacher Assessment:
One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.
ISE are based on practical performed/Quiz/Mini-Project assigned/Presentation/Group Discussion/ Internal oral etc.
ESE: Assessment is based on oral examination

Assessment	Marks
ISE	25
ESE-POE	25

Course Contents:

Experiment No.1: --- Aim and Objectives: To Study of VI characteristics of SCR. Outcomes: The students will be able to plot V-I Characteristics of the SCR for the Forward characteristics Theoretical Background: Theory of V-I characteristics of SCR Experimentation: Characteristics of SCR. Results and Discussions: Observed and noted analysis Parameters Conclusion: Implemented circuit and observed the result.	2 **Hrs.**
Experiment No.2: --- Aim and Objectives: To Study of Triggering circuits of SCR. Outcomes: The students will be able demonstrate working of different triggering circuits of SCR. (R, R-C, UJT Triggering circuits) Theoretical Background: Theory of Triggering methods of SCR. Experimentation: Triggering methods of SCR. Results and Discussions: Observed Waveforms and noted analysis Parameters. Conclusion: Implemented circuit and observed the result.	2 **Hrs.**
Experiment No.3: --- Aim and Objectives: To Study single phase HWR with R and RL load. Outcomes: The students will be able to demonstrate working of single phase HWR. Theoretical Background: Theory and operating principle single phase HWR for R and RL load. Experimentation: Analysis of out waveforms and o/p voltage for R and RL load. Results and Discussions: Observed Waveforms and noted analysis Parameters. Conclusion: Implemented single phase HWR.	2 Hrs.
Experiment No. 4: --- Aim and Objectives: To Study of single phase FWR with R and RL load. Outcomes: The students will be able to demonstrate working of single phase FWR. Theoretical Background: Theory and operation principle single phase FWR. Experimentation: Analysis of out waveforms and o/p voltage for R and RL load. Results and Discussions: observed Waveforms and noted analysis Parameters Conclusion: Implemented FWR for R and RL Loads.	2 Hrs.

Experiment No. 5: --- Aim and Objectives: To Study of single phase semi converter with R and RL load. Outcomes: The students will be able to demonstrate working of single phase FWR. Theoretical Background: Theory and operation principle single phase FWR. Experimentation: Analysis of out waveforms and o/p voltage for R and RL load. Results and Discussions: Observed Waveforms. Conclusion: Implemented semi converter for R and RL Loads.	
Experiment No. 6: --- Aim and Objectives: Three Phase Half Wave Controlled rectifier Outcomes: The students will be able to demonstrate working principle of 3-phase Half wave Controlled rectifier. Theoretical Background: Theory and operation principle of Three Phase Half Wave Controlled rectifier Experimentation: Analysis of out waveforms and o/p voltage for R and RL load. Results and Discussions: Observed Waveforms. Conclusion: Implemented Three Phase Half Wave Controlled Rectifier for R and RL Loads.	2 Hrs.
Experiment No. 7: - Aim and Objectives: Three Phase Full Wave Controlled rectifier Outcomes: The students will be able to demonstrate working principle of 3-phase Full wave Controlled rectifier Theoretical Background: Theory and operation principle of Three Phase full wave Controlled rectifier Experimentation: Analysis of out waveforms and o/p voltage for R and RL load. Results and Discussions: Observed Waveforms. Conclusion: Implemented Three Phase full wave Controlled rectifier for R and RL Loads.	2 Hrs.
Experiment No. 8: - Aim and Objectives: Single Phase half bridge Inverter Outcomes: The students will be able to demonstrate working principle of Single Phase PWM Bridge Inverter. Theoretical Background: Theory and operation principle of Single Phase half bridge Inverter Experimentation: Analysis of out waveforms and o/p voltage for R and RL load. Results and Discussions: Observed Waveforms. Conclusion: The simulation of the single-phase half-bridge inverter successfully demonstrated the conversion of a DC input into an AC output using two switching devices. The output waveform obtained was a quasi-square wave, confirming proper alternation of voltage across the load. The effect of switching frequency and dead-time on waveform quality was observed, and the inverter operated as expected under different load conditions.	2 Hrs.
Experiment No.9: - Aim and Objectives: Single Phase full bridge Inverter Outcomes: The students will be able to demonstrate working principle of Single Phase full Bridge Inverter. Theoretical Background: Theory and operation principle of Single Phase full bridge Inverter Experimentation: Analysis of out waveforms and o/p voltage for R and RL load.	2 Hrs.

Results and Discussions: Observed Waveforms. Conclusion: The simulation of the full-bridge inverter produced a clear square-wave AC output with full utilization of the DC supply. Compared to the half-bridge, the full-bridge configuration delivered a higher output voltage and improved power delivery to the load.	
Experiment No. 10: - Aim and Objectives: Step up chopper Outcomes: The students will be able to demonstrate working principle of step up chopper Theoretical Background: Theory and operation principle of Step up chopper Experimentation: Analysis of out waveforms and o/p voltage Results and Discussions: Observed Waveforms. Conclusion: The simulation of the step-up chopper verified its ability to increase the input DC voltage to a higher level. As the duty cycle increased, the output voltage proportionally increased, matching the theoretical boost converter characteristics.	2 Hrs
Experiment No. 11: - Aim and Objectives: Step Down chopper Outcomes: The students will be able to demonstrate working principle of step down chopper Theoretical Background: Theory and operation principle of Step down chopper Experimentation: Analysis of out waveforms and o/p voltage. Results and Discussions: Observed Waveforms. Conclusion: The simulation results of the step-down chopper showed a successful reduction of the input voltage to a lower controlled output voltage. The output voltage decreased with the decrease in duty cycle, which aligns with buck converter theory.	2 Hrs
Experiment No. 12: --- Aim and Objectives: To study Battery Management system. Outcomes: The students will be able to demonstrate working principle of Battery Management system	2 Hrs
Textbooks: 1) M.H. Rashid, "Power Electronics-Circuits, Devices and Applications", 3rd Edition, Pearson. 2) M.D. Singh, K.B. Khanchandani, "Power Electronics", 2nd Edition, Tata- McGraw Hill. 3) Ned Mohan, Tore M. Undeland, William P. Robbins "Power Electronics Converters, Applications and Design" 3rd Edition Wiley India Pvt Ltd	
Reference Books: 1) P.C.Sen, "Power Electronics", Tata McGraw-Hill Education. 2) Dr. P. S. Bhimbra "Power Electronics" Khanna Publications.	

Experiment wise Measurable students Learning Outcomes:

1) Students will be able to explain various electrical parameters of op-amp
2) Students will be able to calculate various electrical parameters of op-amp
3) Students will be able to design inverting and non-inverting amplifier using op-amp
4) Students will be able to design summing, scaling and averaging amplifier using op-amp
5) Students will be able to analyze o/p waveform of precision HWR & FWR
6) Students will be able to analyze o/p waveform of Schmitt trigger
7) Students will be able to design Butterworth LPF & HPF and analyze their operation from the frequency response
8) Students will be able to design square and triangular waveform generator.
9) Students will be able to design IC555 timer as astable multivibrator to generate square wave of various duty cycles
10) Students will be able to design Wien bridge oscillator using op-amp to generate sinusoidal signal.

Title of the Course: Project – I Course Code: UETIL0771	L	T	P	Credits
	-	-	8	4

Course Pre-Requisite: Knowledge of micro-projects and mini-projects, Matlab, proteus, KIEL, Tinker cad etc

Course Description:

The project-I is a capstone experience in which students integrate and apply knowledge and skills acquired in earlier units to a substantial real-world design challenge relevant to their discipline. Students work in teams, typically with four members, and are supervised by an academic and/or industry mentor. Teams are responsible for managing their project as well as reporting against milestones and preparing the necessary design documentation. The academic objectives of the project are to lead students through a systematic engineering design and synthesis process and to better prepare them for professional practice as engineers. The focus of the unit is on teamwork, skills, lifelong learning and the design process.

Course Objectives:

1. To apply engineering knowledge in practical real time problem solving
2. To foster innovation in design of products, processes or systems
3. To develop creative thinking in finding viable solutions to engineering problems

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Descriptor
CO1	Identify innovative research ideas, questions or problems to formulate a research hypothesis for a complex engineering problem.	III	Applying
CO2	Design and demonstrate appropriate research methodologies for a complex engineering problem.	VI	Creating
CO3	Apply appropriate modern tools to execute the project work.	III	Applying
CO4	Evaluate application of project work with appropriate societal consideration.	V	Evaluating
CO5	Develop presentation and interpersonal communication skills through project work.	VII	Creating
CO6	Analyze ethical practices and tools used for different technologies.	IV	Analyzing

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	2	-	-	-	-	-	-	2	-	-
CO2	3	2	2	2	-	-	-	-	-	-	2	2	2
CO3	2	2	-	-	3	-	-	-	-	-	2	-	-
CO4	-	-	-	-	-	2	-	-	-	-	-	-	-
CO5	1	-	2	-	-	-	-	2	2	-	1	-	-
CO6	1	2	-	-	-	-	3	-	-	-	1	-	-

Assessments:

Teacher Assessment:

ISE components are synopsis presentation, design methodology, final presentation of detailed system design etc.

Assessment	Marks
ISE	50
ESE(OE)	50

ISE is based on Identification of Problem Domain and Detailed Analysis, Study of the Existing Systems, Feasibility of Project Proposal, Objectives, and Methodology of the Proposed Work, Design Methodology and project report.

ESE (OE): Assessment is based on work done in entire semester – I, project group should give the presentation of complete work done in semester - I

Course Contents:

1. The project work is to be carried out in two semesters of B. Tech. (Electronics & Telecommunication Engg.) i.e. Semester 7 & semester 8.

2. The practical batch for project shall be a maximum of 16 students. The batch will be preferably divided into groups, each consisting of not more than 4 students.

3. In semester – 7, the group will select an innovative project with the approval of the guide and submit the synopsis of project compulsory in the 7^{th} or 8^{th} week of the semester.

4. The group is expected to complete **problem identification, literature survey, feasibility of project proposal, detail system design with component values, objectives and methodology of proposed work, layout, PCB etc**. in semester – 7, as a part of ISE.

5. In addition, all students of project group will deliver a seminar on latest topics related to proposed project and submit the joint seminar report consisting of Literature survey, basic proposed project work and the size of the report should be at least 30 pages.

6. ISE comprises of **Identification of Problem Domain and Detailed Analysis, Study of the Existing Systems, Feasibility of Project Proposal, Objectives, Methodology of the Proposed Work, Design Methodology and project report.**

Note: The group should compulsorily maintain a logbook of progress of the project activities. The logbook should have entries related to the work done, problems faced, solutions evolved etc. duly signed by internal guide.

Title of the Course: Internship Course Code:UETIL0871	L	T	P	Credit
	-	-	12	6

Course Pre-Requisite: Knowledge of 7th-semester coursework, project basics, and departmental domain fundamentals as per curriculum. Students must have attended internship orientation and completed all documentation as per Internship Policy.

Course Description: The internship is an essential and mandatory component of the B.Tech programme. It provides students with real-time exposure to industrial, research, or incubation environments, enabling them to apply engineering knowledge in practical situations. Students work under the guidance of an industry mentor and a faculty mentor. The objective is to familiarize students with professional practices, develop workplace skills, and integrate academic learning with field experience. The internship duration will be a minimum of 4 week and up to 6 months depending on the mode of execution.

Course Objectives: The course aims to: ----

1. To expose students to industrial/research work practices and organizational processes.
2. To apply engineering knowledge to real-world tasks, assignments, and problem solving.
3. To develop communication, teamwork, ethics, and professional skills in workplace settings.
4. To enhance understanding of industrial tools, technologies, and engineering workflow.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Taxonomy	
		level	Descriptor
CO1	Understand workplace processes, tools, and industrial workflow.	II	Understanding
CO2	Apply engineering knowledge to tasks/mini projects assigned during internship.	III	Applying
CO3	Communicate effectively through diary, reports, presentations, and professional interactions.	III	Communicate
CO4	Demonstrate workplace discipline, teamwork, ethics, and safety practices	IV	Demonstrate

CO-PO Mapping:

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

Assessments:

Teacher Assessment:

Teacher Assessment: Two components of In-Semester Evaluation (ISE), ISE-1 and ISE-2, as per Internship Policy

Assessment	Marks
ISE1	75
ISE2	75
Total	150

ISE-1: Based on internship diary/logbook, monthly report, and first evaluation by mentor(s).

ISE-2: Based on final report, final presentation, and overall performance as per internship evaluation formats.

There is no separate ESE, as internship is a continuous assessment component.

Course Contents:	**Hrs.**
1. The internship work is to be carried out during 8th semester as per Internship Policy 2024-25. 2. Students shall undergo internship through any approved execution mode: • Full-time industry internship cum project • Full-time research internship • Short-duration industry internship with in-house project • Internship through incubation center 3. Students shall complete minimum 4 weeks of internship. Departments may extend duration. 4. Required documents must be submitted before internship: Application Form, Consent Form, Joining Letter, etc. 5. Students must maintain a weekly logbook containing tasks, processes learned, difficulties, and mentor remarks. 6. Students shall follow workplace rules, safety, and report weekly to faculty mentor. 7. Students must complete: Logbook, Monthly Presentation, Final Internship Report, Supervisor Evaluation, Final Viva. 8. Students must submit: Internship Certificate, Attendance Record, Final Report, Logbook with signatures. Note: Students must maintain all documentary evidence. Absence without permission may cancel internship.	

Title of the Course: Project Phase – II Course Code: UETIL0872	L	T	P	Credits
	--	--	8	4

Course Pre-Requisite: Knowledge of micro-projects and mini-projects, MATLAB, protius, KIEL, Tinkercad etc.

Course Description:

The project-I is a capstone experience in which students integrate and apply knowledge and skills acquired in earlier units to a substantial real-world design challenge relevant to their discipline. Students work in teams, typically with four members, and are supervised by an academic and/or industry mentor. Teams are responsible for managing their project as well as reporting against milestones and preparing the necessary design documentation. The academic objectives of the project are to lead students through a systematic engineering design and synthesis process and to better prepare them for professional practice as engineers. The focus of the unit is on teamwork, skills, lifelong learning and the design process.

Course Objectives:

1. To apply engineering knowledge in practical real time problem solving
2. To foster innovation in design of products, processes or systems
3. To develop creative thinking in finding viable solutions to engineering problems

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Taxonomy	
		level	Descriptor
CO1	Apply appropriate modern tools to execute the project work.	III	Applying
CO2	Design and demonstrate hardware and software of a complex engineering problem.	V	Design, Demonstrate
CO3	Make use of research ethics and responsibilities while conducting a complex engineering problem.	III	Make use of
CO4	Outline collaboratively with team members and lead in diverse teams	VI	Outline
CO5	Explain confidently and constructively the various system components	II	Explain
CO6	Elaborate the knowledge and understanding of complex research problem in teams of final demo	IV	Elaborate

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	3	-	-	-	-	-	2	-	-
CO2	-	2	2	2	-	-	-	-	-	-	2	2	2
CO3	2	-	-	1	-	-	3	-	-	-	2	-	-
CO4	-	-	-	-	-	1	-	3	2	-	1	-	-
CO5	-	-	-	-	-	-	-	2	2	-	1	2	-
CO6	2	2	-	2	-	-	-	2	2	-	1	-	-

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), that is ISE-1 and ISE-2and one End Semester Examination (ESE).

Assessment	Marks
ISE	50
ESE (OE)	50

ISE – 1: ISE marks shall be based on the project evaluations 1, 2 and 3.

ISE – 2: ISE marks shall be based on the internship in industry.

ESE (OE): ESE is based on final demonstration of project in front of external examination.

Course Contents:

1. The project work is to be carried out in 8th semesters of B. Tech. (Electronics & Telecommunication Engg.).

2. In semester – 8, the project group will continue the project work from semester VII.

3. In this semester, the project work is evaluated in three phases, evaluation -I, evaluation-II and evaluation – III. At the same time project group has to complete the internship in industry for a minimum for 4 weeks.

4. The group is expected to complete **PCB, rough design notes, component receipts, circuit testing, and complete system design** in Evaluation-1, as a part of ISE - 1.

5. The group is expected to complete **PCB, rough design notes, component receipts, circuit testing, software programming** in Evaluation-II, as a part of ISE - 1.

6. The group is expected to complete **PCB, rough design notes, component receipts, circuit testing, software programming** in Evaluation-III, as a part of ISE - 2.

7. Assessment of software projects involves analyzing design approach, execution, performance, innovation level, and completeness of documentation.

8. In addition, all students of project group will deliver a final project demonstration in front of evaluation panel and submit the final hard-bound report of project work done in semester-8 which consists of at least 50 pages.

Note: The group should compulsorily maintain a logbook of progress of the project activities. The logbook should have entries related to the work done, problems faced, solutions evolved etc. duly signed by internal guide.

Title of the Course: Information Theory and Coding Course Code: UETPE0711	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Probability, Fundamentals of digital communication.

Course Description: The course introduces information theory, the fundamentals of error control coding techniques and their applications.

Course Objectives:

1. To understand information theory, estimate information content of a random variable from its probability distribution.
2. To understand the types of communication channels, their capacities and construct efficient codes for data on imperfect communication channels.
3. To understand the need & objective of error control coding with encoding & decoding procedure to analyze error detecting & correcting capability of different codes.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Illustrate basic concepts of information theory and entropy coding.	II	Understanding
CO2	Analyze the basic communication channel models.	IV	Analyzing
CO3	Analyze the error detecting and correcting capability of different coding scheme.	IV	Analyzing
CO4	Design encoder and decoder for various coding techniques as per the need and specification.	VI	Creating

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	3	2	1	1	1	1	-	-	-	-	-	-	-
CO2	3	2	1	1	1	1	-	-	-	-	-	-	-
CO3	3	2	2	1	1	1	-	-	-	-	-	-	-
CO4	2	3	2	2	3	2	-	-	-	-	-	-	-

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30

ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 30%-40% Weightage (Normally first three modules) for syllabus covered up to MSE and 60-70% Weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1: --- : INFORMATION THEORY: Introduction, Concept of information: Unit, Properties, Entropy (Average Information) Definition, Mathematical expression, Entropy of Binary Source, Information Rate, Joint Entropy, Conditional entropy, relation between Joint & Conditional Entropy, Mutual Information: Average Mutual Information, Mathematical expression, Relation between Mutual Information & Entropy	9 Hrs.
Unit 2:--- CHANNEL CAPACITY AND CODING: Channel Capacity, Redundancy and Efficiency of channel, Discrete memory less channel – Channel Matrix, Classification of channels: lossless Channel, Deterministic Channel, Noise free channel, Binary Symmetric Channel (BSC), Cascaded Channels and Binary Erasure Channel (BEC), Calculation of channel capacity of all channel theorem, Capacity of a band limited Gaussian channel, Shannon-Hartley Theorem, Trade of between Bandwidth and Signal to Noise ratio. Entropy Coding: Shannon Fano Coding, Huffman Coding.	8 Hrs.
Unit 3:-- LINEAR BLOCK CODE: Introduction: Error Control Coding: Need, Objectives & Approaches of Error Control Coding, Classification, Error Detection and Error Correction Techniques, Linear Block Code: Structure, Terms Related to Block Code, Matrix Description of Linear Block Code, Generator and Parity Check Matrices, Hamming Codes, Encoder and Syndrome decoder for (n, k) block Code.	7 Hrs.
Unit 4: -- CYCLIC CODE: Algebraic structure, Properties, Polynomial representation of Codeword, Generator Polynomial, Generation of Code Vector in Non-systematic and Systematic form, Generator and Parity check matrices in Systematic form, Encoding of Cyclic Code, Syndrome decoding for Cyclic code, Hardware Representation of (n, k) cyclic code. Cyclic Redundancy Check Code.	8 Hrs.
Unit 5: --- CONVOLUTIONAL CODE: Introduction, Encoding of Convolution Codes, Generation of Output code sequence: Time Domain Approach, Transform Domain Approach, Graphical Approach –Code Tree, State diagram and Trellis Diagram, Decoding of Codes : Maximum Likelihood Decoding - Viterbi Algorithm. Turbo Coding, LDPC, Case Study.	6 Hrs.
Unit 6: --- BCH & RS CODE: Binary Field Arithmetic, BCH Code: Properties, Primitive element and primitive polynomial, Primitive BCH Code, Construction of Galois Field GF (2^m), Addition & Multiplication of GF (2^m), Minimal & Generator	5 Hrs.

Polynomial for BCH Code, Decoding of BCH Code, Reed-Solomon code, Turbo Coding. Case Study.	

Textbooks:

1. R.P Singh &S.D.Sapre ,Analog Communication Systems,Mc-Graw Hill, &IInd Edition, 2001.

2. Muralidhar Kulkarni, K.S. Shivprakasha,Information Theory,& Coding Wiley (India) Publication 2014

3. ArijitSaha,Surajit Mandal, Information Theory Coding& Cryptography Pearson Education, Ist Edition, 2013.

4. Salvatore Gravano,"Introductionto Error Control Codes", Oxford University Press, Ist Edition,2001

References:

1. Simon Haykin, "Communication Systems" John Wiley&Sons,Inc, IVth Edition

2. Sam Shanmugam, "Digital and Analog CommunicationSystems JohnWileyPublication , 2005.

3. Martin Roden, " Analog Digital& CommunicationSystems",Prentice Hall India,IIIrd Edition.

4. Ranjan Bose, "Information Theory Coding &Cryptography",TataMcGraw-Hill Publishing Company Ltd, IInd Edition 2008

Unit wise Measurable students Learning Outcomes:

1. Demonstrate knowledge of Information Theory
2. Explain basic concepts of communication channel and entropy coding.
3. Analyze the Linear block code error detecting and correcting capability.
4. Analyze the cyclic code error detecting and correcting capability.
5. Analyze the convolution code error detecting and correcting capability.
6. Analyze the BCH code error detecting and correcting capability.

Title of the Course: Mechatronics	L	T	P	Credit
Course Code: UETPE0712	3	-	-	3

Course Pre-Requisite: Sensors, Control system, Digital systems, Electrical machines

Course Description: Studying the mechatronics course is of importance due to the developments in Mechatronics systems, Industry 4.0 and automated manufacturing planning and controlling activities etc. The mechanical systems are becoming smart and for designing and developing such smart systems students must understand basic elements of smart systems such as sensors, actuators, process controllers, PLC and programs for automating the processes.

Course Objectives:

1. Study of different Mechanical operations & Processes.
2. To study different Actuators.
3. To study PLC & programming of PLC using standard tool.
4. To study CNC, NC machine's structure and design

Course Learning Outcomes: Upon successful completion of this course, the student will be able to

CO	After the completion of the course the student should be able to	Bloom's Cognitive Level	Bloom's Cognitive Descriptor
CO1	Select actuators according to need.	III	Applying
CO2	Compare different Process controllers to meet application requirement.	II	Understanding
CO3	Describe PLC and Design solutions for industrial automation problems using PLC programming instructions.	III	Describe
CO4	Illustrate different concept related to CNC and DNC machines and design.	II	Understanding

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	2	1	2	-	-	-	-	-	-	-	-	1	-
CO2	2	1	3	-	-	-	-	-	-	-	-	-	-
CO3	3	1	3	-	2	1	-	-	-	-	-	2	-
CO4	1	1	1	-	2	1	-	-	-	-	-	2	-

Assessments: Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.	
Course Contents:	
Unit 1: ---Introduction to mechatronics & MEMS sensors: What is mechatronics, design of process, systems, measurement of system, Control system, Programmable logic controllers, MEMS Sensors & applications.	7 Hrs.
Unit 2: ---Actuators and Mechanisms: Introduction, Actuator Types and Application Areas, Electro- mechanical Actuators, DC motor, AC motor, Piezoelectric Actuators, Chemical Actuator, Bearings, Gears.	7 Hrs.
Unit 3: ---Process Controllers: Controller Principles, two position controller (ON/OFF controller), Proportional controller, integral controller, Derivative controller, Pneumatic controllers, PID controller tuning.	8 Hrs.
Unit 4: --Programmable Logic Controllers: Introduction, Definition of PLC, PLC system and components of PLC input output module, PLC advantages and disadvantages, RS-232 serial interface, Block diagram for interfacing of PLC, Various Communication Protocols in PLC, interfacing PLC of IO cards to CPU.	8 Hrs.
Unit 5: ---Ladder diagram & PLC programming fundamentals Basic components and other symbols, Fundamentals of ladder diagram, PLC input instructions, outputs, coils, indicators, operational procedures, contact and coil input output, programming example, simple industrial applications, Nesting of ladders. PLC timer functions – Introduction, timer functions, industrial applications, industrial process timing applications, PLC control functions – PLC counters and its industrial applications.	8 Hrs.
Unit 6: --- Introduction to CNC machines and Design of Mechatronics system: CNC machines, NC machines, CNC machines, DNC machines, machine structure. Introduction, Mechatronics approach into design, Case Examples, Future Trends-smart homes.	7 Hrs.
Textbooks 1. Mechatronics", W. Bolton, Pearson Education, 4th Edition. 2. "Mechatronics principles, concept and application ", Mahalik, TATA McGraw Hill, 2nd edition 3. "Introduction to PLC Programming" NIIT. 4. Mechatronics Integrated mechanical electronic system, K.P Ramachandan, G.K Vijayaraghavan Willey India.	
References: 1. Programmable logical controller, Reis Webb, Prentice Hall 2. Mechatronics – Appu Kuttam, Oxford publications 3. Automated Manufacturing systems, S. Brain Morris, McGraw Hill 4. Programmable logical controller, Hackworth & Hackworth, Pearson Education 5. Programmable logical controller,3e Gary Dunning Cengage Learning	
Unit wise Measurable students Learning Outcomes: 1. Identification of key elements of mechatronics system and its representation in terms of	

block diagram

2. Interface at least 5 sensors & Actuators with controller.
3. Use different process controllers for minimum 3 applications.
4. Development of PLC ladder programming and implementation for simple applications.
5. Write difference in CNC, NC machines by visiting any industry.

Title of the Course: Multimedia Engineering Course Code: UETPE0713	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Digital Communication, Information coding & theory, Digital Signal Processing

Course Description: Course will cover all the multimedia data representation, efficient techniques for better bandwidth utilization & its hardware & software

Course Objectives:

1. To study the Multimedia information representations.
2. To study compression techniques for efficient utilization of bandwidth.
3. To understand multimedia hardware & software.

Course Learning Outcomes: Upon successful completion of this course, the student will be able to

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Distinguish between Text, image, audio and video representation and compression	IV	Analyzing
CO2	Explain different Audio, Video and Data compression technique	II	Understanding
CO3	Understand hardware and software requirements	II	Understand
CO4	Analyze audio, Video and animation formats	IV	Analyzing

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	3	-	1	-	2	-	-	-	-	-	-	-	-
CO2	-	1	-	2	-	-	-	-	-	-	-	-	-
CO3	2	-	2	-	2	2	-	-	-	-	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	-	-	-

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:	
Unit 1: --- Multimedia Information Representation Introduction, Digitization principles, Text, Images, Audio and Video, Global structure of Multimedia, Multimedia system and properties.	6 Hrs.
Unit 2: --- Text and Image Compression Introduction, Digital Image Representation, Image and graphics Format, Compression principles, text compression, image Compression	6 Hrs.
Unit 3: -- Audio and video compression Introduction, Audio compression, video compression, video compression principles, video compression.	7 Hrs.
Unit 4: --- Data **Compression** Storage Space, Coding Requirements, Source, Entropy and Hybrid Coding, Lossy Sequential DCT based Mode, Expanded Lossy DCT-based Mode, JPEG and MPEG	7 Hrs.
Unit 5: --- Multimedia Hardware and Software Understand analog and digital conversion process, Discuss the hardware requirement of multimedia system, classify multimedia software based on its function, Text and Graphics: text-related element in multimedia design, bitmap and vector graphic	8 Hrs.
Unit 6: --- Audio, Video and Animation Audio digitization, audio file format and audio software, digital video standards, basic principles behind animation and techniques, Multimedia Applications: Media preparation and composition, Media integration and communication, Media Entertainment	9 Hrs.
Textbooks: 1. Tay Vaughan, —Multimedia making it work‖, Tata McGraw-Hill, 2008. 2. Rajneesh Aggarwal & B. B Tiwari, Multimedia Systems, Excel Publication, New Delhi, 2007.	
References: 1. Parekh Ranjan, —Principles of Multimedia‖, Tata McGraw-Hill, 2007 2. Li & Drew, — Fundamentals of Multimedia‖ , Pearson Education, 2009.	

Title of the Course: Optical Fiber Communication Course Code: UETPE0714	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Semiconductor Physics, Fundamentals of Electromagnetic theory, Principles of Communication Systems

Course Description: To introduce the students to various optical fiber modes, configurations and various signal degradation factors associated with optical fiber and to study about various optical sources and optical detectors, SONET/SDH, WDM / DWDM and their use in the optical communication system. Fiber optical communication enables telecommunications networks to provide high bandwidth high speed data connections across countries and the globe. Optical fiber also offers low power loss, lost cost, lower attenuation, and greater security.

Course Objectives:

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
2. To understand the different kinds of losses, signal distortion in optical wave guides and other signal degradation factors
3. To learn the various optical source materials, LED structures, Laser diodes
4. To learn the fiber optical receivers, noise performance in photo detectors, receiver operation and configuration
5. To learn the fiber optical network components, variety of networking aspects, SONET/SDH and operational principles of WDM/DWDM.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Understand advantages, disadvantages and basics of optical communication System	II	Understanding
CO2	Compare different types of optical fibers, optical sources and detectors	II	Understanding
CO3	Calculate signal degradation in optical fibers	III	Calculate
CO4	Explain the optical receiver operation, WDM and optical network in detail	II	Understanding

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	1	1	2	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	-	1	-	-	-	-	-	-	2	2
CO4	1	1	-	-	1	-	-	-	-	-	-	2	2

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10

MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1: --- **INTRODUCTION OF OPTICAL FIBERS** The evolution of Optic System, Elements of Optical Fiber Transmission Link, optical spectral band, The nature of Light, Basic Optical Laws and Definitions, Single Mode Fibers, Graded Index fiber structures. Fiber Materials and fabrication methods.	7 Hrs.
Unit 2: --- **TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS** Attenuation, material absorption losses, scattering losses, bending losses, dispersion, polarization, nonlinear effects.	7 Hrs.
Unit 3: --- **OPTICAL SOURCES** Light source materials - LED -Structure - Quantum efficiency -Modulation. Laser Diode - Modes and threshold condition - Structures and Radiation Pattern. Light Source Linearity, Modal, Partition and Reflection Noise, Reliability considerations.	8 Hrs.
Unit 4: --- **OPTICAL DETECTORS AND RECEIVERS** Physical Principal of Photodiodes, Photodetector Noise, Detectors Response Time, Avalanche Multiplication Noise, Structure for InGaAs APDs, Temperature effect of Avalanche Gain, Comparison of Photodetectors, Fundamental Receiver Operation, Digital Receiver Performance	7 Hrs.
Unit 5: --- **WDM CONCEPTS AND COMPONENTS** Operational Principles of WDM, couplers, Isolators, Circulators, Fabry Perot Filters, Mach-Zehnder Interferometer, tunable filters and sources	8 Hrs.
Unit 6: --- **OPTICAL NETWORKS** Basic Network, SONET/SDH: - Optical specifications - SONET frame structure – SONET layers - SONET/SDH networks. Operational principles of WDM - Broadcast and Select WDM networks - Single hop networks - Wavelength routed networks - Performance of WDM+EDFA Systems, FFTH Network, Li-Fi Technology	8 Hrs.

Textbooks:

1. Gerd Keiser, Optical Fiber Communication, 5thEdition, McGraw Hill Education (India) Private Limited.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3 Edition, Pearson Education, 2010.
3. S. E. Miller and I. P. Kaminow, eds., Optical fiber Telecommunications- II, Academic, New York.
4. Rajeev Ramaswamy and Kumar N Sivarajan, "Optical Networks: A Practical Perspective", 2nd Ed., 2004, Elsevier Morgan Kaufmann Publishers (An imprint of Elsevier).

References:

1. Harold Kolimbris, "Fiber Optic Communication", 2nd Ed, 2004, PEI
2. Uyless Black, "Optical Networks: Third Generation Transport Systems", 2nd Ed, 2009, PEI
3. Govind Agarwal, "Optical Fiber Communications", 2nd Ed, 2004, TMH.
4. S. C. Gupta, "Optical Fiber Communications and its Applications", 2004, PHI
5. P.E Green, "Optical Networks" Prentice Hall.
6. C.S.Murthy & M. Gurusamy, "WDM Optical Networks", Prentice Hall (India).

Unit wise Measurable students Learning Outcomes:

ULO1: : To understand the nature of light and its propagation in fiber cables and also about different types of optical fibers, fiber materials and fabrication methods

ULO2: To understand the different kinds of losses, signal distortion in optical wave guides and other signal degradation factors.

ULO3: To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes structures noises, linearity and reliability of sources

ULO4: To understand different structures, working and properties of photo detectors.

ULO5: To learn the fiber optical receivers, noise performance, receiver operation and configuration

ULO6: To learn, the basic optical network and also different types of network topologies, WDM and configuration

Title of the Course: Digital TV and Multimedia Course Code: UETPE0715	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Basic knowledge of digital electronics, signals & systems, and communication fundamentals.

Course Description: This course introduces the fundamentals of Digital Television and Multimedia systems. It covers TV signal generation, transmission standards, digital broadcasting, video compression, audio coding, MPEG systems, and multimedia technologies. Students will understand the evolution of TV, digital video processing, and real-world multimedia applications.

Course Objectives: The course aims to: ----

1. Provide foundational understanding of digital TV systems and broadcasting standards.
2. Introduce digital video/audio formats, compression techniques, and multimedia frameworks.
3. Develop ability to analyze and design basic multimedia solutions.
4. Enable learning of modern DTV technologies such as HDTV, IPTV, and streaming platforms.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Describe principles of analog and digital TV systems and broadcasting.	II	Describe
CO2	Explain video and audio compression techniques used in multimedia systems.	II	Understanding
CO3	Analyze multimedia container formats and streaming architectures.	IV	Analyzing
CO4	Apply concepts of digital TV and multimedia to basic system design or evaluation	III	Applying
CO5	Demonstrate understanding of modern DTV standards like HDTV, IPTV, and DTH.	II	Understanding

CO-PO Mapping:

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

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE),One Mid Semester Examination(MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE1	10
MSE	30

ISE2	10
ESE	50

ISE1 and ISE2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:	**Hrs.**
Unit 1: --- Introduction to Television Systems, Evolution from analog TV to digital TV, Scanning, interlacing, aspect ratio, Composite video signal, Digital video basics (pixels, frames, resolution, color models: RGB, YUV), Overview of SDTV, HDTV, UHDTV	8 Hrs
Unit 2 Digital TV Broadcasting S tandards, DVB-T/T2, DVB-S/S2, DVB-C, DTH and digital cable TV, ATSC and ISDB standards, Conditional Access Systems (CAS), Set-top box architecture: tuner, demodulator, decoder	8 Hrs
Unit 3: -- Video Compression Techniques, Need for compression, Lossy vs lossless compression, Basics: DCT, quantization, motion estimation, JPEG, MPEG-1, MPEG-2, Modern codecs: H.264/AVC, H.265/HEVC (intro only)	7 Hrs
Unit 4: --- Audio Compression & Multimedia Systems, Digital audio basics: sampling, quantization, channels, MP3, AAC, Dolby Digital (AC-3), Containers: MP4, AVI, MKV, TS,Streaming concepts: buffering, RTP/RTSP, DASH, HLS	7 Hrs
Unit 5: ---: Digital TV Architectures & IPTV, IPTV vs OTT vs DTH, Middleware & Electronic Program Guide (EPG), Smart TV components, CDN basics, Security: DRM, watermarking	6 Hrs
Unit 6: --- Multimedia Applications & Trends, Video conferencing systems, Multimedia in mobile and web platforms, AR/VR multimedia basics, Future trends: 8K, immersive media, cloud gaming	6 Hrs

Textbooks:

1. R. R. Gulati, “Modern Television Practice – Principles, Technology & Service”, New Age International Publishers.
2. K. R. Rao, Z. S. Bojkovic & D. A. Milovanovic, “Introduction to Multimedia Communications”, Wiley.

References:

1. Poynton, “Digital Video and HD: Algorithms and Interfaces”, Morgan Kaufmann.
2. T. Sikora, “MPEG Digital Video Coding Standards” (Open-access book & papers).
3. K. Sayood, “Introduction to Data Compression”, Morgan Kaufmann.
4. Pete Diston, “Digital TV and IPTV”

Unit wise Measurable Students Learning Outcomes:

1. Understand analog and digital TV fundamentals.
2. Explain broadcasting standards and digital TV technologies.
3. Apply video and audio compression concepts to real scenarios.
4. Analyze multimedia formats and streaming systems.
5. Describe modern IPTV, DTH, and OTT platforms.

Title of the Course: Digital Image Processing Course Code: UETPE0811	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Basic knowledge of signals and systems, Fundamentals of linear algebra and calculus, Understanding of sampling theory, Basics of programming (MATLAB/Python), Fundamentals of image formation and optics

Course Description: This course provides a comprehensive introduction to the principles and techniques of digital image processing. Students will learn about digital image representation, enhancement, filtering, segmentation, and compression methods.

Course Objectives:

The course aims to:

CO1: To understand the fundamental concepts of digital image representation, sensing, Sampling, and quantization.

CO2: To learn and apply various image enhancement techniques in spatial and frequency domains.

CO3: To study filtering, restoration, and morphological operations for image analysis.

CO4: To understand segmentation and compression methods used in digital imaging applications.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Explain image representation, sampling, quantization, and basic pixel relationships.	Understanding (II)	Explain
CO2	Apply image enhancement techniques for quality improvement.	Understanding (III)	Appling
CO3	Use of morphological operations for shape and structural assessment.	Evaluating (V)	Assess
CO4	Analyze image segmentation techniques to extract features.	Applying (IV)	Analyze

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	2	-	2	-	-	-	-	-	2	-	1	1	-
CO2	1	2	-	2	-	-	-	-	2	-	1	1	-
CO3	-	2	-	2	-	-	-	-	2	-	1	1	-
CO4	-	2	-	-	-	-	-	-	2	-	1	1	-

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1: --- Digital Image Fundamentals Fundamental steps in DIP, Components of image processing system, Elements of visual perception, Image sensing and acquisition, Image sampling and quantization, Basic relations between pixels.	7 Hrs
Unit 2: --- Image Enhancement Basic intensity transformation: image negation, log transformation, power law transformation, Piecewise linear transformation functions, Arithmetic and logic operations, Histogram processing (equalization and matching), Sine, cosine, Hadamard, Haar, Slant transforms.	7 Hrs
Unit 3: --- Image Filtering Fundamentals of spatial filtering, Smoothing and sharpening in spatial domain, Smoothing and sharpening in frequency domain, Image restoration: introduction to degradation and restoration, Image degradation model, Types of noise and blur	7 Hrs
Unit 4: --- Image Segmentation Detection of discontinuities: point, line, and edge detection (Sobel, Prewitt, Laplacian), Thresholding: global and local techniques, Region-based segmentation: region growing, region splitting and merging	7 Hrs
Unit 5: --- Morphological Image Processing Dilation & erosion, Opening and closing operation, Hit-or-miss transformation, Basic algorithms: boundary extraction, region filling, thinning, thickening, skeletons.	7 Hrs
Unit 6: --- Image Compression Fundamentals:Coding redundancy, interpixel redundancy, Fidelity criteria, Image compression model, Lossless and lossy predictive coding, Color image processing: color fundamentals and models	7 Hrs

Textbooks:

- Digital Image Processing – Rafael C. Gonzalez, Richard E. Woods
- Digital Image Processing Using MATLAB – Rafael C. Gonzalez, Richard E. Woods

References:

- Fundamentals of Digital Image Processing – Anil K. Jain
- Computer Vision: Algorithms and Applications – Richard Szeliski

• Image Processing, Analysis, and Machine Vision – Milan Sonka, Vaclav Hlavac, Roger Boyle
Unit wise Measurable students Learning Outcomes: After the completion of the course the student should be able to • Understand image formation, sampling, and quantization. • Apply enhancement techniques using transformations and histogram methods. • Implement spatial and frequency-domain filtering. • Apply morphological operators for shape analysis. • Detect edges, lines, and points using different operators. • Explain redundancy concepts and compression techniques.

Title of the Course: Cyber Security Course Code: UETPE0812	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Basic knowledge of computer networks, operating systems, and internet usage.

Course Description:

This course introduces core concepts of cyber security, threats, vulnerabilities, network security mechanisms, cryptography fundamentals, application security, and best practices used to secure digital systems. Students will learn common attack techniques, defense strategies, authentication, malware, firewalls, intrusion detection, and modern security domains such as cloud and IoT security.

The course aims to:

1. Provide foundational understanding of cybersecurity principles, terminology, and threat landscape.
2. Familiarize students with network security mechanisms, authentication, and cryptographic techniques.
3. Introduce common cyber-attacks and corresponding defensive measures.
4. Develop awareness of system hardening, secure communication, and emerging cyber security technologies.

Course Learning Outcomes:

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

CO	After the completion of the course the student should be able to	Bloom's Taxonomy	
		level	Descriptor
CO1	Describe cybersecurity concepts, threats, and vulnerabilities.	II	Understanding
CO2	Explain security mechanisms such as authentication access control and firewalls.	II	Understanding
CO3	Analyze cyber-attacks, malware behavior, and security risks.	IV	Analyzing
CO4	Apply basic cryptography techniques and security controls to protect information.	III	Applying

CO-PO Mapping:

CO	PO												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**PSO 1**	**PSO2**
CO1	2	1	-	-	-	-	-	-	-	1	-		1
CO2	2	2	-	1	-	-	-	-	-	1	-		1
CO3	-	3	-	2	-	-	-	-	-	2	-		1
CO4	2	2	1	-	-	-	-	-	1	1	-		

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:	**Hr.**
UNIT I: Introduction to Cyber Security Introduction to Cyber Security, What is Cyber Security? Need and scope, Security goals: Confidentiality, Integrity, Availability (CIA triad), Security threats: phishing, spoofing, ransomware, DoS, social engineering, Vulnerabilities and exploits, Concept of risk, attack surface, zero-day vulnerabilities, Cyber security domains overview	6

UNIT II : Access Control Authentication, Authorization, and Access Control, Password-based and multifactor authentication, Hashing & salting of passwords, Identity and Access Management (IAM), DAC, MAC, RBAC access models, SSO, OAuth, OpenID, Session management & secure login	6
UNIT III: N/WSecurity Network Security Fundamentals, Sniffing, ARP poisoning, MITM attacks, Firewalls: packet filtering, proxy, stateful inspection, IDS/IPS concepts, VPN fundamentals, Wireless security: WPA2/WPA3, rogue AP, Network monitoring (Wireshark basics)	6
UNIT IV: Cryptography Cryptography Basics, Symmetric encryption: AES, DES basics, Asymmetric encryption: RSA basics, Hashing algorithms: SHA family, Digital signatures, Public Key Infrastructure (PKI), SSL/TLS overview	6

UNIT V: Threats to Cyber Security Malware, Attacks, and Security Controls, Types of malware: virus, worm, trojan, spyware, ransomware, Malware delivery mechanisms, Vulnerability scanning basics: Nmap, OpenVAS, System hardening principles, Antivirus, endpoint security, sandboxing, Incident response basics	6
UNIT VI: Mobile Data Networks Advanced Topics and Modern Security Trends, Cloud security basics, IoT Security vulnerabilities, Web security: SQL injection, XSS, CSRF, Mobile security fundamentals, Blockchain basics, Cyber laws in India	**5**
TEXTBOOKS: • William Stallings, "Cryptography and Network Security", Pearson. • Mark Stamp, "Information Security: Principles and Practice", Wiley. • Eric Maiwald, "Fundamentals of Network Security", McGraw Hill.	
REFERENCE BOOKS: Dafydd Stuttard & Marcus Pinto, "The Web Application Hacker's Handbook". • Matt Bishop, "Computer Security: Art and Science". • Richard Bejtlich, "The Practice of Network Security Monitoring".	

Title of the Course: CMOS VLSI Course Code: UETPE0813	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Student should have knowledge of Basics of Transistors, FET, MOSFET, and Principles of Digital Design.

Course Description: This course gives an introduction to CMOS VLSI Design aspects, Circuit formations, Problems and Advantages associated with CMOS.

Course Objectives: The course aims to: ----

1. To understand the Basics of CMOS technologies.
2. To introduce the concepts CMOS and its Variants.
3. To Understand construction of different circuits, subsystems using CMOS Technology

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Explain the CMOS technologies	II	Understanding
CO2	Illustrate different parameters in CMOS design	II	Understanding
CO3	Design and Test CMOS circuits using different Strategies	VI	Creating
CO4	Design subsystems using CMOS.	VI	Creating

CO-PO Mapping:

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

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), Mid Semester Examination(MSE) and End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE1	10
MSE	30
ISE2	10
ESE	50

ISE1 and ISE2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents: **Hrs.**

Unit1: ---INTRODUCTION: Introduction to of COMS VLSI Technologies. Circuit and System Representations, MOS Device Design Equations, The Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters, The Differential Inverter, The Transmission Gate, The Tri State Inverter, Bipolar Devices.	5 Hrs
Unit 2: CIRCUIT CHARACTERISATION AND PERFORMANCE ESTIMATION: Introduction, Resistance Estimation Capacitance Estimation, Inductance, Switching Characteristics, CMOS-Gate Transistor Sizing, Power Dissipation, Sizing Routing Conductors, Charge Sharing, Design Margining, Reliability.	8 Hrs
Unit 3: -- CMOS CIRCUIT AND LOGIC DESIGN: CMOS Logic Gate Design, Basic Physical Design of Simple Gate, CMOS Logic Structures, Clocking Strategies, I/O Structures, Low Power Design gate logic.	5 Hrs
Unit 4: --- SYSTEM DESIGN AND DESIGN METHOD: Design Strategies CMOS Chip Design Options, Design Methods, Design Capture Tools, Design Verification Tools, Design Economics, Data Sheets.	8 Hrs
Unit 5: ---: TESTING: CMOS Testing - Manufacturing Test Principles, Design Strategies for Test, Chip Level Test Techniques, System Level Test Techniques, Layout Design for Improved Testability.	4 Hrs
Unit 6: --- CMOS SUB SYSTEM DESIGN: Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements, Control-FSM, Control Logic Implementation.	6 Hrs

Textbooks:

1.Weste and Kamran Eshraghian, **" Principles of CMOS VLSI Design "**, Addision Wesley, II nd edition .

References:

1. John P . Uyemura " Introduction to VLSI Circuits and Systems", Wiley IndiaEdition

2. Jacob Backer, Harry W. Li and David E. Boyce, " CMOS Circuit Design, Layout and Simulation ", Prentice Hall of India, 1998.

Unit wise Measurable Students Learning Outcomes:

1. Student would be able to explain the structure of CMOS basic digital circuits.
2. Student would be able to explain characterization of CMOS and different performance measures.
3. Student would be able to design basic logic circuits in CMOS.
4. Student would be able to identify different tools required for CMOS design.
5. Student would be able to explain different testing techniques for CMOS.
6. Student would be able to design different subsystems using CMOS.

Title of the Course: Real Time Systems Course Code: UETPE0814	L 3	T 0	P 0	Credit 3

Course Pre-Requisite: Fundamentals of Commuter systems, Microcontroller architecture and programming

Course Description:

To introduce students to the fundamental problems, concepts, and approaches in the design and analysis of real-time systems. To study issues related to the design and analysis of systems with real-time constraints. The problem of ensuring such constraints is ultimately a scheduling problem, so much attention is devoted to such problems**.**

Course Objectives:

1. Real-time scheduling and schedulability analysis
2. Formal specification and verification of timing constraints and properties
3. Design methods for real-time systems
4. Development and implementation of new techniques to advance the state-of-the-art real-time systems research

Course Learning Outcomes:

1. Student is able to explain basic concepts of Real time system, characteristics of languages, different database scheduling algorithms.
2. Student is able to create a schedule for a given task set-in Real-Time System
3. Student is able to analyze different communication algorithms.
4. Student is able to identify the different Evaluation Techniques of Real time systems.

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Explain basic concepts of Real time system, characteristics of languages, different database scheduling algorithms.	II	Understanding
CO2	create a schedule for a given task set-in Real-Time System	III	Applying
CO3	Analyze different communication algorithms.	IV	Analyzing
CO4	identify the different Evaluation Techniques of Real time systems.	III	Applying

CO-PO Mapping:

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

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit I:- Introduction Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.	7 Hrs.
Unit 2:- Real Time Scheduling Common Approaches to Real Time Scheduling: Clock Driven Approach, weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.	8 Hrs.
Unit 3:- Programming Languages and Tools Desired languages characteristics, data typing, control structures, facilitating hierarchical decomposition, packages, run time errors handling, overloading and generics, multitasking, low programming, task scheduling, timing specification, some experimental languages, programming environments, run time support.	7 Hrs.
Unit 4: Real Time Databases Basic definitions, real time vs general purpose databases, main memory databases, transaction priorities, transaction aborts, concurrency control issues, disk scheduling algorithms, a two-phase approach to improve predictability, maintaining serialization consistency, database for hard real time systems.	8 Hrs.
Unit 5: Fault Tolerance Techniques Fault types, fault detection, fault and error containment, redundancy, Data diversity, Reversal checks, malicious or Byzantine failures, Integrated failure handling, Integrated failure handling.	7 Hrs.

Unit 6: Reliability Evaluation Techniques Reliability models for hardware redundancy, software error models, taking time into account. Clock Synchronization: Clock, non-fault tolerant, synchronization algorithm, impact of faults, fault tolerant, synchronization in hardware, synchronization in software, **Case study.**	7 Hrs.

Textbooks:

1. Real Time Systems – By C. M. Krishna, Kang G. Shin (McGraw Hill International Edn.)
2. Real Time Systems – By Jane W. S. Liu, (Pearson Education Asia, 2001).

References:

1. Giorgio C. Buttazzo , "Hard real-time computing systems: predictable scheduling algorithms and applications" , Springer, 2008.
2. C. Siva Ram Murthy, G. Manimaran, "Resource management in real-time systems and networks", PHI, 2009.

Unit wise Measurable students Learning Outcomes:

Students will be able

1. To understand characteristics of Real time systems
2. To understand the basics of tasks and scheduling
3. To understand programming languages and databases
4. To analyze real time communication
5. To analyze evaluation techniques and reliability models for Hardware Redundancy
6. To understand clock synchronization

Title of the Course: System on Chip	L	T	P	Credit
Course Code: UETPE0815	3	-	-	3

Course Pre-Requisite:

Students should possess a foundational understanding of the following areas:

Digital Logic Design: Proficiency in combinational and sequential logic circuits, finite state machines (FSMs), and timing analysis.

Computer Organization and Architecture: Knowledge of CPU components (ALU, registers, control units), instruction set architectures (ISA), and memory hierarchies.

Microprocessors and Microcontrollers: Understanding of interrupt handling, I/O interfacing, and peripheral management (UART, SPI, I2C).

Hardware Description Languages (HDL): Familiarity with Verilog or VHDL syntax for modeling digital systems at the Register Transfer Level (RTL).

Embedded C Programming: Basic ability to write low-level code and understand how software interacts with hardware registers.

Course Description:

This course provides a theoretical foundation in architecture, integration, and verification of complex System on Chip (SoC) designs using hardware-software co-design principles.

Students examine the evolution of platform-based design, focusing on the architectural requirements for integrating processors, memory, and analog Intellectual Property (IP) cores.

The curriculum details standardized on-chip communication frameworks, such as AMBA and Network-on-Chip (NoC), alongside industry standards for low-power and secure hardware.

Theoretical modules explore High-Level Synthesis (HLS) algorithms and system-level performance modeling to optimize power, performance, and area (PPA) tradeoffs.

The course concludes with an in-depth study of formal verification methodologies and Design-for-Test (DFT) strategies essential for ensuring silicon reliability and manufacturability.

Course Objectives:

1. To study and understand SoC design methodologies and hardware–software co-design principles
2. To develop an approach to Analyze processor architectures and embedded software interfaces, including ARM/RISC-V cores,
3. To study on-chip communication, memory, and peripheral subsystems.
4. To study Apply verification, testing, security, and prototyping technique.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's level	Bloom's Descriptor
CO1	Analyze hardware-software tradeoffs for optimal power performance and area.	IV	Analyze
CO2	Understand standardize on-chip interconnects like AMBA for efficient IP core communication.	II	Understanding
CO3	Integrate processor, memory, and peripheral IP blocks into a unified system architecture.	V	Evaluate
CO4	Understand co-verification and Design-for-Test methodologies for system functionality and manufacturability	I	Understanding

CO-PO Mapping:

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

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 60-70% Weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1: --- Introduction to SoC Design & Methodology Concepts: Evolution of ASIC technology; Platform-based SoC design; Multiprocessor SoC (MPSoC). Methodology: Hardware/Software Co-design flow; Design reuse and Intellectual Property (IP) libraries. Tradeoffs: System performance metrics (Power, Performance, Area); Low-power design perspectives.	**6Hrs.**
Unit 2:--- Processor Core Architecture Architecture Details: Micro-architectural components of ARM Cortex-M or RISC-V cores; Nested Vectored Interrupt Controller (NVIC). Instruction Sets: Programming with C and Assembly for embedded cores; Arm CMSIS (Cortex Microcontroller Software Interface Standard). Software Interface: Writing software drivers for peripherals; Bootloading sequences.	**8Hrs.**
Unit 3:-- Interconnects & On-Chip Communication Bus Standards: AMBA bus architectures (AHB, APB, AXI); AHB-Lite bus principles; Address decoding and multiplexing. Network-on-Chip (NoC): Topologies (Mesh, Torus, Ring); Routing algorithms and flow control; NoC switch/router architecture.	**5Hrs.**

Synthesis: Communication synthesis and separation of communication from computation.	
Unit 4: --- Memory & Analog-Mixed Signal Integration Embedded Memory: Cache organization; Design methodology for SRAM and Flash; Virtual-to-physical memory mapping. Analog IP: Integration of A-to-D converters (ADCs), Phase-Locked Loops (PLLs), and oscillators.	**5Hrs.**
Unit 5: --- I/O Integaraton and Design Validation I/O Interfacing: GPIO, UART, SPI, and I2C peripheral design and integration. Validation: Co-specification and co-simulation; Virtual platform prototyping; Hardware/Software co-verification.	**6Hrs.**
Unit 6: --- SOC FPGA Architecture Architecture of Zynq™-7000 series , Versal AI Edge XA Series	**7Hrs.**
Textbooks: 1. Computer System Design: System-on-Chip by Michael J. Flynn and Wayne Luk. 2. ARM System on Chip Architecture by Steve Furber. 3. On-Chip Communication Architectures by S. Pasricha and N. Dutt.	
References: 1. Digital Integrated Circuits: A Design Perspective by Jan M. Rabaey. 2. System-on-a-Chip: Design and Testby Rochit Rajsuman. 3. Advanced Digital System Design using SoC FPGAs by Ross K. Snider.	
Unit wise Measurable students Learning Outcomes: Unit 1: Introduction to SoC Design & Methodology U1-LO1: Explain the evolution of ASIC technology, platform-based SoC design, and MPSoC concepts. *(Bloom's: Understand)* U1-LO2: Analyze and evaluate hardware–software co-design flow and power–performance–area (PPA) trade-offs in SoC design. *(Analyze / Evaluate)* --- Unit 2: Processor Core Architecture U2-LO1: Describe the micro-architectural components of ARM Cortex-M / RISC-V cores and NVIC operation. *(Understand)* U2-LO2: Develop and debug embedded programs and peripheral drivers using C/Assembly and CMSIS libraries. *(Apply / Analyze)* --- Unit 3: Interconnects & On-Chip Communication U3-LO1: Explain AMBA bus architectures and address decoding mechanisms. *(Understand)* U3-LO2: Design and analyze on-chip interconnects and NoC architectures for efficient communication. *(Apply / Analyze)* --- Unit 4: Memory & Analog-Mixed Signal Integration U4-LO1: Analyze cache organization and memory mapping techniques in embedded systems. *(Analyze)* U4-LO2: Integrate and implement embedded memory, analog IP, and peripheral interfaces in a SoC platform. *(Apply / Analyze)* ---	

Unit 5: Design Validation & Testing
U5-LO1: Apply co-simulation and virtual prototyping techniques for SoC validation. *(Apply)*
U5-LO2: Develop and evaluate test strategies using DFT, BIST, and hardware security mechanisms. *(Create / Evaluate)*

Unit 6: FPGA Prototyping & High-Level Synthesis
U6-LO1: Convert C-based designs into RTL using High-Level Synthesis tools. *(Apply)*
U6-LO2: Implement and evaluate SoC designs on FPGA platforms for performance and resource optimization. *(Apply / Evaluate)*

Title of the Course: Cryptography and Network Security Course Code: UETPE0817	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Basic knowledge of computer networks, discrete mathematics, operating systems, fundamentals of programming (C/C++/Python).

Course Description:
This course provides foundational knowledge of cryptography and network security principles. Students will study classical and modern encryption techniques, key management, authentication, network threats, and security mechanisms used in modern communication systems.

The course aims to:

1. Understand basic cryptographic concepts and classical encryption methods.
2. Learn symmetric and asymmetric key cryptography and key management techniques.
3. Understand network security services, protocols, and authentication mechanisms.
4. Analyze network attacks and apply security solutions for secure communication

Course Learning Outcomes:
Upon successful completion of this course, a student will be able to:

CO	After the completion of the course the student should be able to	Bloom's Taxonomy	
		level	Descriptor
CO1	Explain basic cryptography concepts and classical ciphers	II	Understanding
CO2	Apply symmetric and asymmetric encryption techniques	III	Apply
CO3	Use authentication and hash functions for secure communication	V	Apply
CO4	Analyse security threats and propose protection mechanisms	IV	Analyse

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	2	-	2	-	-	-	-	-	2	-	1	1	1
CO2	1	2	-	2	-	-	-	-	2	-	1	1	1
CO3	-	2	-	2	-	-	-	-	2	-	1	1	1
CO4	-	2	-	-	-	-	-	-	2	-	1	1	1

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:	**Hr.**
Unit 1: Introduction to Cryptography and Classical Cipher Concepts of cryptography, security goals, CIA triad, Attacks and services, Classical ciphers: Caesar, Monoalphabetic, Playfair, Hill cipher, Vigenère cipher, Transposition techniques	**07**
Unit 2: Symmetric Key Cryptography Block ciphers, Feistel structure, DES, AES: structure and rounds, Modes of operation (ECB, CBC, CFB, OFB, CTR), Key distribution and management.	**7**
Unit 3: Public Key Cryptography Introduction to number theory (modular arithmetic, prime numbers), RSA algorithm, Diffie–Hellman Key Exchange, Elliptic Curve Cryptography (basics), Digital signatures	**7**
Unit 4: Hash Functions and Authentication Message authentication requirements, MAC, Hash functions: MD5, SHA-1, SHA-256, HMAC, Digital certificates, PKI	**7**
Unit 5: Network Security Network security protocols: SSL/TLS, HTTPS, IPSec, Firewalls, IDS/IPS, Email security: PGP, S/MIME	**7**
Unit 6: Security Threats and Countermeasures Types of attacks: DoS, SQL Injection, Malware (virus, worm, Trojan), Phishing, Spoofing, Security policies and mechanisms	**7**

TEXT BOOKS:

- William Stallings – Cryptography and Network Security (PDF available)
- Behrouz A. Forouzan – Cryptography and Network Security (PDF available)

REFERENCE BOOKS:

Applied Cryptography – Bruce Schneier.

- Network Security Essentials – William Stallings.
- Introduction to Modern Cryptography – Katz & Lindell.

Unit wise Measurable Students Learning Outcomes:

After the completion of the course the student should be able to:

- Understand classical and modern cryptographic techniques.
- Apply symmetric and asymmetric cryptography.
- Implement authentication and hashing mechanisms.
- Analyse threats and propose suitable security measures.
- Explain network security protocols and applications.
- Understand key distribution and certificate management.

Title of the Course: Machine Learning Course Code: UETPE0818	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Fundamental knowledge of AI, linear algebra, probability & statistics, and algorithm**.**

Course Description: This course provides a comprehensive introduction to the field of Machine Learning (ML), a critical sub-domain of Artificial Intelligence (AI) focused on developing statistical algorithms that enable computers to learn from data and improve performance on specific tasks without being explicitly programmed. The course covers the foundational theory and practical implementation of the most common ML paradigms.

Course Objectives:

1. To introduce the basic building blocks and general principles of machine learning techniques.
2. To impart adequate knowledge about modelling and performance evaluation of machine learning algorithms.
3. To understand the concepts of supervised, unsupervised, and reinforcement learning methods.
4. To construct programs in Python to solve machine learning algorithms.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Explain the fundamentals of machine learning.	II	Understanding
CO2	To familiarize with Python programming language.	II	Understanding
CO3	To learn common unsupervised machine learning approaches.	III	Applying
CO4	To learn common supervised machine learning approaches.	III	Applying
CO5	Illustrate reinforcement learning.	IV	Analyzing

CO-PO Mapping:

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

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE),One Mid Semester Examination(MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE1	10
MSE	30
ISE2	10

ESE	50

ISE1 and ISE2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:	**Hrs.**
Unit 1: ---Basics of Machine Learning Types of learning, common aspects of machine learning approach: model, parameters, Bias Variance. Test, train and validation datasets, error function. Curse of dimensionality Predictive analysis using regression.	8
Unit 2: --- Basics of Python Fundamental Data Types in Python, Looping and Decision-making constructs, functions, classes, file handling, database access, output formatting, classes, modules, statistics module, numpy, introduction to popular machine learning libraries Tensor Flow &Keras.	8
Unit 3: --Unsupervised Learning Clustering, K-means, GMM & EM Algorithm. Eigen values and Eigen vectors, PCA – unsupervised dimensionality reduction technique.	8
Unit 4: --- Supervised Learning Classification: KNN, Bayes, Decision Tree. SVM: soft and hard margin, kernel trick. LDA – supervised dimensionality reduction technique.	8
Unit 5: --- Reinforcement Learning Bagging, Random Forest and Boosting. Q-learning and SARSA algorithm.	8

Textbooks:

1. Tom, Mitchell, "*Machine Learning*", McGraw-Hill, 2017.
2. Shai, Shalev-Shwartz, Shai, Ben-David, "Understanding Machine Learning from Theory to Algorithms", Cambridge University Press, 2014.

References:

1. Ethem, Alpaydin, "*Introduction to Machine Learning*", PHI, 2005.
2. Bishop, Christopher, "*Pattern Recognition and Machine Learning*", Springer, 2006.
3 Duda, R.O., Hart, P.E. and Stork, D.G., "*Pattern Classification*", Wiley-Interscience, 2nd Edition November, 2000.

Unit wise Measurable Students Learning Outcomes:

1. Students will explain ML types, dataset splits, bias–variance, dimensionality issues, and perform basic regression.
2. Students will write Python programs using core concepts, libraries, and ML-related modules.
3. Students will apply clustering techniques and perform PCA-based dimensionality reduction.
4. Students will implement supervised classification methods and use LDA for dimensionality reduction.
5. Students will use ensemble learning methods and implement Q-learning and SARSA algorithms.

Title of the Course: Database Security & Access Control Course Code: UETMM0741	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Basic knowledge of Database Management Systems, Networking fundamentals, and Operating Systems.

Course Description:
This course introduces database security concepts, access control mechanisms, encryption techniques, and administrative policies required to protect modern database systems.

The course aims to:

1, To understand fundamental concepts of database security.

2. To study access control models and mechanisms.

3. To explore encryption, auditing, and secure transaction management.

4. To understand security issues in SQL, NoSQL and distributed databases.

Course Learning Outcomes:
Upon successful completion of this course, a student will be able to:

CO	After the completion of the course the student should be able to	Bloom's Taxonomy	
		level	Descriptor
CO1	Explain basic concepts of database security and vulnerabilities	II	Understanding
CO2	Apply access control models and policies	III	Applying
CO3	Analyze encryption, auditing, and secure transaction management	IV	Analyzing
CO4	Describe security issues in SQL, NoSQL and distributed databases	II	Understanding

Assessments:
Teacher Assessment:
One component of End Semester Examination (ESE) has 100% weights.

Assessment	Marks
ESE	100

Course Contents: **Unit 1: Introduction to Database Security** Threats to databases, CIA triad, vulnerabilities, attack surfaces, security models, DBMS security architecture.	8
Unit 2: Access Control & Authorization Discretionary Access Control (DAC), Mandatory Access Control (MAC), Role-based Access Control (RBAC), policies, privileges, SQL GRANT/REVOKE.	8
Unit 3: Database Encryption & Auditing Database encryption types, key management, Transparent Data Encryption, hashing, auditing mechanisms, log analysis.	7
Unit 4: Secure Transaction Management Concurrency control security, SQL injection prevention, secure stored procedures, triggers, anomaly detection.	7
Unit 5: NoSQL & Distributed Database Security NoSQL security challenges, CAP theorem implications, distributed access control, replication security.	7
Unit 6: Administrative Policies & Best Practices Backup & recovery security, patch management, secure configuration, compliance standards (GDPR/ISO 27001).	5
TEXTBOOKS: 1. Database Security and Auditing: Protecting Data Integrity and Accessibility *Author:* Hassan A. Afyouni, Cengage Learning. 2. Database System Concepts *Authors:* Silberschatz, Korth, Sudarshan – McGraw Hill. 3. Information Security: Principles and Practice *Author:* Mark Stamp – Wiley.	

REFERENCE BOOKS:

1. Database Security
   Author: Alfred Basta & Melissa Zgola – Cengage.
2. SQL Injection Attacks and Defense
   Authors: Justin Clarke et al. – Syngress.
3. Principles of Information Security
   Authors: Michael Whitman & Herbert Mattord – Cengage.
4. NoSQL Security: A Comprehensive Guide
   Author: K. A. Morris – Auerbach Publications.
5. Computer Security: Art and Science.
   Author: Matt Bishop – Addison Wesley.

Title of the Course: Pattern Recognition & Computer Vision	L	T	P	Credit
Course Code: UETMM0742	3	-	-	3

Course Pre-Requisite: Signal processing, Digital Image Processing, Probability Theory

Course Description: The course covers feature extraction techniques and representation of patterns in feature space. Measure of similarity between two patterns. Statistical, nonparametric and neural network techniques for pattern recognition have been discussed in this course. Techniques for recognition of time varying patterns have also been covered.

Course Objectives:

The course aims to:

1. Introduce the fundamental concepts of image formation and computer vision.
2. Understanding feature detection, matching, and image alignment techniques.
3. Understand different feature extraction and selection algorithms to optimize pattern representation.
4. Develop knowledge of statistical, non-parametric, and neural network-based pattern recognition methods.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Explain the fundamental concepts of image formation and the goals of computer vision.	II	Understand
CO2	Apply feature detection and matching techniques (SIFT, SURF) for applications like image stitching and alignment.	III	Applying
CO3	Analyze feature selection algorithms (Branch and Bound, SFS/SBS) to solve dimensionality problems in pattern recognition.	IV	Analyzing
CO4	Evaluate various supervised and unsupervised classification algorithms (Bayesian, SVM, k-NN) for object and pattern recognition tasks.	IV	Evaluating

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	2
CO2	2	3	2	2	2	-	-	-	-	-	-	1	2
CO3	2	3	2	2	-	-	-	-	-	-	-	-	-
CO4	2	3	2	2	2	-	-	-	-	-	-	-	2
Avg	2	2.5	2	2	2							1	2

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ESE	100

ESE: Assessment is based on 100% course content equal weightage for course content.

Course Contents:

Unit 1: Introduction to Computer Vision and Basic Concepts of Image Formation: Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts.	06Hrs
Unit 2: Feature Detection and Matching: Points and patches, Edges and contours, Contour tracking, Lines and vanishing points, SIFT, SURF IMAGE ALIGNMENT AND STITCHING Pairwise alignment, Image stitching.	07 Hrs
Unit 3: Image Understanding: Pattern recognition methods, Object recognition, Image Classification, Face detection and recognition, 3D shapes models of faces.	06 Hrs
Unit 4: Feature Extraction: Introduction of feature extraction and feature selection, types of feature extraction, Problem statement and Uses, Algorithms - Branch and bound algorithm, sequential forward / backward selection algorithms, (l,r) algorithm.	07Hrs
Unit 5: Pattern Representation & Preprocessing: Data types, Feature Extraction, Feature Selection, Noise Removal. Discriminant Functions, Decision Surfaces, Minimum Error Rate Classification, ROC Curves.	06Hrs
Unit 6: Key Algorithms & Techniques: Bayesian Classifiers: Naïve Bayes, Gaussian Models, MAP/ML Estimation. On-Parametric Methods: k-Nearest Neighbors (k-NN) Parzen Window Density Estimation. Supervised Learning: Decision Trees, Support Vecto Machines (SVMs), Perceptrons, Neural Networks (MLPs). Unsupervised Learning & Clustering: K-Means, Hierarchical Clustering, Cluster Validation, EM Algorithm (Gaussian Mixture Models).	04Hrs

Textbooks:

1. Computer Vision: Algorithms & Applications, R. Szeleski, Springer.
2. Pattern Recognition and Image Analysis by Earl Gose, Richard Johnsonbaugh, Steve Jost, Eastern Aconomy Edition, PHI Publication.

References:

1) J.I. Tou & R.C. Gonzalez, Pattern Recognition Priciples, Addition-Wesley.
2) R. Schalkoff, Pattern Recognition - Statistiucal, Structural and Neural Approaches, John Wiley, 1992.
3) P.A. Devijer & J. Kittler, Pattern Recognition - A Statistical Approach, Prentice-Hall.
4) Computer vision: A modern approach: Forsyth and Ponce, Pearson.

Unit wise Measurable students Learning Outcomes:

After the completion of the course the student should be able to

1) Unit 1: Describe the physics of image formation and fundamental goals of computer vision systems.
2) Unit 2: Demonstrate image stitching by detecting and matching features using SIFT or SURF descriptors.
3) Unit 3: Discuss methodologies for high-level image understanding, including face detection.
4) Unit 4: Apply sequential and branch-and-bound algorithms to select the most relevant features for a given problem.
5) Unit 5: Construct decision surfaces and analyze classifier performance using ROC curves and error rate metrics.
6) Unit 6: Compare and contrast Bayesian, Non-parametric, and Neural Network classifiers for solving specific pattern recognition problems.

Title of the Course: Industrial sensors Course Code: UETMN0761	L	T	P	Credit
	3	-	-	3

Course Pre-Requisites: Student should have background of basics of electronics devices and circuits, Engineering physics.

Course Description: The syllabus for industrial sensors typically covers fundamental principles, characteristics, various sensor types for different physical measurements, signal conditioning, and integration into automation and data acquisition systems.

Course Objectives:

1 To understand physics and working principles of the industrial sensors

2 To study and interpret the performance parameters of the industrial sensors

3 To evaluate application constraints of the industrial sensors

4 To design a suitable signal conditioner for industrial sensors.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Understand physics in the sensor	II	Understand
CO2	Analyze / Interpret performance parameters/ Specifications of sensors	IV	Analyze
CO3	Evaluate application constraints of the industrial sensors	V	Evaluate
CO4	Design signal conditioners for interfacing to digital systems	III	Apply

CO-PO Mapping:

CO/PO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	-	2	-	-	-	-	-	-	-	-	-	2	2
CO3	-	-	-	2	-	-	-	-	-	-	-	2	2
CO4	-	-	2	-	-	-	-	-	-	-	-	2	2

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1: Introduction and Fundamentals Static and dynamic characteristics: accuracy, precision, sensitivity, linearity, resolution, hysteresis, drift, and calibration techniques. Error analysis and performance measures. Need for signal conditioning, resistive/inductive/capacitive bridges (e.g., Wheatstone bridge). DC and AC signal conditioning, amplifiers (instrumentation, isolation), and filters. Analog signals (0-10V, 4-20mA), digital signals, and Pulse Width Modulation (PWM).	6 Hrs.
Unit 2: Temperature Measurement: Principles, construction, and applications of RTDs (Resistance Temperature Detectors), thermocouples, thermistors, IR temperature sensors	6 Hrs.
Unit 3: Pressure Measurement Capacitive pressure sensors. Strain gauges, load cells, shear web, and piezoelectric force transducers.	6 Hrs.
Unit 4: Displacement, Proximity, and Ranging	

Potentiometers, LVDT/RVDT (Linear/Rotary Variable Differential Transformers), encoders (optical, magnetic), Hall effect sensors, inductive and capacitive proximity sensors, ultrasonic, and laser range sensors (LIDAR).	6 Hrs
Unit 5: Flow and Level Measurement Differential pressure flow meters, variable area meters (rotameter), ultrasonic, magnetic, and radar level detectors.	6 Hrs
Unit 6: Optical and Other Sensors Photo conductive cells, LDRs, fiber optic sensors, chemical sensors, Overview of MEMS (Micro-electromechanical Systems) technology and smart sensors	6 Hrs

Textbooks:

1. Measurement Systems - Application and Design by E. O. Doebelin, McGraw Hill
2. Sensors and Transducers by Patranabis D PHI second edition
3. Instrumentation: Devices and Systems by C. Rangan, G Sarma , V.S.V. Mani, McGraw Hill
4. Industrial control electronics, Applications and Design J Michal Jacob PHI

References:

1. Instrument Engineers' Handbook, Vol. 1: Process Measurement and Analysis by Bela G. Liptak., CRC Press
2. Handbook of Modern Sensors: Physics, Designs and Applications by Jacob Fraden, Springer
3. Instrumentation for Process Measurement and Control by Norman A. Anderson, CRC Press
4. Design with Operational Amplifiers and Analog Integrated Circuits, McGraw Hill

Unit wise Measurable students Learning Outcomes:

U1: Able to select suitable method for signal conditioning for industrial sensor
U2: analyze and design temperature measurement system
U3: analyze and design pressure measurement system
U4: analyze and design Displacement, Proximity, and Ranging systems
U5: analyze and design Flow and Level Measurement systems
U6: analyze and design Optical and Other Sensors system

Title of the Course: Data Analytics and Security of IOT Course Code: UETHN0751	L	T	P	Credit
	3	-	-	3

Course Pre-Requisites: Probability theory, Computer networks basics, TCP IP protocol.

Course Description: Internet of Things (IoT) is one of the essential parts of modern manufacturing and social life. Normally IoT applications generate huge time series data. Secure transport of data is very much important for IoT applications industry. Analysis of data to produce meaningful information for decision making on the situation is essential. This course introduces students to the principles of Data analytics and Secure data transfer with case studies on IoT applications.

Course Objectives:

1. Introduce principles of data analytics.
2. To provide strong foundation for data analytics applications development
3. To explore different types of Data analytics
4. Security issues and mitigation of security attacks on IoT system

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Explore the fundamental concepts of data analytics	II	Understanding
CO2	Understand data analysis techniques for applications handling large data	III	Analyzing
CO3	Analyze the data and visualization	IV	Design
CO4	Specify different types of IoT Attack methods	VI	Analyzing

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	2	-
CO3	-	3	-	3	2	-	-	-	-	-	-	-	-
CO4	-	-	3	-	2	-	3	-	-	-	-	-	-

Assessments:

Teacher Assessment:

ESE: Assessment is based on 100% course content with equal weightage for all units of the course.

Course Contents:

Unit 1: -: Introduction to Data Analytics: Basic Nomenclature Analytics Process, Model Analytical, Model Requirements, Data Analytics Types.	6 Hrs.
Unit 2: --- Data Collection, Sampling, and Preprocessing: Standardizing Data, Categorization, Weights of Evidence Coding, Variable Selection Segmentation	8 Hrs.
Unit 3: - Predictive Analytics: Target Definition, Linear Regression,	6 Hrs.

Logistic Regression, Decision Trees, Neural Networks, Support Vector Machines, Ensemble Methods, Multiclass Classification Techniques, Evaluating Predictive Models.	
Unit 4: - Descriptive Analytics: Association Rules, Sequence Rules, Segmentation, Advantages and Disadvantages of Descriptive analysis.	6 Hrs.
Unit 5: - Survival and Social network Analysis: Survival Analysis Measurements, Kaplan Meier Analysis, Parametric Survival Analysis , Social Network Definitions, Social Network Metrics, Social Network Learning, Relational Neighbor Classifier	8 Hrs.
Unit 6: -. IoT Security: Introduction to IoT privacy and security. Vulnerabilities, security requirements and threat analysis, IoT Security Tomography and layered attacker model	8 Hrs.

Textbooks:

1. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley.
2. Data Analytics Made Accessible by Dr. Anil Maheshwari
3. Internet of Things : Architecture And Design Principles, Raj Kamal, McGraw Hill 2017

References:

1. 1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Introducing Data Science, Manning Publications Co., 1st edition, 2016.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer, 1st edition, 2013.
3. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2nd edition, 2014.

Unit wise Measurable students Learning Outcomes:

1. Discuss the basics concepts of Data Analysis
2. Discuss the methods of data collection
3. Discuss the methods of Predictive Analytics
4. Discuss the methods of Descriptive Analytics
5. Discuss the methods of Survival and Social network Analysis
6. Discuss the methods of IoT Security

Title of the Course: Industrial Instrumentation **Course Code:** UILOE0724	**L** **2**	**T** **-**	**P** **-**	**Credit** **2**

Course Pre-Requisite: Sensors, Control system, Digital systems, Electrical machines

Course Description:

This course provides a comprehensive introduction to the principles and practices of industrial instrumentation used in monitoring and controlling process variables. It covers sensor technologies, transducers, signal conditioning, and data acquisition systems, along with practical measurement techniques for temperature, pressure, flow, and level. Students will also explore industrial automation concepts including PLC-based control systems, safety standards, and emerging trends like smart sensors and IoT. The course emphasizes both theoretical understanding and practical application in real-world industrial environments.

Course Objectives:

1. To introduce the fundamental components and working principles of industrial instrumentation systems.
2. To develop an understanding of various sensors and transducers used for measuring temperature, pressure and flow along with data acquisition techniques for accurate and reliable measurement.
3. To provide knowledge of industrial automation systems with emphasis on PLC-based control and process regulation with safety measures.
4. To familiarize students with fundamental concepts of PLC and SCADA for automation.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Descriptor
CO1	**Identify** and explain the operation of various sensors and instruments used for measuring industrial process variables like temperature, pressure, and flow	II	**Identify**
CO2	**Design** and analyze basic signal conditioning and data acquisition systems for industrial applications	III	**Design**
CO3	**Apply** control strategies and implement PLC-based automation for monitoring and controlling industrial processes and understand safety measures.	III	**Apply**
CO4	**Evaluate** instrumentation systems based on knowledge acquired after studying fundamental concepts of PLC and SCADA.	V	**Evaluate**

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**PSO1**	**PSO2**
CO1	2	3											
CO2	2	3		2	2							2	
CO3	3	2		2	2					2	2		
CO4	3				2	2	2						2

Assessments: Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30

ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc. MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:-: Transducers & Sensors: Definition, Various Types of Transducers, Classification of Transducers, Selection Factors and General Applications of Transducers, Detailed Study of Transducers: (i) Motion (ii) Flow (iii) Pressure (iv) Temperature (v) Force (vi) Sound Transducer, Hall Effect Transducers, Digital Transducers, Proximity Devices, optical Sensors, Piezzo – electric sensors.	7 **Hrs.**
Unit 2:- Introduction to Measurement & Data Acquisition System: Introduction of measurement system, Performance Characteristics, Static Characteristics, Error in Measurement, Types of Static Error, Sources of Error, Introduction, analog DAS, digital DAS, multi channel DAS, data converters-ADC integrating type ADC, dual slope integrating type ADC, successive approximation type ADC, flash type ADC. DAC	8 **Hrs.**
Unit 3:- Industrial Automation and Control Systems: Introduction to Automation, Process control basics: Two position controller (ON/OFF controller), Proportional controller, Integral controller. Control system components: actuators, valves, relay, Safety in measurement systems, intrinsically safe instrumentation, Instrumentation standards (ISA, ANSI, ISO), Case studies	7 **Hrs.**
Unit 4:- Fundamentals of PLC and SCADA: Introduction to PLCs and SCADA systems, hardware, programming (e.g., ladder and logic) and real-time control system. SCADA fundamentals like data acquisition, human-machine interfaces (HMI) and centralized supervision across a larger system, Basics of feedback and feed-forward control system.	8 **Hrs.**
Textbooks: 1] A course in Electrical, Electronics measurement and Instrumentation, A.K. Sawhney 2]Electronic Instrumentation, H. S. Kalsi, MGH, 3rd Edition 3] Automatic Control Systems by Benjamin C. Kuo 4] Programmable Logic Controllers by Frank D. Petruzella 5] Instrumentation and Control Systems" by W. Bolton	

6] Process Control and Instrumentation Technology by Curtis D. Johnson	
References: 1] Electronic Instrumentation and Measurement Techniques, Helfrick Cooper. 2] Instrumentation for Engineers And Scientists , John Turner ,II Edition , Wiley 3] Electronic Instrumentation and Measurements, David A Bell, Third Edition, Oxford 4]Instrumentation for Engineering Measurements, James W Dally, II Edition , Wiley	
Unit wise Measurable students Learning Outcomes: Upon successful completion of this course students will be able to: 1] Identify and classify error sources and explain how their effects can be minimized in Measurement. 2] Analyze different systems used in data acquisition 3] Compare various sensors. 4] Understand Different process controllers. 5] Understand principle of operation of transducers & Apply knowledge of transducer and sensor for various applications. 6] Analyze the different case studies.	