## **VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY**

### (Autonomous)

Thindal, Erode - 638 012

(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai) (Accredited by NAAC with 'A+' grade)



## **REGULATIONS 2022**

## **CURRICULUM AND SYLLABUS**

# BE - ELECTRONICS AND COMMUNICATION ENGINEERING

**Choice Based Credit System (CBCS)** 

### SUMMARY OF CREDITS

				Cre	edits p	er Sem	ester				Credits	Credits as
S.No	Course Category	1	2	3	4	5	6	7	8	Total Credits	in %	per AICTE Model Curriculum
1	HS	4	4				3	1		12	8	12
2	BS	11	8	4						23	14	25
3	ES	7	9	4	4	4				28	17	24
4	PC			14	19	7	8	8		56	35	48
5	PE					6	6	6		18	11	18
6	OE					3	3	3		9	6	18
7	EC						3		12	15	9	15
8	MC	~	✓	✓	~	~	✓	~		-	-	-
9	VC					√						-
10	OC, SC, AC					$\checkmark$						-
Total	Credits / Sem	22	21	22	23	20	23	18	12	161	100	160

HS - Humanities and Social Science

**BS** - Basic Science

ES - Engineering Science

PC - Professional Core

PE - Professional Elective

OE - Open Elective

EC - Employability Enhancement Course (Project, Seminar, Internship, etc.)

MC - Mandatory Course

VC - Value added course

OC - Online Course (If six or more credits earned, then two elective courses may be exempted) SC - Self Study course AC - Audit Course

### ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For Minor Degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

10									CURR	ICUI	JUM
VELALAR COLLEGE OF ENGINEERING AND TECHNOLOG (Autonomous)										UG	
	CET		(Autonomous)					I	R ncorpor Gradi	– 2022 ating F ing Sys	2 Relative tem
Dep	artment	Ele	ectronics and Communication Engineering								
Prog	gramme	BE	- Electronics and Communication Engineering	3							
			SEMESTER 1		D	• 1	. ,				
S.	Cours	se	<b>Course Title</b>	tegory	Pe V	riod Vee	is / k	edits	Ma	x. Ma	arks
NO	No Code $\mathbf{\tilde{U}}$ L T P								CA	SE	Tot.
1	122MCT01Induction Programme2 w							wee	ks		
			Theory								
2	22ENT	'11	Communicative English	HS	3	0	0	3	40	60	100
3	22MAT	511	Matrices and Differential Equations	BS	3	1	0	4	40	60	100
4	22PHT	'11	Engineering Physics	BS	3	0	0	3	40	60	100
5	22CYT	`11	Engineering Chemistry	BS	3	0	0	3	40	60	100
6	22CST	'11	Python Programming	ES	3	0	0	3	40	60	100
7	22ECT	11	Semiconductor Devices (For the students admitted in AY 2022-2023 only)	ES	3	0	0	3	40	60	100
7 a	22ECT2	21	Electrical and Instrumentation Engineering (For the students admitted from AY 2023-2024 onwards)	ES	3	0	0	3	40	60	100
8	22HST	11	தமிழர் மரபு (For the students admitted from AY 2023-2024 onwards)	HS	1	0	0	1	40	60	100
			Practical		-	-	•				r
9	22PHL	11	Physics and Chemistry Laboratory -I	BS	0	0	2	1	60	40	100
10	22CSL1	11	Python Programming Laboratory	ES	0	0	2	1	60	40	100
10a	22CSL1	11	Python Programming Laboratory (For the students admitted from AY 2024-2025 onwards)	ES	0	0	2	1	60	40	100
			Mandatory								
11	22MCT	02	Universal Human Values-1	MC	0	0	2	0	100	0	100
	Total Credits 22										

		SEMESTER 2									
S.	Course	Course Title	Course Title Course		edits	Ma	x. Ma	arks			
No	Code		Cat	L	Т	Р	Cr	CA	SE	Tot.	
	<b>r</b>	Theory				•				r	
1	22ENT21	Professional English	HS	3	0	0	3	40	60	100	
2	22MAT21	Calculus And Complex Analysis	BS	3	1	0	4	40	60	100	
3	22PHT23	Physics for Electrical Sciences (For the students admitted in AY 2022-2023 only)	BS	3	0	0	3	40	60	100	
3 a	22ITT21	C Programming (For the students admitted from AY 2023-2024 onwards)	ES	3	0	0	3	40	60	100	
4	22ECT21	0	3	40	60	100					
4 a	22ECT11	Semiconductor Devices (For the students admitted from AY 2023- 2024 onwards)	ES	3	0	0	3	40	60	100	
5	22MET11	Engineering Graphics	ES	2	0	4	4	40	60	100	
6	22HST11	தமிழர் மரபு (For the students admitted in AY 2022-2023 only)	HS	1	0	0	1	40	60	100	
6 a	22HST21	தமிழரும் தொழில்நுட்பமும் (For the students admitted from AY 2023- 2024 onwards)	HS	1	0	0	1	40	60	100	
		Practical									
7	22PHL21	Physics and Chemistry Laboratory –II (For the students admitted in AY 2022-2023 only)	BS	0	0	2	1	60	40	100	
7 a	22ITL21	C Programming Laboratory (For the students admitted from AY 2023-2024 onwards)	ES	0	0	2	1	60	40	100	
8	22MEL11	Workshop Practices Laboratory	ES	0	0	2	1	60	40	100	
922ECL21Electron Devices LaboratoryES002							1	60	40	100	
		Mandatory									
10	22MCT03	Environmental Science and Engineering	MC	2	0	0	0	100	0	100	
	Total Credits 21										

		SEMESTER 3									
S.	Course	Course Title	egory	Pe V	rioc Vee	ls / k	edits	Ma	ix. Ma	arks	
No	Code				Р	Cr	CA	SE	Tot.		
		Theory									
1	22MAT32	Transform Techniques and Probability Theory	BS	3	1	0	4	40	60	100	
2	22ECT31	Signals and Systems	PC	3	1	0	4	40	60	100	
3	22ECT32	Analog Electronics	PC	3	1	0	4	40	60	100	
4	22ECT33	Digital Electronics	PC	3	1	0	4	40	60	100	
5	22ECT34	Circuit Analysis	ES	3	1	0	4	40	60	100	
6	22HST21	தமிழரும் தொழில்நட்பமும் (For the students admitted in AY 2022-2023)	HS	1	0	0	1	40	60	100	
		Practical									
7	22ECL31	Analog Electronics Laboratory	PC	0	0	2	1	60	40	100	
8	22ECL32	Digital Electronics Laboratory	PC	0	0	2	1	60	40	100	
	Total Credits 22										

	SEMESTER 4												
S.	Course	Course Title	egory	Pe V	eriods / Week		edits	Max. Mar		arks			
No	Code		Cat	L		Р	Cr	CA	SE	Tot.			
		Theory											
1	22ITT32	Data Structures using Python	ES	3	0	0	3	40	60	100			
2	22ECT41	Electromagnetic Fields	PC	3	0	0	3	40	60	100			
3	22ECT42	Control Systems	PC	3	1	0	4	40	60	100			
4	22ECT43	Digital Signal Processing	PC	3	1	0	4	40	60	100			
5	22ECT44	Linear Integrated Circuits and Applications	PC	3	0	0	3	40	60	100			
6	22ECT45	Analog and Digital Communication	PC	3	0	0	3	40	60	100			
		Practical											
7	22ITL32	Data Structures Laboratory	ES	0	0	2	1	60	40	100			
8	22ECL41	Digital Signal Processing Laboratory	PC	0	0	2	1	60	40	100			
9	22ECL42	Communication Systems Laboratory	PC	0	0	2	1	60	40	100			

		Mandatory								
10	22MCL04	English for Professionals (For the students admitted in AY 2022-2023)	MC	0	0	2	0	100	0	100
10a	22MCL04	English for Professionals (For the students admitted from AY 2023-2024 onwards)	MC	0	0	2	0	100	0	100
			Tot	tal (	Cred	lits	23			

		SEMESTER 5								
S.	Course	Course Title	egory	Pe V	riod Vee	ls / k	edits	Ma	x. Ma	arks
No	Code		Cat	L	Т	Р	Cre	CA	SE	Tot.
		Theory	Theory Oriented Programming using Java Dra a a							
1	22ITT31	Object Oriented Programming using Java	ES	3	0	0	3	40	60	100
2	22ECT51	Wireless and Mobile Communication	PC	3	0	0	3	40	60	100
3	22ECT52	Microprocessor and Microcontroller	PC	3	0	0	3	40	60	100
4		Professional Elective - 1	PE	3	0	0	3	40	60	100
5		Professional Elective - 2	PE	3	0	0	3	40	60	100
6		Open Elective - 1	OE	3	0	0	3	40	60	100
		Practical								
7	22ITL31	Object Oriented Programming Laboratory	ES	0	0	2	1	60	40	100
8	22ECL51	Microprocessor and Microcontroller Laboratory	PC	0	0	2	1	60	40	100
		Mandatory		•	•	•	-			
9	22MCT05	Aptitude and Logical Reasoning	MC	2	0	0	0	100	0	100
			Tot	al (	Cred	lits	20			

		SEMESTER 6								
S.	Course	Course Title	egory	Pe V	riods / Veek		edits	Max. Mark		arks
NO	Code		Cat	L T P		Р	Cr	CA	SE	Tot.
		Theory	•					•	•	
1	22ECT61	Economics and Management for Engineers	HS	3	0	0	3	40	60	100
2	22ECT62	Computer Communication Networks	PC	3	0	0	3	40	60	100
3	22ECT63	CMOS VLSI Design	PC	3	0	0	3	40	60	100
4		Professional Elective - 3	PE	3	0	0	3	40	60	100
5		Professional Elective - 4	PE	3 0 0 3 0 0		0	3	40	60	100
6		Open Elective - 2	OE	3	0	0	3	40	60	100
		Practical								
7	22ECL61	Communication Networks Laboratory	PC	0	0	2	1	60	40	100
8	22ECL62	VLSI Design Laboratory	PC	0	0	2	1	60	40	100
9	22ECL63	Mini Project	EC	0	0	6	3	40	60	100
Mandatory									-	
10	22MCL06	Communication Skills Laboratory	MC	0	0	2	0	100	0	100
	Total Credits 23									

	SEMESTER 7											
S.	Course	Course Title	tegory	Pe V	Periods / Week		edits	Max. Marks		arks		
INO	Code		Cai	L	Т	Р	Cr	CA	SE	Tot.		
Theory												
1	22ECT71	Embedded and Real Time Systems	PC	3	0	0	3	40	60	100		
2	22ECT72	Microwave and Optical Communication	PC	3	0	0	3	40	60	100		
3		Professional Elective -5	PE	3	0	0	3	40	60	100		
4		Professional Elective - 6	PE	3	0	0	3	40	60	100		
5		Open Elective - 3	OE	3	0	0	3	40	60	100		
6	22HST71	Human Values and Professional Ethics	HS	1	0	0	1	40	60	100		
	-	Practical					-					
7	22ECL71	Embedded Laboratory	PC	0	0	2	1	60	40	100		

8	22ECL72	2Microwave and Optical Communication LaboratoryPC002						60	40	100
9	22MCT07Indian Constitution and Traditional KnowledgeMC20						0	100	0	100
Total Credits						its	18			

		SEMESTER 8										
S.	Course	Course Title	egory	Pe	erioo Wee	ls / k	edits	Ma	x. Ma	arks		
No	Code		Cat	L	Т	Р	Cr	CA	SE	Tot.		
	Practical											
1	22ECL81	Internship	EC	-	-	-	2	100	-	100		
2	22ECL82	Project Work	EC	0	0	20	10	40	60	100		
			Т	otal	Cre	dits	12					

### **PROFESSIONAL ELECTIVE COURSES: VERTICALS**

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V	Vertical VI
High Speed	Medical	RF and Space	Sensor	Signal	Semiconductor
Communication	Electronics	Technologies	and IoT	Processing	Chip Design and Testing
Wireless	Medical	Transmission	Computer	Digital	ASIC and
Networks	Electronics	Lines and RF Systems	Architecture	Image Processing	FPGA Design
Wireless Sensor	IoT for Health	EMI/EMC Pre	Micro	DSP	Hardware
Network	Care	Compliance	python	Architecture	Software Co-
		Testing		and Programming	design
High	Medical Sensor	Antenna	IoT Based	Advanced	Low Power IC
Performance	and	Design	System	Digital	Design
Networks	Applications		Design	Signal	
				Processing	
Modern	Tele Health	Remote	Embedded	Digital	VLSI Testing
Wireless	Technology	Sensing	Internet of	Speech	and Design For
Communication			Things	Processing	Testability
Systems	<b>D</b> ' '' 1			<u> </u>	
Information	Biomedical	Modern	MEMS	Software	Mixed Signal
Coding	Instrumentation	Communication	Design	Defined	IC Design
Counig		Communication		Kaulo	Testing
Cryptography	Hospital	Radar	Industrial	Computer	CAD for VLSI
and Network	Management	Technologies	IoT and	Vision	
Security			Industry 4.0		
Cognitive Radio	Medical	Avionics	Software	VLSI Signal	VLSI Signal
	Wearable	Systems	Defined	Processing	Processing
	Systems		Networks		

### **Registration of Professional Elective Courses from Verticals:**

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2022.

### VERTICALS FOR MINOR DEGREE

#### (In addition to all the verticals of other programmes)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

Vertical I Fintech and	Vertical II Entrepreneurship	Vertical III Public	Vertical IV Business	Vertical V Environmental	Vertical VI Artificial
Block Chain		Administration	Data	and	Intelligence
			Analytics	Sustainability	
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development	Introduction to Data Science
Fundamentals of Investment	Team Building & Leadership Management for Business	Constitution of India	Data mining for Business Intelligence	Sustainable Agriculture and Environmental Management	Principles of Artificial Intelligence
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials	Data Warehousing and Data Mining
Introduction to Block chain and its Applications	Principles of Marketing Management For Business	Administrative Theories	Digital Marketing and Social Network Analytics	Materials for Energy Sustainability	Machine Learning Techniques
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Supply Chain Analytics	Green Technology	Expert Systems
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis	Cognitive Science
-	-	-	-	Integrated Energy Planning for Sustainable Development	Gamification
-	-	-	-	Energy Efficiency for Sustainable Development	-

	PROFESSIONAL ELECTIVE COURSES: VERTICALS   S Course Periods / 2 Max. Marks												
S.	Course	Course Title	tegory	Pe V	riod Veel	ls / k	redits	Ma	ıx. Ma	arks			
	Coue		Ca	L	Τ	P	Ū	CA	SE	Tot.			
		VERTICAL 1: High Speed Con	nmur	nicat	tion			1					
1	22ECE11	Wireless Networks	PE	3	0	0	3	40	60	100			
2	22ECE12	Wireless Sensor Network	PE	3	0	0	3	40	60	100			
3	22ECE13	High Performance Networks	PE	3	0	0	3	40	60	100			
4	22ECE14	Modern Wireless Communication Systems	PE	3	0	0	3	40	60	100			
5	22ECE15	Information Theory and Coding	PE	3	0	0	3	40	60	100			
6	22ECE16	Cryptography and Network Security	PE	3	0	0	3	40	60	100			
7	22ECE17	Cognitive Radio	PE	3	0	0	3	40	60	100			
		VERTICAL 2: Medical Ele	ectror	nics									
1	22ECE21	Medical Electronics	PE	3	0	0	3	40	60	100			
2	22ECE22	IoT for Health Care	PE	3	0	0	3	40	60	100			
3	22ECE23	Medical Sensor and Applications	PE	3	0	0	3	40	60	100			
4	22ECE24	Tele Health Technology	PE	3	0	0	3	40	60	100			
5	22ECE25	Biomedical Instrumentation	PE	3	0	0	3	40	60	100			
6	22ECE26	Hospital Management	PE	3	0	0	3	40	60	100			
7	22ECE27	Medical Wearable Systems	PE	3	0	0	3	40	60	100			
		VERTICAL 3: RF and Space 7	Гесhn	olog	gies								
1	22ECE31	Transmission Lines and RF Systems	PE	3	0	0	3	40	60	100			
2	22ECE32	EMI/EMC Pre Compliance Testing	PE	3	0	0	3	40	60	100			
3	22ECE33	Antenna Design	PE	3	0	0	3	40	60	100			
4	22ECE34	Remote Sensing	PE	3	0	0	3	40	60	100			
5	22ECE35	Modern Satellite Communication	PE	3	0	0	3	40	60	100			
6	22ECE36	Radar Technologies	PE	3	0	0	3	40	60	100			
7	22ECE37	Avionics Systems	PE	3	0	0	3	40	60	100			
		VERTICAL 4: Sensor Technol	logy a	nd ]	loT		·						
1	22ECE41	Computer Architecture	PE	3	0	0	3	40	60	100			

2	22ECE42	Micro python	PE	3	0	0	3	40	60	100
3	22ECE43	IoT Based System Design	PE	3	0	0	3	40	60	100
4	22ECE44	Embedded Internet of Things	PE	3	0	0	3	40	60	100
5	22ECE45	MEMS Design	PE	3	0	0	3	40	60	100
6	22ECE46	Industrial IoT and Industry 4.0	PE	3	0	0	3	40	60	100
7	22ECE47	Software Defined Networks	PE	3	0	0	3	40	60	100
	·	VERTICAL 5: Signal Pro	cessi	ıg						
1	22ECE51	Digital Image Processing	PE	3	0	0	3	40	60	100
2	22ECE52	DSP Architecture and Programming	PE	3	0	0	3	40	60	100
3	22ECE53	Advanced Digital Signal Processing	PE	3	0	0	3	40	60	100
4	22ECE54	Digital Speech Processing	PE	3	0	0	3	40	60	100
5	22ECE55	Software Defined Radio	PE	3	0	0	3	40	60	100
6	22ECE56	Computer Vision	PE	3	0	0	3	40	60	100
7	22ECE57	VLSI Signal Processing	PE	3	0	0	3	40	60	100
		VERTICAL 6: Semiconductor Chip I	Desig	n an	d T	esti	ng			
1	22ECE61	ASIC and FPGA Design	PE	3	0	0	3	40	60	100
2	22ECE62	Hardware Software Co-design	PE	3	0	0	3	40	60	100
3	22ECE63	Low Power IC Design	PE	3	0	0	3	40	60	100
4	22ECE64	VLSI Testing and Design For Testability	PE	3	0	0	3	40	60	100
5	22ECE65	Mixed Signal IC Design Testing	PE	3	0	0	3	40	60	100
6	22ECE66	CAD for VLSI	PE	3	0	0	3	40	60	100
7	22ECE67	VLSI Signal Processing	PE	3	0	0	3	40	60	100

	VERTICALS FOR MINOR DEGREE													
S.	Course	Course Title	egory	Pe V	riod Veel	ls / k	edits	Ma	x. Ma	arks				
No	Code		Cat	L	Т	Р	Cr	CA	SE	Tot.				
		VERTICAL 1: Fintech and B	lock	Cha	in									
1	22ITM11	Financial Management	PE	3	0	0	3	40	60	100				
2	22ITM12	Fundamentals of Investment	PE	3	0	0	3	40	60	100				

3	22ITM13	Banking, Financial Services and Insurance	PE	3	0	0	3	40	60	100
4	22ITM14	Introduction to Block chain and its Applications	PE	3	0	0	3	40	60	100
5	22ITM15	Fintech Personal Finance and Payments	PE	3	0	0	3	40	60	100
6	22ITM16	Introduction to Fintech	PE	3	0	0	3	40	60	100
		VERTICAL 2: Entrepren	eursh	ip						
1	22MEM21	Foundations of Entrepreneurship	PE	3	0	0	3	40	60	100
2	22MEM22	Team Building & Leadership Management for Business	PE	3	0	0	3	40	60	100
3	22MEM23	Creativity & Innovation in Entrepreneurship	PE	3	0	0	3	40	60	100
4	22MEM24	Principles of Marketing Management For Business	PE	3	0	0	3	40	60	100
5	22MEM25	Human Resource Management for Entrepreneurs	PE	3	0	0	3	40	60	100
6	22MEM26	Financing New Business Ventures	PE	3	0	0	3	40	60	100
		VERTICAL 3: Public Admi	nistra	ntior	1					
1	22ECM31	Principles of Public Administration	PE	3	0	0	3	40	60	100
2	22ECM32	Constitution of India	PE	3	0	0	3	40	60	100
3	22ECM33	Public Personnel Administration	PE	3	0	0	3	40	60	100
4	22ECM34	Administrative Theories	PE	3	0	0	3	40	60	100
5	22ECM35	Indian Administrative System	PE	3	0	0	3	40	60	100
6	22ECM36	Public Policy Administration	PE	3	0	0	3	40	60	100
		VERTICAL 4: Business Data	a Ana	lytio	es					
1	22CSM41	Statistics for Management	PE	3	0	0	3	40	60	100
2	22CSM42	Data mining for Business Intelligence	PE	3	0	0	3	40	60	100
3	22CSM43	Human Resource Analytics	PE	3	0	0	3	40	60	100
4	22CSM44	Digital Marketing and Social Network Analytics	PE	3	0	0	3	40	60	100
5	22CSM45	Supply Chain Analytics	PE	3	0	0	3	40	60	100
6	22CSM46	Financial Analytics	PE	3	0	0	3	40	60	100

	VERTICAL 5: Environmental and Sustainability     22CEM51   22CEM51												
1	22CEM51	Sustainable infrastructure Development	PE	3	0	0	3	40	60	100			
2	22CEM52	Sustainable Agriculture and Environmental	PE	3	0	0	3	40	60	100			
3	22CEM53	Sustainable Bio Materials	PE	3	0	0	3	40	60	100			
4	22CEM54	Materials for Energy Sustainability	PE	3	0	0	3	40	60	100			
5	22CEM55	Green Technology	PE	3	0	0	3	40	60	100			
6	22CEM56	Environmental Quality Monitoring and Analysis	PE	3	0	0	3	40	60	100			
7	22CEM57	Integrated Energy Planning for Sustainable	PE	3	0	0	3	40	60	100			
8	22CEM58	Energy Efficiency for Sustainable Development	PE	3	0	0	3	40	60	100			
		VERTICAL 6: Artificial In	tellige	ence									
1	22ADM61	Introduction to Data Science	PE	3	0	0	3	40	60	100			
2	22ADM62	Principles of Artificial Intelligence	PE	3	0	0	3	40	60	100			
3	22ADM63	Data Warehousing and Data Mining	PE	3	0	0	3	40	60	100			
4	22ADM64	Machine Learning Techniques	PE	3	0	0	3	40	60	100			
5	22ADM65	Expert Systems	PE	3	0	0	3	40	60	100			
6	22ADM66	Cognitive Science	PE	3	0	0	3	40	60	100			
7	22ADM67	Gamification	PE	3	0	0	3	40	60	100			

		OPEN ELECTIVE	S							
S.	Course		gory	Pe V	riod Veel	ls / k	dits	Ma	x. Ma	arks
No	Code	Course Title	Categ	L	Т	Р	Cree	CA	SE	Tot.
OF	FERED BY I	DEPARTMENT OF ARTIFICIAL INT	ELLI	GE	NCF	EAN	ND D	ATA	SCIE	NCE
1	22ADO01	Fundamentals of Database	OE	3	0	0	3	40	60	100
2	22ADO02	Data Science for Engineers	OE	3	0	0	3	40	60	100
3	22ADO03	Cyber Security	OE	3	0	0	3	40	60	100
4	22ADO04	Data Visualization	OE	3	0	0	3	40	60	100
5	22ADO05	Business Analytics	OE	3	0	0	3	40	60	100

	OFFERED BY DEPARTMENT OF BIO MEDICAL ENGINEERING22BMO01Biometric systems and their30034060100												
1	22BMO01	Biometric systems and their	OF	3	0	0	3	40	60	100			
1		applications	OL										
2	22BMO02	Healthcare Management Systems	OE	3	0	0	3	40	60	100			
3	22BMO03	Basics of Bioinformatics	OE	3	0	0	3	40	60	100			
4	22BMO04	Biology for Engineers	OE	3	0	0	3	40	60	100			
5	22BMO05	Regulatory requirements in Pharmaceutical Industries	OE	3	0	0	3	40	60	100			
6	22BMO06	Rapid Prototyping	OE	3	0	0	3	40	60	100			
7	22BMO07	Radiotheraphy Basics and Applications	OE	3	0	0	3	40	60	100			
8	22BMO08	Nanotechnology and Applications	OE	3	0	0	3	40	60	100			
		OFFERED BY DEPARTMENT OF CI	VIL I	ENG	INI	EER	ING						
1	22CEO01	Civil and Infrastructure Engineering	OE	3	0	0	3	40	60	100			
2	22CEO02	Environmental pollution and waste management	OE	3	0	0	3	40	60	100			
3	22CEO03	Disaster Management and Mitigation	OE	3	0	0	3	40	60	100			
4	22CEO04	Building Services	OE	3	0	0	3	40	60	100			
	OFFERED	BY DEPARTMENT OF COMPUTER	SCIE	NCI	E AI	ND I	ENG	INEE	RINC	Ţ			
1	22CSO01	Foundation of AR/VR	OE	3	0	0	3	40	60	100			
2	22CSO02	Web Designing	OE	3	0	0	3	40	60	100			
3	22CSO03	Block Chain Fundamentals	OE	3	0	0	3	40	60	100			
4	22CSO04	Knowledge Management	OE	3	0	0	3	40	60	100			
5	22CSO05	Cloud Computing Essentials	OE	3	0	0	3	40	60	100			
	OFFEREI	D BY DEPARTMENT OF ELECTRON ENGINEERING	ICS A	AND	• CC	)MN	MUN	ICAT	ION				
1	22ECO01	Consumer Electronics	OE	3	0	0	3	40	60	100			
2	22ECO02	Advanced Mobile Communication	OE	3	0	0	3	40	60	100			
3	22ECO03	Optoelectronics	OE	3	0	0	3	40	60	100			
4	22ECO04	IOT System Design and Applications	OE	3	0	0	3	40	60	100			
5	22ECO05	5G Technologies	OE	3	0	0	3	40	60	100			
OF	FERED BY	DEPARTMENT OF ELECTRICAL AN	ND EI	LEC	TR	ONI	ICS F	ENGI	NEER	ING			

1	22EEO01	Domestic and Industrial Electrical Installations	OE	3	0	0	3	40	60	100
2	22EEO02	Renewable Energy Sources	OE	3	0	0	3	40	60	100
3	22EEO03	Electric Vehicles	OE	3	0	0	3	40	60	100
4	22EEO04	Energy Auditing and Conservation	OE	3	0	0	3	40	60	100
	OFF	ERED BY DEPARTMENT OF MECH	ANIC	AL	EN	GIN	IEER	ING		
1	22MEO01	Industrial Instrumentation	OE	3	0	0	3	40	60	100
2	22MEO02	Product Design and Development	OE	3	0	0	3	40	60	100
3	22MEO03	Sustainable Manufacturing	OE	3	0	0	3	40	60	100
4	22MEO04	Entrepreneurship Development	OE	3	0	0	3	40	60	100
5	22MEO05	Fundamentals of Ergonomics	OE	3	0	0	3	40	60	100
6	22MEO06	Principles of Management and	OE	3	0	0	3	40	60	100
	22ME007	Industrial Psychology		2						
7	22MEO07	Safety Measures for Engineers	OE	3	0	0	3	40	60	100
	0	FFERED BY DEPARTMENT OF MEI	DICAI	L EI	LEC	TR	ONI	CS		
1	22MDO01	Introduction to Medical Electronics	OE	3	0	0	3	40	60	100
2	22MDO02	Hospital Waste Management	OE	3	0	0	3	40	60	100
3	22MDO03	Hospital Information System	OE	3	0	0	3	40	60	100
4	22MDO04	IoT Applications in Healthcare	OE	3	0	0	3	40	60	100
	OFFI	ERED BY DEPARTMENT OF INFOR	MAT	<b>ON</b>	TE	CH	NOL	OGY		
1	22ITO01	Basics of Java Programming	OE	3	0	0	3	40	60	100
2	22ITO02	Ethical Hacking	OE	3	0	0	3	40	60	100
3	22ITO03	E-Commerce and Applications	OE	3	0	0	3	40	60	100
4	22ITO04	Basics of Android Application Development	OE	3	0	0	3	40	60	100
5	22ITO05	Web Essentials	OE	3	0	0	3	40	60	100
6	22IT006	Digital Video Editing	OE	3	0	0	3	40	60	100
	OF	FERED BY DEPARTMENT OF SCIEN	NCE A	ND	HU	JMA	NIT	IES		
1	22GEO01	National Cadet Corps Studies – I	OE	3	0	0	3	40	60	100
2	22GEO02	National Cadet Corps Studies – II	OE	3	0	0	3	40	60	100
		MANDATORY COUL	RSES					•		

S.	Course	Course Title	gory	Pe V	rioc Vee	ls / k	dits	Ma	ax. Ma	arks
No	Code	Course Thie	Cate	L	Т	Р	Cre	CA	SE	Tot.
1	22MCT01	Induction Programme				2	weel	<b>K</b> S		
2	22MCT02	Universal Human Values	MC	0	0	2	0	100	0	100
3	22MCT03	Environmental Science and Engineering	MC	2	0	0	0	100	0	100
4	22MCL04	English for Professionals	MC	0	0	2	0	100	0	100
5	22MCT05	Aptitude and Logical Reasoning	MC	2	0	0	0	100	0	100
6	22MCL06	Communication Skills Laboratory	MC	0	0	2	0	100	0	100
7	22MCT07	Indian Constitution and Traditional Knowledge	MC	2	0	0	0	100	0	100

L - Lecture Period

T - Tutorial Period

P - Practical Period

CA - Continuous Assessment

SE - Semester Examination

Tot - Total Marks

**22MCT01** 

#### (Common to all Branches)

#### **Preamble:**

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. "Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

# The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program:

### (i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

### (ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

#### (iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

#### (iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

#### (v) **Proficiency Modules**

This would address some lacunas that students might have, for example, English, computer familiarity etc.

#### (vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

#### (vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

### (viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

### (ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering /Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

# Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

### **References:**

• Guide to Induction program from AICTE

#### 22ENT11

(Common to all B.E /B. Tech Programmes)

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#### **Preamble :**

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Communicative English aims at developing Communication Skills in English which is essential for the learner to handle English language for a variety of everyday purposes through acquisition of basic grammar and vocabulary along with LSRW skills.

#### INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION UNIT 1

Listening: Listening for General Information - Specific Details - Conversations - Telephone Conversation - Listening to Voicemail and Messages - Listening and Filling a form Speaking: Self Introduction - Introducing a Friend - Politeness Strategies - Telephone Conversation - Leave a Message with Another Person - Asking for Information to Fill Details in a form Reading: Reading Brochures - Telephone Messages - Social Media Messages relevant to Technical Contexts Writing: Writing Reviews - Book/Movie – Writing about Oneself Grammar & Vocabulary: Tenses - Types of Questions - Parts of Speech - Contextual Meaning of Words - Abbreviations and Acronyms. 9

#### EXPRESSING CASUAL CONVERSATIONS UNIT 2

Listening: Information about Hotels and Accommodation - Recipes and Food Items - Listening to Conversations Asking for and Giving Directions – Making an Enquiry Speaking: Life Style Changes and Making Comparisons - Talking about Food - Making Conversation using Asking for Directions -Making an Enquiry - Role Plays - Dialogues Reading: Habit Formation and Changing Habits -International Cuisine - Reading a Print Interview and Answering Comprehension Questions Writing: E-Mail to Friend – E-Mails about Food and Recipes, Inviting Dignitaries, Accepting and Declining Invitations Grammar & Vocabulary: Evaluations and Comparisons with Adjectives – Prepositions -Modifiers.

#### UNIT 3 **CLARIFICATIONS AND RECOMMENDATIONS**

**Listening:** Listening to Short Talks and Fill a table – Gap Filling Exercises - Note Taking **Speaking:** Group Discussion - Agreeing and Disagreeing - Tips and Strategies for GD Reading: Reading Problems and Solutions - Articles - Essays drawn from various sources Writing: Making Recommendations -Giving Instructions - Note Making - Itinerary- Process Description Grammar & Vocabulary: Word Formation - Compound Nouns - Phrasal Verbs.

#### PUBLIC SPEAKING AND BUSINESS COMMUNICATION UNIT 4

Listening: Listening to Speeches by Famous People and Identifying the Central Message of the Speech -Answering Multiple Choice Questions Speaking: Welcome Address - Vote of Thanks - Special Address on Specific Topic Reading: Life and Achievements of a Famous Personality - Reading Motivational Essays on Famous Engineers and Technologists Writing: Checklists - Business Communication -Quotations, Placing Orders, Complaints Grammar & Vocabulary: Modal Verbs and Probability -Collocations - Fixed Expressions - Semi-Fixed Expressions.

#### WRITING DEFINITIONS AND PRODUCT DESCRIPTIONS UNIT 5

Listening: Listening to Product Description - Labeling and Gap Filling Exercises - Seeking help with Office Equipment - Job Details Speaking: Describe a Product - Compare and Contrast with other Products - Buying a Product - Selling a Product - Cancelling and Fixing Appointments - Hotel Accommodation - Training Facilities - Conference Facilities Reading: Reading Graphical Material for Comparison (advertisements) - Clarifying an Error in the Bill Writing: Writing Definitions - Single Line Definition and Extended Definition - Compare and Contrast Paragraphs - Designing a Website Grammar & Vocabulary: Use of Discourse Markers – One Word Substitution.

### **TOTAL: 45 PERIODS**

### **TEXT BOOKS:**

- 1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level 1, Student's Book) Cambridge University Press, New Delhi: 2017.
- 2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook, Oxford University Press, 2020.

### **REFERENCES:**

- 1. M Ashraf Rizvi, "Effective Technical Communication", McGraw-Hill, 2<sup>nd</sup> Edition, New Delhi, 2018.
- 2. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1<sup>st</sup> Edition, Delhi, 2014.

### e -Resources :

- 1. https://learnenglish.britishcouncil.org/intermediate-vocabulary
- 2. http://www.usingenglish.com
- 3. https://learnenglish.britishcouncil.org/intermediate-grammar
- 4. https://learnenglish.britishcouncil.org/speaking

Course Outcomes: Upon completion of the course, students will be able to:

- **CO1** Converse and read fluently using basic grammar components.
- **CO2** Communicate through writing without any grammatical errors.
- CO3 Write clear, coherent and organized passages adhering to instructions.
- CO4 Speak effectively in real-time and business situations.
- **CO5** Enhance vocabulary through listening and reading.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1					1	3			2	3		1		
CO 2					1	3			2	3		1		
CO 3					1	3			2	3		1		
CO 4					1	3			2	3		1		
CO 5					1	1			2	3		1		

#### 22ENT11

### **COMMUNICATIVE ENGLISH** (Common to all B.E./B. Tech Programmes)

## (Students admitted during 2023- 24 onwards)

**Preamble :** 

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Communicative English aims at developing Communication Skills in English which is essential for the learner to handle English language for a variety of everyday purposes through acquisition of basic grammar and vocabulary along with LSRW skills.

#### UNIT 1 INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION

Listening: Listening for General Information - Specific Details - Conversations - Telephone Conversation - Listening to Voicemail and Messages - Gap Filling Speaking: Self Introduction -Expressing Opinions - Introducing a Friend - Telephone Conversation - Leave a Message - Reading: Reading Brochures and Pamphlets Writing: Writing Reviews - Book/Movie - Writing about Oneself Grammar & Vocabulary: Parts of Speech - Tenses - Contextual Meaning of Words - Abbreviations and Acronyms.

#### UNIT 2 **EXPRESSING CASUAL CONVERSATIONS**

Listening: Information about Hotels and Accommodation - Recipes and Food Items - Listening to Conversations Asking for and Giving Directions – Making an Enquiry Speaking: Talking about Daily Routine - Talking about Food - Making Conversation using Asking for and Giving Directions - Making an Enquiry - Role Plays - Dialogues Reading: International Recipes - Reading a Print Interview and Answering Comprehension Questions Writing: E- Mail to a Friend – E-Mails about Food and Recipes, Inviting Dignitaries, Accepting and Declining Invitations Grammar & Vocabulary: Evaluations and Comparisons with Adjectives - Word Formation.

#### CLARIFICATIONS AND RECOMMENDATIONS UNIT 3

Listening: Listening to Short Talks and Fill a table – Gap Filling Exercises - Note Taking Speaking: Group Discussion - Agreeing and Disagreeing - Tips and Strategies for GD Reading: Articles - Essays drawn from various sources - Note Making Writing: Writing Recommendations - Giving Instructions -Itinerary - Process Description Grammar & Vocabulary: Prepositions - Modifiers - Phrasal Verbs. 9

#### UNIT 4 PUBLIC SPEAKING AND BUSINESS COMMUNICATION

Listening: Listening to Speeches by Famous People and Identifying the Central Message of the Speech -Answering Multiple Choice Questions Speaking: Welcome Address - Vote of Thanks - Special Address on Specific Topic Reading: Life and Achievements of Famous People Writing: Checklists - Personal Letters Grammar & Vocabulary: Modal Verbs and Probability - Collocations - Fixed Expressions -Semi-Fixed Expressions.

#### UNIT 5 WRITING DEFINITIONS AND PRODUCT DESCRIPTIONS

Listening: Listening to Product Description - Labeling and Gap Filling Exercises - Seeking help with Office Equipment - Job Details Speaking: Describe a Product - Compare and Contrast with other Products - Buying a Product - Selling a Product - Cancelling and Fixing Appointments - Hotel Accommodation Reading: Reading Graphical Material for Comparison - Tables - Pie Charts Writing: Writing Definitions - Single Line Definition and Extended Definition - Compare and Contrast Paragraphs - Clarifying an Error in the Bill Grammar & Vocabulary: Types of Questions - Use of Discourse Markers - One Word Substitution.

### **TOTAL: 45 PERIODS**

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#### **TEXT BOOK:**

1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level 1, Student's Book) Cambridge University Press, New Delhi: 2017.

#### **REFERENCES:**

- 1. M Ashraf Rizvi, "Effective Technical Communication", McGraw-Hill, 2<sup>nd</sup> Edition, New Delhi, 2018.
- 2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook, Oxford University Press, 2020.
- 3. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1<sup>st</sup> Edition, Delhi, 2014.

### e. RESOURCES :

- 1. https://learnenglish.britishcouncil.org
- 2. https://www.usingenglish.com

**Course Outcomes:** Upon completion of the course, students will be able to:

- **CO1** Converse and read fluently using basic grammar components.
- CO2 Communicate through writing without any grammatical errors.
- CO3 Write clear, coherent and organized passages adhering to instructions.
- CO4 Speak effectively in real-time and business situations.
- **CO5** Enhance vocabulary through listening and reading.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 2	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 3	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 4	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 5	-	1	-	-	1	1	-	-	2	3	-	1	-	-

MATRICES AND DIFFERENTIAL EQUATIONS

(Common to B.E.- BM, EC, EE and MD Programmes)

### Preamble

**22MAT11** 

The course aims at achieving conceptual understanding of topics in Differential Calculus, Differential equations and computation of Matrix. The syllabus is designed to provide the skills for modeling engineering problems and understand the role of single variable and multi variables in the discipline of engineering.

### **UNIT 1 MATRICES**

Characteristic equation – Statement and application of Cayley Hamilton Theorem – Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors (without proof) – Orthogonal transformation of a symmetric matrix to diagonal form - Quadratic form - Nature of Quadratic forms -Reduction of quadratic form to canonical form by orthogonal transformation.

### **UNIT 2 DIFFERENTIAL CALCULUS**

Curvature - Radius, Centre and Circle of curvature in Cartesian and Parametric form - Evolute -Envelope of family of curves with one and two parameters.

### UNIT 3 FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives - Differentiation of implicit functions - Jacobian- Properties - Taylor's series expansion for functions of two variables - constrained Maxima and Minima - Lagrange's multipliers with single constraint.

### **UNIT 4 ORDINARY DIFFERENTIAL EQUATIONS**

Linear higher order differential equations with constant coefficients – Particular Integrals for the types:  $e^{ax}$ , cosax or sinax,  $x^n$ ,  $e^{ax}V(X)$  – Method of variation of parameters –Applications of differential equations: Simple harmonic motion – Electric circuits (Differential equations and associated conditions need to be given).

### **UNIT 5 PARTIAL DIFFERENTIAL EQUATIONS**

Formation of partial differential equations – Solving partial differential equations of first order: Clairaut's form, Lagrange's linear equation – Solving Linear partial differential equations of second and higher order with constant coefficients of homogeneous type - Particular Integrals for the types:

 $e^{ax+by}$ ,  $x^m y^n$ ,  $\sin(ax+by)$  or  $\cos(ax+by)$ ,  $e^{ax+by}V(x,y)$ .

### Lecture: 45, Tutorial: 15, Total: 60

### **TEXT BOOKS:**

- 1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
- George B, Thomas, Joel Hass, Christopher Heil and Maurice D. Weir "Thomas' Calculus". 2. Pearson 14 th Edition, 2018

### **REFERENCES:**

- N.P.Bali, Manish Goyal, "Engineering Mathematics", Lakshmi Publications (Pvt) Ltd,4th 1. Edition. 2014.
- 2. Grewal B.S., "Higher Engineering Mathematics" 43rd Edition, Khanna Publishers, New Delhi, 2014.

### e-Resources:

- 1. https://nptel.ac.in/courses/122104018, Mathematics II, Prof. P. Chandra, Prof. A.K. Lal, Prof. V. Raghavendra, Prof. G. Santhanam, IIT Kanpur.
- https://nptel.ac.in/courses/111106139, Laplace Transform, Prof. Indrava Roy, IIT Madras. 2.

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### 9+3

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**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Determine eigenvalues and eigenvectors of real symmetric matrices and reduce the quadratic form to canonical form by orthogonal transformation.
- CO2 Compute curvature, centre of curvature, evolute and envelope of curves.
- CO3 Express functions of two variables in Taylor's series and compute Jacobians, maximum and minimum values.
- CO4 Solve linear differential equations with constant coefficients and apply them in solving real problems.
- CO5 Compute the solution for the standard forms of linear partial differential equations of first order and solve homogeneous partial differential equations of first and higher order with constant coefficients.

COs/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	1	1								1		
CO 2	3	3	1	1								1		
CO 3	3	3	1	1								1		
<b>CO 4</b>	3	3	1	1								1		
CO 5	3	3	1	1								1		

### Mapping of COs with POs and PSOs

#### 22PHT11

(Common to all B.E/B.Tech Programmes)

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#### Preamble

This course aims to impart the essential concepts of laser, fibre optics, ultrasonics, quantum physics and crystal structure and crystal defects. It also describes the physical phenomena related to the above mentioned concepts and their applications in engineering and provides motivation towards innovations.

### UNIT 1 LASER

Introduction –spontaneous emission and stimulated emission, population inversion, pumping. Einstein's coefficients - derivation. Types of lasers- Nd-YAG-CO<sub>2</sub>, Semiconductor lasers (homojunction & heterojunction) – Industrial applications - lasers in welding, heat treatment, cutting- medical applications-holography-construction and reconstruction-Safety classes of laser.

### UNIT 2 FIBRE OPTICS

Principle and propagation of light in optical fibres – numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – double crucible technique of fibre drawing - splicing, losses in optical fibre, dispersion - fibre optical communication system (Block diagram) - light sources - detectors - fibre optic sensors – temperature & displacement - endoscope.

### UNIT 3 ULTRASONICS

Introduction – Production – magnetostriction effect – piezoelectric effect - piezoelectric generatordetection of ultrasonic waves properties – cavitations - velocity measurement – acoustic grating -Industrial applications – drilling, welding, soldering and cleaning – SONAR - non destructive testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays, medical applications - sonograms.

### UNIT 4 QUANTUM PHYSICS

Black body radiation – Planck's theory (derivation) – deduction of Wien's displacement law and Rayleigh – Jeans' law from Planck's theory – Compton effect - theory and experimental verification – matter waves – Schrödinger's wave equation – time independent and time dependent equations – physical significance of wave function – particle in a one dimensional box.

### UNIT 5 CRYSTAL PHYSICS

Lattice – unit cell – Bravais lattice – lattice planes – Miller indices – d spacing in cubic lattice – calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – polymorphism and allotropy - crystal defects – point, line and surface defects.

### **TOTAL: 45 PERIODS**

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### **TEXT BOOKS:**

- 1 Gaur R.K. and Gupta S.L., "Engineering Physics", 8<sup>th</sup> Edition, Dhanpat Rai publishers, 2009.
- 2 Mani Naidu S., "Engineering Physics", 2<sup>nd</sup> Edition, Pearson Publishing, 2011.

#### **REFERENCES:**

- 1. Serway and Jewett, "Physics for Scientists and Engineers with Modern Physics", 9<sup>th</sup> Edition, Thomson Brooks Cole, 2013
- 2. Palanisamy P.K., "Engineering Physics", 2<sup>nd</sup> Edition, Scitech Publications, 2011
- 3. Chitra Shadrach and Sivakumar Vadivelu, "Engineering Physics", 1<sup>st</sup> Edition, Pearson Education, 2007.

#### e-Resources :

- 1. http://oupinheonline.com/book/bhattacharya-tandon-engineering-physics/9780199452811.
- 2. https://www.khanacademy.org/science/physics/quantum-physics.

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

- CO1 Compare Nd-YAG, CO<sub>2</sub> and Semiconductor lasers for welding, heat treatment, cutting, medical applications and holography using Stimulated Emission.
- CO2 Demonstrate the knowledge of wave optics using light waves for communication system.
- CO3 Describe the production and applications of ultrasonics.
- CO4 Examine the dual nature of light waves using quantum theory for Black body radiation and Schrodinger's wave equations in particle in a one and three dimensional box.
- CO5 Explain the description of a crystal structure in terms of atom positions, unit cells, and crystal symmetry; and to relate the crystal symmetry to the symmetry observed in a diffraction experiment.

COs/POs	PO 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	1	1			1	1	1		
CO 2	3	2	1	1	1	1	1			1	1	1		
CO 3	3	2	1	1	1	1	1			1	1	1		
CO 4	3	2	1	1	1	1	1			1	1	1		
CO 5	3	2	1	1	1	1	1			1	1	1		

#### Mapping of COs with POs and PSOs

**ENGINEERING CHEMISTRY** 

(Common to all B.E/B.Tech Programmes)

# **Preamble**

The study of water technology enables engineers to acquire skills to choose the appropriate method of water treatment for industrial and domestic purposes. Electrochemistry and corrosion explain the fundamentals, identification and corrosion prevention for solving electrochemical and corrosion problems. The study of energy storage devices exposes some of the most commonly used energy storage devices. Nanochemistry empowers engineers to acquire knowledge about nanomaterials and their applications in various fields. Polymeric materials aim to equip the engineering students to realize the importance of chemistry in composites and conducting polymers.

#### UNIT 1 WATER TECHNOLOGY

Hardness – types and its units – Boiler troubles – scale and sludge, boiler corrosion, caustic embrittlement, priming and foaming - Internal conditioning - carbonate and calgon conditioning -External conditioning - demineralization process - Desalination - electrodialysis, reverse osmosis -Treatment of water for municipal water supply (Removal of suspended particles and disinfection methods – Ozonisation).

#### ELECTROCHEMISTRY AND CORROSION UNIT 2

Electrochemistry – Emf Series and its applications. Metal Finishing – Manufacture of Printed Circuit Board.

Corrosion – mechanism – Galvanic, atmospheric  $(O_2)$  and Pitting corrosion. Protective coating – electroplating of nickel and electroless copper plating on printed circuit board.

#### UNIT 3 **ENERGY STORAGE DEVICES**

Batteries - types - Construction and working of Primary battery - Zinc-Air/carbon, Secondary batteries - Lead-acid battery and Lithium-ion battery, Fuel cells - H<sub>2</sub>-O<sub>2</sub> fuel cell and Microbial fuel cell. 9

#### UNIT 4 NANOCHEMISTRY

Nanomaterials – Types – Synthesis – sol-gel and laser ablation – Characterization – Scanning Electron Microscope and Transmission Electron Microscope - Principle and instrumentation (block diagram) -Properties – optical, electrical, mechanical and magnetic and Applications of nanomaterials – medicine, agriculture, electronics and catalysis.

#### POLYMERS UNIT 5

Polymers – thermoplastics and thermosetting plastics – polymerization – types (definition only) – Compounding of plastics – fabrication – compression and injection – Composites – polymer matrix composites (Fibre reinforced composites) and metal matrix composites - Conduction polymers -General mechanism of conduction in polymers.

#### **TOTAL: 45 PERIODS**

#### **TEXT BOOKS:**

- Engineering chemistry, 17th Edition. P. C. Jain & Monica Jain, Dhanpat Rai Publishing 1. Company, 2021.
- Applied chemistry, 2<sup>nd</sup> Edition. P. N. Palanisamy, P. Manikandan, A. Geetha, K. Manjula Rani, 2. McGraw Hill Education (India) Private Limited, 2019.

#### **REFERENCES:**

Wiley Engineering Chemistry, 2<sup>nd</sup> Edition, Wiley, Wiley India Pvt. Ltd, New Delhi, 2014. 1.

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- 2. Engineering chemistry, 2<sup>nd</sup> Edition. O. G. Palanna, McGraw Hill Education (India) Private Limited, New Delhi, 2017.
- 3. A Textbook of NanoScience, 2<sup>nd</sup> Edition, Dr. Rakesh Kumar, Dr. Kamala Pati Tiwary, S. K. Kataria & Sons, New Delhi, 2013.

#### e-Resources:

- 1. http://nptel.ac.in/courses/113105028/, "Science and Technology of Polymers"- Prof. Basudam Adhikari, Materials Science Centre, IIT Kharagpur
  - https://archive.nptel.ac.in/courses/118/102/118102003/, "Nano structured materials-Synthesis,
- 2. Properties, Self-Assembly and Applications" Prof. Ashok K Ganguli, Department of Chemistry, IIT Delhi

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

- CO1 Evaluate the process to purify hard water using internal and external treatment.
- CO2 Apply the principle of electrochemistry in PCB etching and surface coating to prevent corrosion.
- CO3 Compare and contrast the performance of primary, secondary and flow battery.
- CO4 Analyze the characteristics of nanomaterials synthesized by top down and bottom-up process with the aid of SEM and TEM.
- CO5 Categorize the types of polymeric materials and fabrication of plastic by injection and compression molding for engineering applications.

COs\POs	PO 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	1	1	2		1	1	1	1		
CO2	3	2	2	1	1	1	2		1	1	1	1		
CO3	3	2	2	1	1	1	2		1	1	1	1		
CO4	3	2	2	1	1	1	2		1	1	1	1		
CO5	3	2	2	1	1	1	2		1	1	1	1		

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-" No correlation

22CST11

(Common to all B.E/B.Tech Programmes)

#### **Pre-requisites : Nil** Preamble

Python is easy to use, powerful, and versatile, making it a great choice for beginners and experts alike. Python's readability makes it a great first programming language — it allows you to think like a programmer and not waste time understanding the mysterious syntax that other programming languages can require. The syntax in Python helps the programmers to do coding in fewer steps. Python is widely used in bigger organizations because of its multiple programming paradigms.

### **UNIT 1 COMPUTING FUNDAMENTALS**

Fundamentals of Computing - Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

### **UNIT 2 INTRODUCTION TO PYTHON**

Python interpreter, data types: int, float, boolean, string, and list; variables, expressions, statements, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

### **UNIT 3 CONTROL FLOW, FUNCTIONS, STRINGS**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (ifelif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

### **UNIT 4 LISTS, TUPLES, DICTIONARIES**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

### UNIT 5 FILES, MODULES AND PACKAGES

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages, Introduction to Pygame tool; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

### **TEXT BOOKS:**

- Reema Thareja, "Python Programming using Problem Solving Approach", Oxford University 1. Press, 2017.
- Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, 2. O'Reilly Publishers, 2016.

**Total : 45 Periods** 

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#### **REFERENCES:**

- 1. E Balagurusamy," Problem Solving and Python Programming", McGraw Hill Education, 2018
- 2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1stEdition, Notion Press, 2021.

#### e-RESOURCES:

- 1. https://swayam.gov.in/course/4178-spoken-tutorial-python-english, "Introduction to Python", Prof. Prabhu Ramachandran, IIT Bombay.
- 2. https://onlinecourses.nptel.ac.in/noc18\_cs21, "Programming, Data Structures and Algorithms Using Python", Prof.Madhavan Mukund, IIT-Bombay.

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

- CO1 Use the basics of algorithmic problem solving techniques (pseudo code, flow chart, language basics) for a given problem.
- CO2 Apply suitable python conditional and looping statements to solve a given problem.
- CO3 Define Python functions and use function calls to solve problems.
- CO4 Use Python data structures (lists, tuples, and dictionaries) to represent complex data.
- CO5 Create python packages, modules and files for a given scenario.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	1						1	1		
CO2	3	2	2	2	1						1	1		
CO3	3	2	2	2	1						1	1		
CO4	3	2	2	2	1						1	1		
CO5	3	2	2	2	1						1	1		

#### Mapping of COs with POs and PSOs

22ECT11

#### SEMICONDUCTOR DEVICES

(For the students admitted in AY 2022-2023 only)

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#### **Pre-requisites : Nil**

#### Preamble

The invention of solid state diodes and transistors has revolutionized the world. All the developments in the applications of electronics started with these. The fundamental components spawned into a range of signal and power devices. An engineer has to understand these devices which the building blocks of the circuits and systems.

#### UNIT 1 **PN JUNCTION DIODE**

Construction, Theory and operation of PN junction diode – VI Characteristics – current equation – Diode resistances and capacitances - Ratings - Applications - Zener diode and its characteristics - voltage regulation using zener diodes.

#### UNIT 2 **BJT TRANSISTOR**

Principle of operation of PNP and NPN transistors - study of CE, CB and CC configurations and comparison of their characteristics.

#### UNIT 3 FET AND MOSFET

Construction, Operation, Characteristics and Application of JFET - JFET Parameters -JFET as VVR. Construction, Operation, Characteristics and Application of MOSFETs - EMOSFET and DMOSFET.

#### **UNIT 4** SPECIAL PURPOSE DIODES

Construction, Operation, Characteristics and Application of Tunnel diode, Varactor diode, LED, Laser diode, Photodiode, Gunn diode, Schottky Diode.

#### POWER DEVICES AND DIODE APPLICATIONS UNIT 5

Construction, Operation, Characteristics and Application of SCR, DIAC, TRIAC-IGBT. Operation and Analysis of Rectifiers: Half-Wave and Full-Wave (both centre-tapped and bridge types) Rectifiers with capacitor filters, Android app based circuit simulation.

### **TEXT BOOKS:**

- Salivahanan S & Sureshkumar N, "Electronic Devices and Circuits", McGraw Hill, Fourth 1. Edition, 2017.
- Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th Edition, 2.
- Pearson Education / PHI, 2013.

### **REFERENCES:**

- 1. Dr. K.R. Valluvan, Prof. M. Vijayan, "Fundamentals of Semiconductor Devices", Charulatha Publications, 2018.
- J. Millman, C Chalkias & SatyabrataJit, "Electronic Devices & Circuits", Tata McGraw Hill, 3rd 2. Edition. 2010.
- 3. David A. Bell, "Electronic Devices and Circuits", Prentice Hall of India, 2004.

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**Total : 45 Periods** 

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#### e-Resources:

- 1. https://nptel.ac.in/courses/108108122, Fundamentals of semiconductor devices, Prof. Digbijoy N. Nath, IISc Bangalore.
- 2. https://nptel.ac.in/courses/117103063, Basic Electronics, Prof. Chitralekha Mahanta, IIT Guwahati.

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

- CO1 Analyze the characteristics of PN junction diode and Zener diode under forward bias and reverse bias condition.
- CO2 Analyze the input and output characteristics of CB, CE and CC configurations of BJT.
- CO3 Discuss the Construction, Operation, Characteristics and Application of JFET and MOSFETs.
- CO4 Discuss the Construction, Operation, Characteristics and Application of Tunnel diode, Varactor diode, LED, Laser diode, Photodiode, Gunn diode, Schottky Diode.
- CO5 Analyze the characteristics of SCR, DIAC and TRIAC.

Cos/POs	PO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1	1	1	1	1			1	1	1		
CO2	3	1	1	1	1	1	1			1	1	1		
CO3	3	1	1	1	1	1	1			1	1	1		
CO4	3	1	1	1	1	1	1			1	1	1		
CO5	3	1	1	1	1	1	1			1	1	1		

#### Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ECT21

(For the students admitted from AY 2023-2024 onwards)

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#### **Pre-requisites : Nil**

#### **Preamble**

This course introduces the fundamental concepts of DC and AC machines and transformers. The use of instruments and techniques for practical measurements required in electrical and electronic measurements are discussed in this course.

#### UNIT 1 **DC MACHINES**

Introduction - Constructional Features - Operation of DC Generator and DC Motor - EMF and Torque equation – Types and Characteristics of DC Generator and DC Motor – Universal Motor – Brushless DC Motor – Applications.

#### UNIT 2 **AC ROTATING MACHINES**

Synchronous Machines: Construction - Working Principle and Types of Alternator - EMF equation -Working Principle of Synchronous Motor.

Induction Motors: Construction and Working Principle of three phase Induction Motors - Losses and Efficiency - Construction and operation of Split Phase Induction Motor.

#### UNIT 3 TRANSFORMER

Single Phase Transformers: Construction - Principle of Operation - EMF Equation - Ideal Transformer -Actual Transformer on No Load and Load - Losses and Efficiency - Three Phase Transformers - Auto Transformers – Applications.

#### UNIT 4 **MEASUREMENTS AND INSTRUMENTATION**

Functional Elements of an Instrument, Standards and Calibration, Construction and Working of Moving Coil Instruments and Moving Iron Instruments - Measurement of three phase Power, Energy Meter, Instrument Transformers: CT and PT - CRO Block diagram.

#### UNIT 5 **BASICS OF POWER SYSTEMS**

Power System Structure - Generation, Transmission and Distribution - Earthing - Methods of Earthing -Protective Devices: Switch Fuse Unit - Miniature Circuit Breaker- Molded Case Circuit Breaker- Earth Leakage Circuit Breaker - Safety Precautions and First Aid.

#### **Total: 45 PERIODS**

### **TEXT BOOKS:**

- Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, 1. McGraw Hill Education, 2020
- S. K, Bhattacharya, "Basic Electrical and Electronics Engineering", Second Edition, 2. Pearson Education, 2017.
- 3. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International pvt.ltd.,2003

#### **REFERENCES:**

- A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & 1. Instrumentation', Dhanpat Rai and Co, New Delhi, 2015.
- 2. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.

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3. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

### e-Resources:

- 1. https://nptel.ac.in/courses/108105153/,"Electrical Measurement and Electronic Instruments", Prof. Avishek Chatterjee, IIT, Kharagpur.
- 2. https://nptel.ac.in/courses/108102146/,"Electrical Machines", Prof. G.Bhuvaneshwari, IIT, Delhi.

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

- CO1 Illustrate the construction, working, characteristics and applications of DC machines.
- CO2 Analyze the working of single phase induction and three phase induction motors and synchronous motor.
- CO3 Explain the construction and working principle of transformers.
- CO4 Explain the principle and operation of instruments used for the measurement of voltage, current, power and energy and waveform analyzers.
- CO5 Explain the earthing techniques used in home and industries and working principle of protective devices.

Cos/POs	PO 1	PO 2	PO 3	РО 4	РО 5	PO 6	РО 7	PO 8	РО 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1			1	1			1		2		
CO 2	3	1	1			1	1			1		2		
CO 3	3	1	1			1	1			1		2		
CO 4	3	1	1	1	1	1	1			1	2	2		
CO 5	3		1	1	1	1	1			1	2	2		

### Mapping of COs with POs and PSOs

22HST11

HERITAGE OF TAMILS (For the students admitted from AY 2023-2024 onwards)

**Pre-requisites : Nil** 

#### UNIT 1 LANGUAGE AND LITERATURE

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

HERITAGE - ROCK ART PAINTINGS TO MODERN ART - SCULPTURE 3 UNIT 2 Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making -Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

#### FOLK AND MARTIAL ARTS UNIT 3

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

#### UNIT 4 THINAI CONCEPT OF TAMILS

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

#### CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN UNIT 5 **CULTURE**

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

### **TEXT BOOKS:**

- 1. பிள்மள தமிழகவரலொறு மக்களும்பண்பொடும் (தவளியீடு: மக.மக. தமிழ்நொடுபொடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
- 2. கணினித்தமிழ் – முமனவர்இல. சுந்தரம். (விகடன் பிரசுரம்).
- 3. கீழடி – மவமகநதிக்கமரயில்ெங்ககொலநகரநொகரிகம் (ததொல்லியல்துமற தவளியீடு)
- 4. தபொருமந – ஆற்றங்கமரநொகரிகம். (ததொல்லியல்துமறதவளியீடு)

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Total: 15 PERIODS
- 5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL (in print)
- 6. Social Life of the Tamils The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
- 7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
- 8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
- 9. Keeladi 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
- 10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
- 11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
- 12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) Reference Book.

#### 22PHL11

(Common to all B.E/B.Tech Programmes)

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#### Preamble

This course aims to impart knowledge in the determination of the physical parameters such as wavelength of laser and mercury spectrum, Numerical aperture and acceptance angle of an optical fiber, velocity of ultrasonic waves and thermal conductivity of bad conductor and additionally necessitate the practical skills in determination of rate of corrosion in mild steel, water quality parameters and amount of iron in the given sample.

## PHYSICS LABORATORY I

### LIST OF EXPERIMENTS

- 1. Determination of Optical property of Laser and Particle size of Lycopodium powder.
- 2. Determination of Numerical aperture and acceptance angle of an optical fiber.
- 3. Determination of velocity of ultrasonic waves- Ultrasonic Interferometer.
- 4. Determination of wavelength of mercury spectrum- Spectrometer grating.
- 5. Determination of Thermal conductivity of Bad conductor.

## CHEMISTRY LABORATORY I

### LIST OF EXPERIMENTS

- 1. Determination of alkalinity in water sample
- 2. Determination of Calcium and Magnesium hardness in water by EDTA method.
- 3. Determination of rate of corrosion in Mild steel by weight loss method.
- 4. Determination of iron content of the water sample using spectrophotometer (1,10-phenanthroline / thiocyanate method).
- 5. Determination of iron content of the given solution using a potentiometer

#### **Total : 45 Periods**

**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Experiment and determine the optical property of light sources and acceptance angle of optical fiber using Laser and Spectrometer.
- CO2 Experiment and determine the velocity of ultrasonic waves and thermal conductivity of a given bad conductor using ultrasonic interferometer and Lee's disc.
- CO3 Experiment and estimate type and amount of alkalinity, Calcium and Magnesium hardness in water sample using titrimetry.
- CO4 Experiment and determine the rate of corrosion in mild steel by weight loss method.
- CO5 Experiment and determine the amount of iron content present in the given sample using potentiometer and spectrophotometer.

## Mapping of COs with POs and PSOs

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1		3		1	1		1	1	1	1		
CO2	2	1		3		1	1		1	1	1	1		
CO3	2	1		3		1	1		1	1	1	1		
CO4	2	1		3		1	1		1	1	1	1		
CO5	2	1		3		1	1		1	1	1	1		

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-" No correlation

# PYTHON PROGRAMMING LABORATORYL T P C(Common to all branches )0 0 2 1

#### **Preamble:**

Python is a dynamic and powerful programming language that focuses on code readability. The Python language has diversified application in the software development companies such as in gaming, web frameworks and applications, language development, prototyping, graphic design applications, etc. This provides the language a higher plethora over other programming languages used in the industry.

#### LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.

(Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)

- Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points)
- 3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
- 4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
- Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
- Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
- 7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
- 8. Implementing programs using written modules and Python Standard Libraries Libraries (pandas, numpy. Matplotlib, scipy)
- 9. Implementing real-time/technical applications using File handling
- 10. Developing a game activity using Pygame like bouncing ball, car race

#### SOFTWARE

- Python 3 interpreter / open source IDE
- Raptor Tool
- Libre Office Packages

#### **TOTAL: 45 PERIODS**

## Course Outcomes: Upon completion of the course, students will be able to:

- 1. Design flowcharts using Raptor.
- 2. Develop programs using expressions and Control statements in Python.
- 3. Develop programs using functions, packages for a given problem..
- 4. Process compound data using Python data structures
- 5. Utilize Python packages in developing software applications.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3					1			1		
CO2	2	2	2	3					1			1		
CO3	2	2	2	3					1			1		
CO4	2	2	2	3					1			1		
CO5	2	2	2	3					1			1		

#### Mapping of COs with POs and PSOs

VCET, B.E-ECE, R2022 Curriculum and Syllabus

# **22MCT02**

#### **Pre-requisites : Nil**

### Preamble

Universal Human Values is a life skill necessary for all to develop physical health and factors for strengthening life force. This course aims to expose the students in the areas of mediation and impart the knowledge on social virtues and morals.

**UNIVERSAL HUMAN VALUES** 

#### UNIT 1 **Physical Health**

SKY - Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for Youth Empowerment - Simplified Physical Exercises: Explanation - Hand, Leg, Breathing and Eye exercises – Kapalabathi, Makarasanam, Massaging, Acupressure and Relaxation practices – Yogasanas-Explanation – Benefits.

#### UNIT 2 **Strengthening Life Forces**

Reasons for Diseases: Natural Reasons (Hereditary, Planetary Position, Natural Calamities and Climatic changes) - Artificial Reasons (Food, Thought, Deed). Philosophy of Kayakalpa: Physical Body -Life Force - Biomagnetism - Mind. Maintaining Youthfulness - Postponing Aging - Transformation of Food into seven Body constituents.

#### UNIT 3 Wellness of Mind

Classification of Mind Waves – Beta, Alpha, Theeta, Delta – Agna Meditation – Benefits. Shanthi Mediation - Benefits. Thuriya Meditation - Benefits. Blessing and its Benefits: Auto Suggestion -Blessing the family and others – Blessings the World – Divine Protection.

#### UNIT 4 Virtues

Individual Virtues: Self Control – Self Confidence – Speaking Truth – Contentment – Humility – Mind Control. Tolerance - Adjustment - Sacrifice - Forgiveness. Cleanliness (Body, Dress, Surrounding)-External, Mental, Inner Cleanliness. Societal Virtues : Ahimsa - Services, Patriotism - Equality, Respecting the parents and elders - Caring for them - Respecting Teachers. Punctuality - Time Management.

#### UNIT 5 **Morals**

Importance of introspection: I and Mine (Ego, Possessiveness), Six Temperaments: Greed - Anger -Miserliness - Immoral Sexual Passion - Inferior Superior complex - Vengeance. Maneuvering the Six Temperaments: Contentment - Tolerance - Charity - Chastity - Parity - Forgiveness. Five important Benefits of Meditation: Perspicacity – Magnanimity – Adaptability – Receptivity – Creativity. (Enhancing memory) (Effective Examination Preparation)

## **TEXT BOOKS:**

- "Yoga for Youth Empowerment" compiled by Vethathiri Maharishi Institute for Spiritual and 1. Institutional Education, Aliyar, Pollachi, 1<sup>st</sup> Edition 2016.
- "Yoga for Human Excellence", compiled by Vethathiri Maharishi Institute for Spiritual and 2. Institutional Education, Alivar, Pollachi 1<sup>st</sup> Edition 2009.

**Total : 30 Periods** 

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#### e-Resources:

1. www.online.vethathiri.edu.in "online in (Virtual) Programme on Yoga and Human Excellence".

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

- CO1 Demonstrate the knowledge on physical health
- CO2 Discuss the factors for strengthening life force
- CO3 Classify mind waves and explain the benefits of meditation
- CO4 Explain individual and social virtues
- CO5 Identify and explain the importance of morals.

#### Mapping of COs with POs and PSOs

Cos/POs	PO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						3								
CO2						3		2						
CO3						3		2						
CO4						3		2	2					
CO5						3			2					

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

"-"No correlation

#### 22ENT21

#### **Preamble:**

The course Professional English aims at developing LSRW skills which are essential for the learners to communicative effectively and appropriately in professional contexts through acquisition of grammar and vocabulary.

**PROFESSIONAL ENGLISH** 

(Common to all B.E /B.Tech Programmes)

#### UNIT 1 ANALYTICAL READING

Listening: Listening to Podcasts - Anecdotes - Stories - Event Narration - Documentaries and Interviews with Celebrities - Evaluative Listening - Advertisements - Listening and Filling a Graphic Organizer Speaking: Conversation Skills - Opening - Turn Taking - Closing - Explaining how something works -Marketing a Product - Persuasive Speech Techniques Reading: Reading Advertisements - User Manuals - Analytical Reading - Deductive and Inductive Reasoning Writing: Professional E-mails – E-mail Etiquette - Compare and Contrast Essays Grammar & Vocabulary: Prepositional Phrases - Impersonal Passive Voice - Product Description.

#### UNIT 2 SUMMARISING

Listening: Listening to Lectures - Talks and Completing Gap Filling Exercises on Science and Technology - Listening Technical Information from Podcasts Speaking: Summarizing - Oral Reporting -Narrating Personal Experiences - Events - Interviewing a Celebrity Reading: Reading Scientific and Technical Articles - Texts Writing: Lab Reports - Summary Writing Grammar & Vocabulary: Purpose Expressions - Same Word used as Different Parts of Speech. 9

#### UNIT 3 **DESCRIBING VISUAL MATERIALS**

Listening: Listening to the Panel Discussion Speaking: Speaking at Formal Situations - Mini Presentation and Making Recommendations Reading: Reading Journal Articles - Speed Reading - Interpretation of Graphics - Tables - Pie Chart - Flow Chart - Bar Chart Writing: Data Commentaries - Describing Visual Materials - Mechanics of Writing - Writing Complaints to Editorial Columns Grammar & Vocabulary: Subject-Verb Agreement - Pronouns - Relative Pronouns.

#### WRITING E-MAILS AND JOB APPLICATION LETTERS UNIT 4

Listening: Listening to Model Interviews Speaking: Speaking at Different Types of Interviews - Role Play Practice **Reading:** Reading Job Advertisements and Company Profile - Statement of Purpose (SOP) Writing: Filling up the Job Application Letter - Cover Letter - Résumé Preparation - Internship Application Grammar & Vocabulary: Error Correction – 'If' Conditionals - Infinitives - Gerunds.

#### **UNIT 5 REPORT WRITING**

Listening: Viewing a Model Group Discussion Speaking: Participating in a Group Presentation -Presentation Reading: Cause and Effect Essays - Letters and E-mails of Complaint Writing: Types of Reports - Report Format - Industrial Accident Report - Industrial Visit Report - Feasibility Report -Designing and Reporting Surveys - Writing Discursive Essays Grammar & Vocabulary: Reported Speech - Numerical Adjectives - Idioms and Phrases.

#### **TEXT BOOK:**

- 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited. 1. 2019.
- 2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook, Oxford University Press, 2020.

#### **TOTAL: 45 PERIODS**

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#### **REFERENCES:**

- 1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level2, Student's Book) Cambridge University Press, New Delhi: 2017.
- 2. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1<sup>st</sup> Edition, Delhi, 2014.

#### e -Resources :

- 1. www.eslgold.com
- 2. www.usingenglish.com

Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Read for gathering and understanding information using narrative techniques.
- CO2 Develop and demonstrate listening skills for academic and professional purposes.
- CO3 Apply apt vocabulary and construct grammatically correct sentences in professional situations.
- **CO4** Face interviews with communicative competence and confidence with a good knowledge of career skills.
- CO5 Enhance writing skills for essays and for preparing reports.

#### Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1					1	3			2	3		1		
CO 2					1	3			2	3		1		
CO 3					1	3			2	3		1		
CO 4					1	3			2	3		1		
CO 5					1	1			2	3		1		

#### **PROFESSIONAL ENGLISH**

#### (Common to all B.E./B. Tech Programmes) (Students admitted during 2023- 24 onwards)

#### **Preamble:**

The course Professional English aims at developing LSRW skills which are essential for the learners to communicative effectively and appropriately in professional contexts through acquisition of grammar and vocabulary.

#### UNIT 1 ANALYTICAL READING

**Listening**: Listening to Anecdotes - Stories - Event Narration – Documentaries and Interviews with Celebrities - Advertisements - Listening and Gap Filling Exercises **Speaking**: Conversation Skills – Initiating - Turn Taking - Closing – Explaining how something works - Persuasive Speech Techniques **Reading:** Reading Advertisements - User Manuals - Analytical Reading - Deductive and Inductive Reasoning **Writing**: Professional E-mails – E-mail Etiquette – Compare and Contrast Essays **Grammar & Vocabulary**: Prepositional Phrases –Same Word used as Different Parts of Speech.

#### UNIT 2 SUMMARISING

**Listening:** Listening to Lectures - Talks and Completing Gap Filling Exercises on Science and Technology – Listening Technical Information from Podcasts **Speaking**: Summarizing - Oral Reporting – Narrating Personal Experiences – Events – Interviewing a Celebrity **Reading**: Reading Scientific and Technical Articles - Texts **Writing**: Lab Reports - Summary Writing. **Grammar & Vocabulary**: Impersonal Passive Voice - Purpose Expressions.

#### UNIT 3 DESCRIBING VISUAL MATERIALS

**Listening**: Listening to the Panel Discussion **Speaking**: Speaking at Formal Situations –Mini Presentation and Making Recommendations **Reading**: Reading Journal Articles - Speed Reading - Interpretation of Graphics – Flow Chart - Bar Chart **Writing**: Data Commentaries - Describing Visual Materials – Mechanics of Writing - Writing Complaints to Editorial Columns **Grammar & Vocabulary:** Subject-Verb Agreement – Pronouns - Relative Pronouns - Numerical Adjectives.

#### UNIT 4 WRITING E-MAILS AND JOB APPLICATION LETTERS

**Listening:** Listening to Model Interviews **Speaking**: Speaking at Interviews – Role Play Practice **Reading:** Reading Job Advertisements and Company Profile - Statement of Purpose (SOP) **Writing:** Filling up the Job Application – Cover Letter – Résumé Preparation – Internship Application **Grammar & Vocabulary:** 'If' Conditionals – Infinitives – Gerunds - Compound Nouns.

#### UNIT 5 REPORT WRITING

Listening: Viewing a Model Group Discussion Speaking: Participating in a Group Talk -

**Reading:** Cause and Effect Essays – Business Letters **Writing:** Types of Reports - Report Format - Industrial Accident Report - Industrial Visit Report – Feasibility Report - Designing and Reporting Surveys – Writing Discursive Essays **Grammar & Vocabulary:** Reported Speech – Idioms and Phrases.

## **TOTAL: 45 PERIODS**

#### **TEXT BOOK:**

1. 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited .2019.

#### **REFERENCES:**

- 1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level2, Student's Book) Cambridge University Press, New Delhi: 2017.
- 2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook , Oxford University Press, 2020.

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3. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1<sup>st</sup> Edition, Delhi, 2014.

#### e. RESOURCES :

- 1. www.eslgold.com
- 2. www.usingenglish.com

Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Read for gathering and understanding information using narrative techniques.
- CO2 Develop and demonstrate listening skills for academic and professional purposes.
- CO3 Apply apt vocabulary and construct grammatically correct sentences in professional situations.
- **CO4** Face interviews with communicative competence and confidence with a good knowledge of career skills.
- CO5 Enhance writing skills for essays and for preparing reports.

#### Mapping of COs with POs and PSOs

Cos/POs	PO 1	<b>PO</b> 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 2	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 3	-	1	-	-	1	3	-	-	2	3	-	1	-	-
CO 4	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 5	-	-	-	-	1	1	-	-	2	3	-	1	-	-

# 22MAT21 CALCULUS AND COMPLEX ANALYSIS L T P

(Common to B.E - BM, EC, EE and MD Programmes) **3** 

**Pre-requisites :** Matrices and Differential Equations

#### Preamble

Vector calculus is a form of mathematics that is focused on the integration of vector fields. An Engineer should know the Transformations of the Integrals, as Transformation of Line Integral to surface and then to volume integrals. Complex Integration approach is very useful to evaluate many improper integrals of a real variable.

## UNIT 1 INTEGRAL CALCULUS

Double and Triple Integrals in Cartesian coordinates – Evaluation of Double Integrals by Change of order of Integration – Applications of Multiple Integrals to find Area and Volume

### **UNIT 2 DIFFERENTIAL VECTOR CALCULUS**

Del Operator – Del applied to scalar point function: Gradient and its applications to find unit normal vector, Directional derivative and Angle between two surfaces – Del applied to vector point function: Divergence, Curl and their applications to find Irrotational and Solenoidal vector fields — Vector operator identities (Statement only) - Simple Problems.

### UNIT 3 INTEGRAL VECTOR CALCULUS

Line, Surface and Volume integrals – Vector Integral Theorems (without proof): Green's theorem in a plane – Gauss Divergence Theorem – Stoke's theorem – Simple applications involving squares, rectangles, cubes and rectangular parallelepipeds.

## UNIT 4 ANALYTIC FUNCTIONS

Functions of a complex variable – Limit and continuity of f(z) – Derivative of f(z) – Cauchy-Riemann equations – Analytic functions – Harmonic and orthogonal properties of analytic function –Construction of analytic functions by Milne's method – Conformal mapping -Translation w=z+k, Magnification and Rotation w=kz, Inversion and Reflection w=1/z and bilinear transformation.

## UNIT 5 COMPLEX INTEGRATION

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proof) –Power series expansions: Taylor's series and Laurent's series – Singularities – Residues– Cauchy Residue theorem (excluding proof) – Evaluation of real definite integrals as contour integrals (around unit circle, semi-circle excluding poles on the real axis).

#### **TEXT BOOKS:**

- 1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
- 2. George B, Thomas, Joel Hass, Christopher Heil and Maurice D. Weir "Thomas' Calculus". Pearson 14 th Edition, 2018

#### **REFERENCES:**

- 1. N.P.Bali,Manish Goyal, "Engineering Mathematics",Lakshmi Publications(PVT) Ltd,4 th edition,2014.
- 2. Grewal B.S., "Higher Engineering Mathematics" 43rd Edition, Khanna Publishers, New Delhi, 2014.

**Total : 60 PERIODS** 

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## 9+3

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#### 9+3

## 9+3

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#### e-Resources:

- 1. https://nptel.ac.in/courses/111105122 "Integral and Vector Calculus", Prof. Hari Shankar Mahato, Department of Mathematicss, IIT Kharagpur.
- 2. https://nptel.ac.in/courses/111103070 "Complex Analysis" Prof. P. A. S. Sree Krishna, Department of Mathematics, IIT Guwahati.

**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Apply multiple integrals to determine area and volume in Cartesian coordinates.
- CO2 Apply the concepts of vector calculus in vector differentiation.
- CO3 Apply the concepts of vector calculus in vector integration.
- CO4 Represent the analytic functions using conformal mapping and bilinear transformation.
- CO5 Classify the singularities and evaluate complex integration.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	1	1								1		
CO 2	3	3	1	1								1		
CO 3	3	3	1	1								1		
CO 4	3	3	1	1								1		
CO 5	3	3	1	1								1		

#### Mapping of COs with POs and PSOs

#### 22PHT23

(For the students admitted in AY 2022-2023 only)

#### **Prerequisites:** Engineering Physics

#### Preamble

Knowledge about the electronic structure of Metals, Semiconductors, Magnetic materials, Superconductors, Dielectrics and New Engineering materials has manifested as a technology to design materials of desired properties with applications.

#### UNIT 1 CONDUCTING MATERIALS

Conductors – Classical free electron theory of metals – Electrical and thermal conductivities -Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory –Fermi distribution function – Effect of temperature on Fermi function – Density of energy states –Carrier concentration in metals.

#### UNIT 2 SEMICONDUCTING MATERIALS

Intrinsic semiconductor – Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – Electrical conductivity – Band gap determination –Types of semiconductor- Derivation of carrier concentration in n-type and p-type semiconductor– Variation of Fermi level with temperature and impurity concentration — Hall effect – Determination of Hall coefficient – Applications –Solar cell

#### UNIT 3 MAGNETIC AND SUPERCONDUCTING MATERIALS

Origin of magnetic moment – Bohr magneton – Comparison of dia, Para and Ferro magnetism –Domain theory – Hysteresis – Soft and hard magnetic materials – Antiferromagnetic materials.

Superconductivity: Properties – Type I and type II superconductors –BCS theory of superconductivity (qualitative) – High  $T_c$  superconductors – Josephson effect - Applications of superconductors –-SQUID, cryotron, magnetic levitation.

#### UNIT 4 DIELECTRIC AND FERROELECTRIC MATERIALS

Macroscopic description of the static dielectric constant. The electronic and ionic polarizabilities of molecules – Orientational polarization – Measurement of the dielectric constant of a solid.

The internal field – Lorentz, Clausius-Mosotti relation.Behaviour of dielectrics in an alternating field, elementary ideas on dipole relaxation – Piezo, pyro and ferroelectric properties of crystals -classification of ferroelectric crystals – BaTiO<sub>3</sub> and KDP.

#### UNIT 5 NEW ENGINEERING MATERIALS

**TEXT BOOKS:** 

2015.

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Light waves in a homogeneous medium – refractive index – dispersion: refractive indexwave length behaviour – group velocity and group index – complex refractive index and light absorption – Luminescence, Opto electronic Devices- LED – LCD -Electro-optic effect and amplitude modulatorselectro-absorption-Classification of transducers-applications-Introduction-Biomaterials.

Palanisamy P.K, "Materials Science", 2<sup>nd</sup> Edition, Scitech publications (India) Pvt. Ltd., Chennai,

#### **TOTAL: 45 PERIODS**

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2 S.O.Pillai "Solid State Physics",9<sup>th</sup>Edition,New Age International(P) Ltd, Publishers, New Delhi, 2020.

#### **REFERENCES:**

- 1. Balasubramaniam R, "Callister's Materials Science and Engineering", 2nd Edition, Wiley-India 2014.
- 2. Donald.A.Neamen., "Semiconductor physics and devices:basic principles", 4<sup>th</sup>Edition, Tata McGraw-Hill 2012.
- 3. Richard J.D.Tilley," Understanding Solids",2<sup>nd</sup> Edition, John Wiley&Sons –India, 2013

#### e-Resources :

- 1. https://www.coursera.org/specializations/semiconductor-devices
- 2. https://nptel.ac.in/courses/113102080

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

- CO1 Explain the behavior of conducting materials based on classical and Quantum theory for Electrical and Thermal conductors.
- CO2 Demonstrate the knowledge on semiconductors with respect to carrier concentration and hall effect using density of energy states
- CO3 Compare the properties of magnetic materials for dia, para and ferro magnets and discuss the applications of superconductors using SQUID, Cryotron and MAGLEV
- CO4 Analyze the performance of dielectric materials using polarization and Piezo, Pyro ,Ferroelectric properties of crystals.
- CO5 Explore the properties of optical devices using refractive index, dispersive power, group velocity, group index, complex refractive index, light absorption for an application.

COs/POs	PO 1	<b>PO</b> 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	1	1			1	1	1		
CO 2	3	2	1	1	1	1	1			1	1	1		
CO 3	3	2	1	1	1	1	1			1	1	1		
CO 4	3	2	1	1	1	1	1			1	1	1		
CO 5	3	2	1	1	1	1	1			1	1	1		

#### Mapping of COs with POs and PSOs

VCET, B.E-ECE, R2022 Curriculum and Syllabus

#### 22ITT21

(For the students admitted from AY 2023-2024 onwards)

**C PROGRAMMING** 

#### **Preamble:**

This course aims at giving adequate exposure to students on the principles of procedural programming language. The course is intended to introduce the students to computational thinking and make the students develop C Programs using basic programming constructs. The course will enable the students to apply the fundamentals of C programming to solve Engineering problems.

#### **UNIT 1 BASICS OF C PROGRAMMING**

Introduction to Programming – Introduction to C - Structure of C program – Compilation and Execution - C Tokens –Keywords, Variables, Constants - Data Types – Input/output statements - Operators: Precedence and Associativity - Expressions – Type Conversion and Typecasting - Decision control and Looping statements - Preprocessor directives. Case study: EB Bill Generation

#### UNIT 2 ARRAYS AND STRINGS

Introduction to Arrays: Declaration, Initialization – One dimensional array –Linear Search, Binary Search. Two dimensional arrays – Matrix Operations (Addition, Multiplication and Transpose) – Strings - String operations: length, compare, concatenate, copy, reverse – Array of Strings. Case Study: Sorting of student namelist in a classroom

#### **UNIT 3 FUNCTIONS AND POINTERS**

Introduction to functions - Built-in functions (string functions, math functions) – User-defined functions - Function prototype, function definition, function call – Parameter passing: Pass by value, Pass by reference - Recursion. Pointers – Declaration – Pointer expression and Pointer arithmetic – Array of pointers –Function Pointers – Case Study: Scientific calculator using built-in functions and user defined functions

#### UNIT 4 STRUCTURES, UNION AND ENUMERATED DATATYPES

Structure - Nested structures – Pointer and Structures – Array of structures – Structure and Functions – Union - Example Programs using structures and Unions – Enumerated Data types. Case Study: Create employee datasheet using Structure, Union.

#### UNIT 5 FILE PROCESSING

Introduction to Files – Using Files in C – Reading and writing Files –Types of file processing: Sequential access, Random access - Functions for selecting a record - Command line arguments -Storage classes – Dynamic memory allocation. Case study: Processing stock details of Library.

#### TEXT BOOKS: PERIODS

- 1. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
- 2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 3<sup>rd</sup> Edition, Oxford University Press, 2013.

#### **REFERENCES:**

1. Paul Deitel and Harvey Deitel, C How to Program with an Introduction to C++, Eighth edition,

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**TOTAL: 45** 

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Pearson Education, 2018.

- 2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
- 3.Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.

#### e-RESOURCES:

- 1. https://onlinecourses.nptel.ac.in/noc22\_cs40/preview
- 2. https://onlinecourses.nptel.ac.in/noc22\_cs45/preview

Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Apply suitable data type and control statements in C language to solve the given problem.
- CO2 Experiment the given list of data through sorting or searching techniques in C.
- CO3 Develop C programs using functions and pointers to access arrays.
- CO4 Apply user defined data types like structures and unions to solve problems.
- CO5 Develop C programs to store and process the given data using files.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	2	-	2	1	-	-	-	-	1	-	-
CO2	3	2	3	2	-	2	1	-	-	-	-	1	-	-
CO3	3	2	3	2	-	2	1	-	-	-	-	1	-	-
CO4	3	2	3	2	-	2	1	-	-	-	-	1	-	-
CO5	3	2	3	2	-	2	1	-	-	-	-	1	-	-

#### Mapping of COs with POs and PSOs

22ECT21

(For the students admitted in AY 2022-2023 only)

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#### **Pre-requisites : Nil**

#### Preamble

This course introduces the fundamental concepts of DC and AC machines and transformers. The use of instruments and techniques for practical measurements required in electrical and electronic measurements are discussed in this course.

## UNIT 1 DC MACHINES

Introduction – Constructional Features – Operation of DC Generator and DC Motor - EMF and Torque equation – Types and Characteristics of DC Generator and DC Motor – Universal Motor – Brushless DC Motor – Applications.

### UNIT 2 AC ROTATING MACHINES

Synchronous Machines: Construction – Working Principle and Types of Alternator – EMF equation - Working Principle of Synchronous Motor.

Induction Motors: Construction and Working Principle of three phase Induction Motors – Losses and Efficiency – Construction and operation of Split Phase Induction Motor.

#### UNIT 3 TRANSFORMER

Single Phase Transformers: Construction - Principle of Operation – EMF Equation - Ideal Transformer – Actual Transformer on No Load and Load – Losses and Efficiency – Three Phase Transformers – Auto Transformers – Applications.

## UNIT 4 MEASUREMENTS AND INSTRUMENTATION

Functional Elements of an Instrument, Standards and Calibration, Construction and Working of Moving Coil Instruments and Moving Iron Instruments - Measurement of three phase Power, Energy Meter, Instrument Transformers: CT and PT – CRO Block diagram.

#### UNIT 5 BASICS OF POWER SYSTEMS

Power System Structure - Generation, Transmission and Distribution – Earthing – Methods of Earthing - Protective Devices: Switch Fuse Unit - Miniature Circuit Breaker- Molded Case Circuit Breaker- Earth Leakage Circuit Breaker - Safety Precautions and First Aid.

## **Total : 45 PERIODS**

#### **TEXT BOOKS:**

- 1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
- 2. S. K, Bhattacharya, "Basic Electrical and Electronics Engineering", Second Edition, Pearson Education, 2017.
- 3. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International pvt.ltd.,2003

#### **REFERENCES:**

1. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi, 2015.

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- 2. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
- 3. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

#### e-Resources:

- 1. https://nptel.ac.in/courses/108105153/,"Electrical Measurement and Electronic Instruments", Prof. Avishek Chatterjee, IIT, Kharagpur.
- 2. https://nptel.ac.in/courses/108102146/,"Electrical Machines", Prof. G.Bhuvaneshwari, IIT, Delhi.

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

- CO1 Illustrate the construction, working, characteristics and applications of DC machines.
- CO2 Analyze the working of single phase induction and three phase induction motors and synchronous motor.
- CO3 Explain the construction and working principle of transformers.
- CO4 Explain the principle and operation of instruments used for the measurement of voltage, current, power and energy and waveform analyzers.
- CO5 Explain the earthing techniques used in home and industries and working principle of protective devices.

Cos/DOs	РО	РО	РО	PO	PO	РО	РО	РО	PO	PO	РО	PO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	1	1			1	1			1		2		
CO 2	3	1	1			1	1			1		2		
CO 3	3	1	1			1	1			1		2		
CO 4	3	1	1	1	1	1	1			1	2	2		
CO 5	3		1	1	1	1	1			1	2	2		

#### Mapping of COs with POs and PSOs

22ECT11

#### **Preamble**

The invention of solid state diodes and transistors has revolutionized the world. All the developments in the applications of electronics started with these. The fundamental components spawned into a range of signal and power devices. An engineer has to understand these devices which the building blocks of the circuits and systems.

SEMICONDUCTOR DEVICES

(For the students admitted from AY 2023-2024 onwards)

#### UNIT 1 **PN JUNCTION DIODE**

Construction, Theory and operation of PN junction diode - VI Characteristics - current equation - Diode resistances and capacitances - Ratings - Applications - Zener diode and its characteristics - voltage regulation using zener diodes.

#### UNIT 2 **BJT TRANSISTOR**

Principle of operation of PNP and NPN transistors - study of CE, CB and CC configurations and comparison of their characteristics.

#### FET AND MOSFET UNIT 3

Construction, Operation, Characteristics and Application of JFET - JFET Parameters -JFET as VVR. Construction, Operation, Characteristics and Application of MOSFETs - EMOSFET and DMOSFET.

#### UNIT 4 SPECIAL PURPOSE DIODES

Construction, Operation, Characteristics and Application of Tunnel diode, Varactor diode, LED, Laser diode, Photodiode, Gunn diode, Schottky Diode.

#### POWER DEVICES AND DIODE APPLICATIONS UNIT 5

Construction, Operation, Characteristics and Application of SCR, DIAC, TRIAC-IGBT. Operation and Analysis of Rectifiers: Half-Wave and Full-Wave (both centre-tapped and bridge types) Rectifiers with capacitor filters, Android app based circuit simulation.

## **TEXT BOOKS:**

- Salivahanan S & Sureshkumar N, "Electronic Devices and Circuits", McGraw Hill, Fourth 1. Edition, 2017.
- Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th Edition, 2. Pearson Education / PHI, 2013.

## **REFERENCES:**

Dr. K.R. Valluvan, Prof. M. Vijayan, "Fundamentals of Semiconductor Devices", Charulatha 1. Publications, 2018.

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**Total : 45 Periods** 

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- 2. J. Millman, C Chalkias & SatyabrataJit, "Electronic Devices & Circuits", Tata McGraw Hill, 3<sup>rd</sup> Edition, 2010.
- 3. David A. Bell, "Electronic Devices and Circuits", Prentice Hall of India, 2004.

#### e-Resources:

- 1. https://nptel.ac.in/courses/108108122, Fundamentals of semiconductor devices, Prof. Digbijoy N. Nath, IISc Bangalore.
- 2. https://nptel.ac.in/courses/117103063, Basic Electronics, Prof. Chitralekha Mahanta, IIT Guwahati.

**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Analyze the characteristics of PN junction diode and Zener diode under forward bias and reverse bias condition.
- CO2 Analyze the input and output characteristics of CB, CE and CC configurations of BJT.
- CO3 Discuss the Construction, Operation, Characteristics and Application of JFET and MOSFETs.
- CO4 Discuss the Construction, Operation, Characteristics and Application of Tunnel diode, Varactor diode, LED, Laser diode, Photodiode, Gunn diode, Schottky Diode.
- CO5 Analyze the characteristics of SCR, DIAC and TRIAC.

Course	PO	PSO	PSO											
outcome	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1	1	1	1	1			1	1	1		
CO2	3	1	1	1	1	1	1			1	1	1		
CO3	3	1	1	1	1	1	1			1	1	1		
CO4	3	1	1	1	1	1	1			1	1	1		
CO5	3	1	1	1	1	1	1			1	1	1		

#### Mapping of COs with POs and PSOs

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#### **Pre-requisites: Basic Geometry**

#### Preamble

The knowledge of Engineering graphics is essential for the Engineering graduates in proposing new product designs through drawings and interpreting data from existing drawings. Engineering Design inculcates into an Engineer the creativity and knowledge on various aspects to be considered while designing and realizing the functional products and processes. This course deals with Engineering curves, orthographic and pictorial projections, sectional views and development of surfaces.

#### UNIT 1 INTRODUCTION AND PLANE CURVES

Importance of graphics in Engineering applications – Use of drafting instruments – BIS conventions and specifications –Size, layout and folding of drawing sheets – Diagonal scales and vernier scales- Lines, lettering and dimensioning - Basic geometrical constructions (circular and polygonal surfaces). (PRACTICE ONLY AND NOT FOR EXAMINATIONS).

Curves used in Engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – Construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

#### UNIT 2 PROJECTION OF POINTS, LINES AND PLANE SURFACES

Orthographic projection- principles-Principal Planes - First angle projection- Projection of points in four quadrants – End point projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method.

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

#### UNIT 3 PROJECTION OF SOLIDS

Projection of simple solids- Cube, prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane and parallel to the other by rotating object method.

#### UNIT 4 SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

Sectioning of above solids in simple vertical position when cut by a cutting plane which is inclined to one of the reference planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids in simple vertical position – Cube, prisms, pyramids, cylinder and cone.

### UNIT 5 ISOMETRIC AND FREE HAND SKETCHING

Principles of isometric projection – Isometric scale –Isometric projections of simple solids - Prisms, pyramids, cylinder and cone- Combination of two solid objects in simple vertical position.

Visualization concepts- Free hand sketching – Conversion of Isometric view to orthographic views. Perspective projection of simple solids (Qualitative only).

Introduction to CAD software (Not for Examinations)

### **Total: 60 PERIODS**

### **TEXT BOOKS:**

- 1. Venugopal K and Prabhu Raja V., "Engineering Graphics", New Age International (P) Ltd, 13th Edition, 2015.
- 2. Jeyapoovan T., "Engineering Graphics with AUTOCAD", Vikas Publishing House Pvt., Ltd., 7th Edition, 2015.

### **REFERENCES:**

- 1. Bhatt N.D., Panchal, V.M. and Ingle P.R., "Engineering Drawing", Charotar Publishing House Pvt. Ltd., 53rd Edition, 2014.
- 2. Parthasarathy N.S. and Vela Murali, "Engineering Drawing", Oxford University Press, 1st Edition, Second Impression 2015.
- 3. Luzzader W..J. and Duff J.M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.

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

- CO1 Draw the various conic sections and Engineering curves
- CO2 Sketch projections of lines and planes with vertical and inclined positions
- CO3 Draw the projections of solids kept in various positions.
- CO4 Sketch sectioned views of solids and development of surfaces.
- CO5 Draw the isometric and orthographic views from given pictorial views.

#### Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1							2		1		
CO 2	3	2	1							2		1		
CO 3	3	2	1							2		1		
CO 4	3	2	1							3		2		
CO 5	3	2	1							3		2		

22HST11

#### **Pre-requisites : Nil**

#### UNIT 1 LANGUAGE AND LITERATURE

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

HERITAGE - ROCK ART PAINTINGS TO MODERN ART - SCULPTURE 3 UNIT 2 Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making -Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

#### FOLK AND MARTIAL ARTS UNIT 3

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

#### UNIT 4 THINAI CONCEPT OF TAMILS

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

#### CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN UNIT 5 **CULTURE**

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

#### **TEXT BOOKS:**

- 1. பிள்மள தமிழகவரலொறு மக்களும்பண்பொடும் (தவளியீடு: மக.மக. தமிழ்நொடுபொடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
- 2. கணினித்தமிழ் – முமனவர்இல. சுந்தரம். (விகடன் பிரசுரம்).
- 3. கீழடி – மவமகநதிக்கமரயில்ெங்ககொலநகரநொகரிகம் (ததொல்லியல்துமற தவளியீடு)
- 4. தபொருமந – ஆற்றங்கமரநொகரிகம். (ததொல்லியல்துமறதவளியீடு)

#### Total: 15 PERIODS

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

#### TAMILS AND TECHNOLOGY

(For the students admitted from AY 2023-2024 onwards)

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#### **Pre-requisites : Nil**

## **UNIT 1** WEAVING AND CERAMIC TECHNOLOGY

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

UNIT 2 DESIGN AND CONSTRUCTION TECHNOLOGY

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

## UNIT 3 MANUFACTURING TECHNOLOGY

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

UNIT 4 AGRICULTURE AND IRRIGATION TECHNOLOGY

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

## UNIT 5 SCIENTIFIC TAMIL & TAMIL COMPUTING

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

## **Total : 15 PERIODS**

## **TEXT BOOKS:**

- தமிழக வரலாறு மக்களும்பண்பாடும் மக.மக. பிள்மள (தவளியீடு: தமிழ்நொடுபொடநூல்மற்றும் கல்வியியல்பணிகள்கழகம்).
- 2. கணினித்தமிழ் முமனவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
- **3.** கீழடி மவமகநதிக்கமரயில்ெங்ககொலநகரநொகரிகம் (ததொல்லியல்துமற தவளியீடு)
- **4.** தபொருமந ஆற்றங்கமரநொகரிகம். (ததொல்லியல்துமறதவளியீடு)
- 5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL (in print)
- **6.** Social Life of the Tamils The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
- 7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
- 8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

- 9. Keeladi 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
- **10.** Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
- **11.** Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
- **12.** Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) Reference Book.

#### 22PHL21

#### PHYSICS AND CHEMISTRY LABORATORY II L T P C

((For the students admitted in AY 2022-2023 only)

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#### Preamble

This course aims to impart knowledge in the determination of the physical parameters such as young's modulus, band gap, Co-efficient of viscosity, thickness of thin wire and Rigidity modulus of wire. This course also aims to impart the significance and estimation of DO and Cl<sup>-</sup> content in water sample by titrimetric method. Amount of Na<sup>+</sup>, Ba<sup>2+</sup>and acid with electroanalytical techniques such as flame photometry, conductometry and pH meter in the aqueous solutions has been quantitatively analyzed.

#### PHYSICS LABORATORY II LIST OF EXPERIMENTS

- 1. Determination of Young's modulus by Uniform bending method.
- 2. Determination of bandgap of semiconductors.
- 3. Determination of co-efficient of viscosity by Poiseuille's method.
- 4. Determination of thickness of thin wire by Air wedge method.
- 5. Determination of rigidity modulus-torsion pendulum.

### CHEMISTRY LABORATORY II LIST OF EXPERIMENTS

- 1. Determination of Dissolved Oxygen content of waste water sample by Winkler's method.
- 2. Determination of chloride content of wastewater sample by Argentometric method.
- 3. Estimation of dissolved metal ions present in wastewater using flame photometer.
- 4. Conductometric precipitation titration of BaCl<sub>2</sub> vs Na<sub>2</sub>SO<sub>4</sub> using conductivity meter.
- 5. Determination of acid strength in waste water using pH meter.

#### **Total: 45 Periods**

- CO1 Experiment and determine the physical characteristics of given solid materials using Young's modulus-Uniform bending method, Air wedge and Torsion Pendulum
- CO2 Experiment and determine the band gap energy of a given semiconducting material using Zener diode.
- CO3 Experiment and determine the physical characteristics of a given liquid using Poiseuille's method.
- CO4 Experiment and estimate the amount of dissolved oxygen by Winkler's method and Chloride content by Mohr's method.
- CO5 Analyse the concentration of metal ions and acid present in the wastewater with the aid of Flame photmeter, Conductivity meter and pH meter.

## Mapping of COs with POs and PSOs

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 1 0	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1		3		1	1		1	1	1	1		
CO2	2	1		3		1	1		1	1	1	1		
CO3	2	1		3		1	1		1	1	1	1		
CO4	2	1		3		1	1		1	1	1	1		
CO5	2	1		3		1	1		1	1	1	1		

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

"-" No correlation

22ITL21

#### C PROGRAMMING LABORATORY

LTPC

(For the students admitted from AY 2023-2024 onwards)

0 0 2 1

### **Preamble:**

This laboratory course is intended to provide students with opportunities to get hands on training to solve Engineering problems using C programming language.

## LIST OF EXPERIMENTS

- 1. If the three sides of a triangle are entered through the keyboard, write a program to check whether the triangle is valid or not. The triangle is valid if the sum of two sides is greater than the largest of the three sides.
- 2. A university has the following rules for a student to qualify for a degree with A as the main subject and B as the subsidiary subject:

(a) He should get 55 percent or more in A and 45 percent or more in B.

(b) If he gets than 55 percent in A he should get 55 percent or more in B. However, he should get at least 45 percent in A.

(c) If he gets less than 45 percent in B and 65 percent or more in A he is allowed to reappear in an examination in B to qualify.

(d) In all other cases he is declared to have failed.

Write a program to receive marks in A and B and Output whether the student has passed, failed or is allowed to reappear in B.

- 3. Twenty-five numbers are entered from the keyboard into an array. Write a program to find out how many of them are positive, how many are negative, how many are even and how many odd.
- 4. Write a program that extracts part of the given string from the specified position. For example, if the sting is "Working with strings is fun", then if from position 4, 4 characters are to be extracted then the program should return string as "king". Moreover, if the position from where the string is to be extracted is given and the number of characters to be extracted is 0 then the program should extract entire string from the specified position.
- 5. A positive integer is entered through the keyboard, write a program to obtain the prime factors of the number. Modify the function suitably to obtain the prime factors recursively.
- 6. Write a function to compute the distance between two points and use it to develop another function that will compute the area of the triangle whose vertices are A(x1, y1), B(x2, y2), and C(x3, y3). Use these functions to develop a function which returns a value 1 if the point (x, y) lines inside the triangle ABC, otherwise a value 0.
- 7. An animal could be a canine (dog, wolf, fox, etc.), a feline (cat, lynx, jaguar, etc.), a cetacean (whale, narwhal, etc.) or a marsupial (koala, wombat, etc.). The information whether a particular animal is canine, feline, cetacean, or marsupial is stored in bit number 0, 1, 2 and 3 respectively of a integer variable called type. Bit number 4 of the variable type stores the information about whether the animal is Carnivore or Herbivore. For the following animal, complete the program to determine whether the animal is a herbivore or a carnivore. Also determine whether the animal is a canine, feline, cetacean or a marsupial.

- 8. There is a structure called employee that holds information like employee code, name, date of joining. Write a program to create an array of the structure and enter some data into it. Then ask the user to enter current date. Display the names of those employees whose tenure is 3 or more than 3 years according to the given current date.
- 9. Given a list of names of students in a class, write a program to store the names in a file on disk. Make a provision to display the nth name in the list (n is data to be read) and to display all names starting with S.
- 10. Assume that a Master file contains two fields, Roll no. and name of the student. At the end of the year, a set of students join the class and another set leaves. A Transaction file contains the roll numbers and an appropriate code to add or delete a student. Write a program to create another file that contains the updated list of names and roll numbers. Assume that the Master file and the Transaction file are arranged in ascending order by roll numbers. The updated file should also be in ascending order by roll numbers.

### **TOTAL:45 PERIODS**

#### **Course Outcomes:**

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

- CO1 Develop and test the C program to solve a given problem statement using suitable data types, decision making and control statements.
- CO2 Write the C program to process the given list of data using the concepts of arrays and strings.
- CO3 Develop and test the C program for the given problem statement using functions and recursion.
- CO4 Apply the concepts of structure and union to solve a given problem statement in C.
- CO5 Construct the C program to store and process the given data using files.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO2	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO3	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO4	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO5	2	3	3	3	2	1	1	-	1	-	-	2	-	-

#### Mapping of COs with POs and PSOs

#### 22MEL11

#### WORKSHOP PRACTICES LABORATORY

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#### **Pre-requisites:** Nil

#### **Preamble:**

Workshop practices give hands-on training practice to Engineering students. This course includes carpentry, plumbing, welding, sheet metal forming and welding exercises. Also, this course will inculcate in the students the habit of selecting right tools, planning the job and its execution

#### **GROUP** A

#### CIVIL

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#### **Plumbing Works**:

- Study of plumbing tools, pipeline joints, its location, functions and safety aspects.
- 1. a. Distribution of water from sump to overhead tank and return to home tap with bye pass connection.
  - b. Distribution of water in mixed pipes.

#### **Carpentry using Power Tools only:**

• Study of the carpentry tools, joints and processes in roofs, doors, windows and furniture and safety precautions.

Hands-on-exercise:

- a. Tee Lap joint
- b. Dove tail joint

#### MECHANICAL

#### Welding:

- 1. Arc welding Lap joint
- 2. Arc welding Tee joint

#### **Basic Machining:**

- 3. Simple Turning and Facing
- 4. Drilling and Tapping

#### **Sheet Metal Work- Forming & Bending:**

5. Model making - Tray / Funnel

#### **Study Experiments:**

- (a) Study of centrifugal pump
- (b) Study of air conditioner

#### **Demonstration:**

• Gas welding practice

#### **GROUP B**

#### ELECTRICAL

1. Residential house wiring using switches, fuse, indicator and lamps.

- 2. Fluorescent lamp wiring.
- 3. Staircase wiring.
- 4. Reading of voltage, current, power, energy and other parameters with 1 phase digital energy meter.
- 5. Measurement of earth resistance.

#### **ELECTRONICS** 1. Identification and Study of Electronic components and equipments – Resistors, capacitors,

- inductors, colour coding and measurement.
- 2. Measurement of AC signal parameters (peak-peak, RMS value, period, frequency) using CRO.
- 3. Verification of the truth tables of logic gates: AND, OR, XOR and NOT.
- 4. Construction of Half Wave and Full Wave Rectifiers and study their output waveforms.
- 5. Soldering practice Using general purpose PCB.

#### **REFERENCES:**

#### Lecture :0, Tutorial: 0, Practical: 45 Total : 45

1. Manual prepared by the faculty of Mechanical Engineering Department, VCET.

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

- CO1 Fabricate various joints by carpentry and to prepare plumbing line assemblies.
- CO2 Fabricate various joints through arc welding and gas welding processes.
- CO3 Perform metal forming and basic machining operations.
- CO4 Construct various types of domestic wiring and measure the various electrical parameters.
- CO5 Develop and test circuits with active elements and verify truth table of logic gates.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1		3			2	2		1		
CO 2	3	2	1	1		3			2	2		1		
CO 3	3	2	1	1		3			2	2		1		
CO 4	3	2	1	1		3			2	2		1		
CO 5	3	2	1	1		3			2	2		1		

#### Mapping of COs with POs and PSOs

# 22ECL21ELECTRON DEVICES LABORATORYLTPC0021

#### Pre-requisites: 22ECT11 - Semiconductor Devices

#### Preamble

The goals are to supplement the theory course 22ECT11 Semiconductor Devices to develop a solid understanding of the devices concepts that will be needed in a broad range of areas from semiconductor to circuit design and engineering.

#### LIST OF EXPERIMENTS

- 1. Verify the Characteristics of PN Junction diode.
- 2. Verify the Characteristics of Zener diode.
- 3. Voltage regulation using Zener diode.
- 4. Verify the Characteristics of Transistor under CE configurations.
- 5. Verify the Characteristics of Transistor under CB configurations.
- 6. Verify the Characteristics of JFET.
- 7. Verify the Characteristics of Photodiode.
- 8. Verify the Characteristics of SCR.
- 9. Verify the Characteristics of DIAC.
- 10. Half wave and Full wave rectifier with filters.

#### **TOTAL: 45 PERIODS**

**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Experiment and determine the VI characteristics of PN junction and Zener diodes.
- CO2 Experiment and test voltage regulation characteristics using Zener diode voltage regulator circuit and determine the regulation characteristics.
- CO3 Experiment and determine the input and output characteristics of BJT using CB and drain & transfer characteristics of JFET.
- CO4 Experiment and determine the VI characteristics of Photodiode, SCR and DIAC.
- CO5 Experiment and test half wave and full wave rectifier circuit using PN junction diode and obtain the ripple factor, rectifier frequency.

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PS O2
CO1	3	2	2	3	1	1			2		2	1		
CO2	3	2	2	3	1	1			2		2	1		
CO3	3	1	2	3	1				2	1	2			
CO4	3	1	2	3	1				2	1	2			
CO5	3	1	2	3	1		1		2		2			

#### Mapping of COs with POs and PSOs

#### **ENVIRONMENTAL SCIENCE AND ENGINEERING** L Т Р **22MCT03** 2 0 0

(Common to all B.E/B.Tech Programmes)

#### **Preamble**

The study of biodiversity reflects the level of national interest in natural resources and heritage, which is considered as an important part of a country's wealth. As India is one of the world's 12 giant diversity hubs, we need to focus on understanding, preserving and utilizing the biodiversity of our biological resources. Environmental protection is an important issue for today's society, as scientific research provides evidence of increased global warming, ozone depletion and increased pollution. Engineers need to learn the importance of green synthesis in the design, development and evaluation of structures, devices and systems to provide practical solutions to the problems caused by the pollution and depletion of natural resources.

#### UNIT 1 NATURAL RESOURCES, ECOSYSTEM AND BIODIVERSITY

Forest Resources - use and over exploitation - Water Resources - use and over utilization - Dams benefits and problems - Ecosystem - structure and function - Biodiversity - types - threats to biodiversity - Biodiversity conservation-In-situ and Ex-situ - Role of an individual in conservation of natural resources.

#### **ENVIRONMENTAL POLLUTION** UNIT 2

Definition – causes, effects and control measures – Air Pollution, Water Pollution, Soil Pollution – Solid waste - methods of disposal - sanitary landfill, incineration and composting - Environmental Impact Assessment and ISO 14000.

#### UNIT 3 **E-WASTE AND ITS MANAGEMENT**

E-Waste – sources of e-waste – hazardous substances in e-waste – effects of e-waste on environment and human health – need for e-waste management – disposal treatment methods of e-waste – Global scenario of e-waste – e-waste in India- case studies.

#### **UNIT 4** SOCIAL ISSUES AND THE ENVIRONMENT

Social issues - Sustainable development - Water conservation - rain water harvesting. Disaster Management – floods, earthquake, cyclone and landslides. Role of IT in environment and human health. UNIT 5 **GREEN CHEMISTRY** 

Green Chemistry - twelve principles of green chemistry - Importance of green synthesis - Green synthesis – dimethyl carbonate – Bio-catalysts – extraction of gold – Applications of green synthesis.

#### **TEXT BOOKS:**

- Environmental Science, 5th Edition. P. N. Palanisamy, P. Manikandan, A. Geetha, K. Manjula 1. Rani, V. N. Kowshalya, Pearson India Education services Private Limited, 2020.
- Environmental Science and Engineering, 2<sup>nd</sup> edition, Dr.T. Arun Luiz, V K publications, 2018. 2.

#### **REFERENCES:**

- Environmental Science and Engineering, 3rd reprint, Benny Joseph, McGraw Hill Education 1. (India) Private Limited, New Delhi, 2015.
- Engineering Chemistry, 1<sup>st</sup> Impression, K. Sesha Maheswaramma, Mridula Chugh, Pearson India 2. Education Services Private Limited, 2016.
- Introduction to Environmental Engineering and Science, 2<sup>nd</sup> edition, Gilbert M. Masters, 3. Prentice Hall of India Private Limited, 2015.

## **TOTAL : 30 PERIODS**

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#### e-Resources:

- 1. https://www.digimat.in/nptel/courses/video/105105169/L01.html, "Electronic waste management-issues and challenges"- Prof. Brajesh Kumar Dubey, Department of Civil Engineering, IIT Kharagpur.
- 2. https://archive.nptel.ac.in/courses/105/103/105103205/, "Municipal solid waste management"-Prof. Ajay Kalamdhad, Department of Civil Engineering, IIT Guwahati.

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

- CO1 Recognize the biodiversity threats, overexploitation of forest and overutilization of water to conserve biodiversity.
- CO2 Analyze sources, impacts, air and water pollution control measures and solid waste management to maintain a green environment.
- CO3 Identify the Environmental impacts of e-waste and its management.
- CO4 Explain human health, environment and disaster management through information technology.
- CO5 Apply the principles of green chemistry to green synthesis for a sustainable environment.

COs\POs	PO 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	2	3	2	1	1	1	2	-	-
CO2	3	2	1	1	1	2	3	2	1	1	1	2	-	I
CO3	3	2	1	1	1	2	3	2	1	1	1	2	-	I
CO4	3	2	1	1	1	2	3	2	1	1	1	2	-	-
CO5	3	2	1	1	1	2	3	2	1	1	1	2	-	_

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-" No correlation
#### VCET, B.E-ECE, R2022 Curriculum and Syllabus

#### Preamble

22MAT32

This course aims to provide sufficient knowledge to engineering students in the specific mathematical techniques such as Fourier series, Fourier transforms and Z transforms. Probability theory is used extensively in the design of modern communication systems in order to understand the behavior of noise in the system.

TRANSFORM TECHNIQUES AND PROBABILTY THEORY

(Common to B.E. Electronics and Communication Engineering and

Medical Electronics Programme in Third Semester)

#### **UNIT 1 FOURIER SERIES**

Dirichlet's conditions - General Fourier series - Odd and even functions - Half range sine series -Half range cosine series – Parseval's identity – Harmonic Analysis

#### UNIT 2 FOURIER TRANSFORMS

Statement of Fourier integral theorem - Fourier transforms pair - Fourier sine and cosine transforms -Properties - Convolution theorem - Parseval's identity.

#### UNIT 3 Z TRANSFORMS

Z-transforms - Elementary properties - Inverse Z-transform (using Partial Fraction and Residues) -Convolution theorem - Formation of difference equations - Solution of difference equations using Z-transform.

#### **UNIT 4 PROBABILITY THEORY**

Sample space – Events – axioms of probability – conditional probability – Baye's theorem – Random variables: Discrete and continuous random variables – Moments.

#### **UNIT 5 STANDARD DISTRIBUTIONS**

Discrete distributions: Binomial, Poisson and Geometric distributions - Continuous distributions: Uniform, Exponential, Weibull and Normal distributions.

#### Lecture : 45; Tutorial : 15; Total : 60

### **TEXT BOOKS:**

- Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, University 1. Press India (P) Ltd, Hyderabad (2015).
- Grewal, B.S, "Higher Engineering Mathematics", 43<sup>rd</sup> Edition, Khanna publishers, Delhi (2016) 2.
- Ibe.O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 2<sup>nd</sup> Edition 3. 2014.
- 4 Walpole, S.C., Myers, R.H., Myers, S.L., and Ye.K., "Probability and Statistics for Engineerrs and Statistics",9<sup>th</sup> Edition,Pearson Education India,2013.

#### **REFERENCES:**

- Ramana.B.V., "Higher Engineering Mathematics", First edition, Tata Mc-GrawHill Publishing 1. Company limited, New Delhi, 2016
- 2. Erwin Kreyszig, "Advanced Engineering Mathematics", Tenth edition, Wiley Dream Tech India (P) Ltd. 2016
- 3. Johnson R.A., and Gupta.C.B., 'Miller and Freund's Probability and Statistics for Engineers," 8th Edition, Pearson Education India, 2015.
- Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata Mc Graw 4. Hill, 4<sup>th</sup> Edition, New Delhi, 2002

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#### e-Resources:

- 1. https://archive.nptel.ac.in/courses/111/106/111106111/ " Transform techniques for Engineers" Dr. Srinivasa Rao Manam, Department of Mathematics, IIT Madras.
- http://nptel.ac.in/courses/117105085/7, "Probability and Random Variables", Prof. M. Chakraborty, Department of Electronics and Electrical Communication Engineering, Indian Institute of Technology, Kharagpur.

**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Compute the trigonometric form of the Fourier series for periodic waveforms satisfying the Dirichlet's conditions and using them to evaluate infinite series.
- CO2 Compute the Fourier transform of non-periodic waveforms using Fourier Transform properties.
- CO3 Solve the difference equations of first and second order using Z-transform techniques.
- CO4 Understand conditional probability and solve the problems of Baye's theorem. Compute the probability and moments of one dimensional random variables.
- CO5 Model and solve the real life problems using discrete and continuous distributions.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 2	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 3	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 4	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 5	3	3	1	1	-	-	-	-	-	-	-	1	-	-

#### Mapping of COs with POs and PSOs

#### SIGNALS AND SYSTEMS

#### **Preamble:**

Signals and systems concerns with analysis and synthesis of deterministic signals and their interaction with LTI systems. The analysis of Signals and its concepts play a vital role in signal processing, image and video processing and digital/analog communications. In order to understand the analysis of signals in the frequency domain it is essential to learn Fourier analysis, Laplace and Z transforms. The discrete time version of a signal is needed to make a filtering and further processing of a signal.

#### UNIT 1 CLASSIFICATION OF SIGNALS AND SYSTEMS

Continuous time signals - Discrete time signals - Impulse, Step, Ramp, Parabolic, Sinusoidal, Exponential, Pulse – Operations on Signals – Classification of CT and DT signals: Deterministic & Random signals, Periodic & Aperiodic signals, Energy & Power signals, Causal & Non-causal, Even & Odd signals – CT systems and DT systems – Classification of systems: Static & Dynamic, Linear & nonlinear, Time-variant & Time-invariant, Causal & non-causal, Stable & unstable.

#### ANALYSIS OF CONTINUOUS TIME SIGNALS UNIT 2

Fourier series (Trigonometric and Exponential) - Spectrum of Continuous Time (CT) signals - Properties of Laplace Transform – Fourier and Laplace Transforms in CT signal analysis.

#### LINEAR TIME INVARIANT- CONTINUOUS TIME SYSTEMS UNIT 3 9+3

Differential Equations - Impulse response - Block diagram representation - Realization using Direct form I, Direct form II – Convolution integrals – Fourier and Laplace transforms in analysis of CT systems - CT Signal Modeling.

#### UNIT 4 ANALYSIS OF DISCRETE TIME SIGNALS

Sampling theorem – DTFT and Inverse DTFT – Z and Inverse Z Transform – Properties of Z Transform – DT Signal Analysis.

#### UNIT 5 LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS

Difference equations - Impulse response - Block diagram representation - Realization using Direct form I, Direct form II - Convolution sum - DTFT and Z Transform analysis of Recursive & Non-Recursive systems -Analysis of CT and DT Systems.

### **TEXT BOOK:**

- Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson Education, India, 1. 2<sup>nd</sup>Edn, reprint 2015.
- P.RameshBabu and R.Anandanatarajan, "Signals and Systems", Scitech Publication, 2018. 2.

### **REFERENCES:**

- B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009. 1.
- 2. M.J.Roberts, "Signals and Systems Analysis using Transform methods and MATLAB", McGraw Hill,  $2^{nd}$  Edition, 2017.
- A.Nagoorkani, "Signals and Systems", McGraw Hill, Second Edition, 2016. 3.

### e-RESOURCES:

Nptel Course, https://nptel.ac.in/courses/108104100, "Principles of Signals and Systems", Prof. Aditya 1. K. Jagannatham, Department of Electrical Engineering, IIT Kanpur.

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**TOTAL: 60 PERIODS** 

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2. Nptel Video, http://www.nptel.in/courses/117104074, "Signals and systems", Prof.K.S.Venkatesh, Department of Electrical Engineering, IIT Kanpur.

#### **OUTCOMES:** Upon completion of the course, students will be able to:

- Analyze the linearity, stability, causality and time invariance properties of CT and DT systems. 1.
- 2. Compute the frequency spectrum of the periodic CT signals using Fourier series and aperiodic CT signals using Fourier & Laplace transforms.
- 3. Realize the Direct Form I & II structures of the given LTI-CT systems and compute the impulse response.
- 4. Determine the frequency response of the given DT sequences using Z transform and DTFT.
- 5. Develop the Direct Form I & II structures of the given LTI-DT systems and determine the impulse response.

Cos/POs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
005/1 05	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	3	3	3	-	-	-	-	1	-	2	3	2
CO 2	3	3	3	3	3	-	-	-	-	-	-	2	3	2
CO 3	3	3	3	3	3	2	2	2	1	-	2	-	3	2
CO 4	3	3	3	3	3	2	2	2	-	1	-	2	3	-
CO 5	3	3	3	3	3	2	2	2	1	-	2	-	3	-
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#### **CO-PO Mapping:**

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

'- "No correlation

### 22EC132

#### **Pre-requisites :** 22ECT11 - Semiconductor Devices

#### Preamble

This course gives a comprehensive exposure to types of devices and circuits constructed with discrete components. This helps to develop a strong basis for building linear integrated circuits. It explains various methods to design and analyze single stage and multistage amplifier circuits. It also explains feedback amplifiers, oscillators principles, tuned amplifiers and multivibrators.

**ANALOG ELECTRONICS** 

#### UNIT 1 BIASING OF BJT AND MOSFET

Need for Biasing – Quiescent Point – DC and AC Load Lines – Stability Factors – Various Biasing Methods for BJT – Fixed Bias – Collector to Base Bias – Voltage Divider Bias – Bias Circuit Design – Bias Compensation Techniques – Biasing the MOSFET – Biasing of Enhancement MOSFET.

#### UNIT 2 BJT AMPLIFIERS

Small Signal Hybrid  $\pi$  Equivalent Circuit – Common Emitter Amplifier – Cascade Ampli

#### UNIT 3 FEEDBACK AMPLIFIERS

General Feedback Structure – Loop Gain – Properties of Negative Feedback – Basic Feedback Topologies – Method of Identifying Feedback Topology and Feedback Factor – Voltage Series, Current Series, Current Shunt and Voltage Shunt feedback – Stability of a Feedback Amplifiers.

#### UNIT 4 OSCILLATORS AND TUNED AMPLIFIERS

Classification – Barkhausen Criterion – Hartley, Colpitts, RC Phase Shift Oscillators – Frequency Stability of Oscillators – Small Signal Tuned Amplifiers – Capacitor Coupled Single Tuned Amplifiers – Large Signal Tuned Amplifiers – Class C Tuned Amplifiers – Efficiency and Applications – Stability of Tuned Amplifiers – Hazeltine Neutralization – Neutrodyne Neutralization.

### UNIT 5 WAVE SHAPING CIRCUITS

RC Integrator and Differentiator Circuits – Calculation of Storage, Delay and Switching Times in a BJT – Speed-up Capacitors – UJT Relaxation Oscillator – Schmitt Trigger Circuit – Diode Clippers – Positive Clippers, Negative Clippers, Biased Clippers, Combination Clippers – Clampers – Positive Clamper, Negative Clamper – Collector Coupled Astable Multivibrator – Voltage and Current Time Base Circuits.

### **TEXT BOOKS:**

- 1. Donald A. Neamen, "Microelectronics Circuit Analysis and Design", McGraw Hill Education (India) Private Limited, Fourth Edition, Reprint 2021.
- 2. S Salivahanan and N Suresh Kumar "Electronic Devices and Circuits", McGraw Hill Education (India) Private Limited, Fourth Edition, Reprint 2017.

#### **REFERENCES:**

1. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5<sup>th</sup> Edition, 2008.

#### Page 77

**TOTAL : 60 PERIODS** 

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## 22ECT32

- 2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India, 10<sup>th</sup> Edition, 2009.
- 3. K.R.Valluvan and K.S.Murugesan, "Analog Electronics", e-Book, 1<sup>st</sup> Edition, 2023.

#### e-Resources:

- 1. NPTEL video http://nptel.ac.in/courses/117103063/2, "Basic Electronics", Dr.Chitralekha, Mahanta, IIT Guwahati.
- 2. NPTEL video http://nptel.ac.in/courses/117101106/1, "Analog Circuits", Prof. A N, Chandorkar, IIT Bombay.

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

- CO1 Design biasing circuits for BJT and MOSFET to implement fixed bias, collector to base bias and voltage divider bias techniques.
- CO2 Determine the voltage gain, input and output resistances of single and multistage amplifiers using small signal hybrid- $\pi$  equivalent circuit for BJT.
- CO3 Analyze voltage series, current series, voltage shunt and current shunt feedback amplifiers using BJT to determine the voltage gain, input and output resistance.
- CO4 Design LC and RC oscillators using BJT to determine the frequency and condition for sustained oscillation. Analyze the characteristics of small signal and large signal tuned amplifiers.
- CO5 Describe the characteristics of wave shaping circuits and design astable multivibrator using BJT to generate non sinusoidal waveforms.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	3	2	2	2	1	1		1	1	1	1	2	3
CO 2	2	3	2	2	2	1	1					1	1	3
CO 3	2	3	2	2	2	1	1					1	1	3
CO 4	2	3	2	2	2	1	1		1	1	1	1	2	3
CO 5	2	3	2	2	2	1	1		1	1	1	1	2	3

#### Mapping of COs with POs and PSOs

#### 22ECT33

#### **Pre-requisites: Semiconductor Devices**

#### Preamble

Digital Electronics is a study of basic digital logic circuit design and implementation. The course aims at imparting the knowledge about Boolean algebra and its minimization techniques, implementation of combinational circuits using logic gates, synchronous and asynchronous sequential circuits design using state reduction.

**DIGITAL ELECTRONICS** 

#### **UNIT 1 BOOLEAN ALGEBRA AND LOGIC GATES**

Boolean laws - De-Morgan's Theorem - Principle of Duality - Minimization of Boolean expressions - Minterm -Maxterm - Sum of Products (SOP) - Product of Sums (POS) - Karnaugh map Minimization. Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR – Implementations of Logic Functions using gates – NAND-NOR implementations.

#### **UNIT 2 COMBINATIONAL CIRCUITS**

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Parallel binary adder – parallel binary Subtractor - Fast Adder: Carry Look Ahead adder - BCD adder - Multiplexer/ Demultiplexer – decoder/encoder – Code Converters: Binary to Gray – BCD to Excess-3 – Magnitude Comparator.

#### **UNIT 3 SEQUENTIAL CIRCUITS**

Flip-flops: SR, JK, D, T – Master-Slave: Characteristic table and equation – Excitation table – Edge triggering – Level Triggering – Asynchronous Up/Down counter – Design of Synchronous Up/Down counters – Modulo n counter – Programmable counters – State reduction – State Assignment --Registers: Shift registers, Universal shift registers.

#### UNIT 4 SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS 9+3

Synchronous Sequential Circuits: General Model – Classification – Design of synchronous sequential circuits -- Asynchronous Sequential Circuits: Design of fundamental mode circuits -- Hazards -- Races.

#### UNIT 5 **VERILOG HDL**

Data types and Operators – Dataflow modeling – Behavioral Modeling – Structural Modeling – Adders – Subtractors – Multiplexers/Demultiplexers – Encoder/Decoder – Asynchronous Counter – Synchronous Counter.

### **TEXT BOOKS:**

- M. Morris Mano, "Digital Design", 6<sup>th</sup> Edition, Prentice Hall of India Pvt. Ltd., New Delhi, May 1. 2018.
- S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", 5th Edition., Vikas Publishing House 2. Pvt. Ltd. New Delhi, 2018.

### **REFERENCES:**

Charles H. Roth, "Fundamentals of Logic Design", 7<sup>th</sup> Edition Thomson Learning, 2020 1.

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**Total : 60 PERIODS** 

- 2. John. M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
- 3. Samir Palnitkar, Verilog HDL-A guide to Digital Design and Synthesis" Pearson, 2003.

#### e-Resources:

- 1. Nptel video, https://nptel.ac.in/courses/108105132 ,"Digital Electronic Circuits", Prof.Goutam Saha , IIT Kharagpur.
- 2. Nptel video https://nptel.ac.in/courses/108103179, "System Design through Verilog", Prof. Shaik Rafi Ahamed, IIT Guwahati.

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

- CO1 Simplify Boolean Expressions of SOP and POS type by applying Boolean laws and Karnaugh Map techniques.
- CO2 Design and implement combinational circuits using logic gates.
- CO3 Design and implement synchronous/asynchronous up/down counters, modulo counters, shift registers using flip-flops.
- CO4 Design Synchronous and Asynchronous sequential circuits using state reductions.
- CO5 Write Verilog HDL Program for Combinational and Sequential Circuits.

#### Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	3							1					3
CO 2	2	3	2	2	2				1			1	1	3
CO 3	2	3		2	2		2			1		1	1	3
CO 4		3	2	2	2	1	2				1			3
CO 5		3	2	2	3	1	2			1	1			3

#### 22ECT34

**Pre-requisites :** 22ECT11 - Semiconductor Devices

#### Preamble

This course explains the basics about the electrical network systems. The course is used to gain knowledge on the fundamentals of electrical circuits, solving circuits using network theorems and to obtain the transient responses of AC and DC circuits.

**CIRCUIT ANALYSIS** 

#### UNIT 1 BASICS OF CIRCUIT ANALYSIS

Circuit elements - Ohms Law - Kirchoff<sup>\*</sup>s laws - Mesh and Nodel methods of analysis for DC and AC circuits, Voltage and Current sources - Resistors in Series and Parallel circuits - Source Transformation, Voltage and Current Division Rule.

#### UNIT 2 NETWORK REDUCTION AND THEOREMS

Network Reduction: Star-Delta Conversion - Network theorems: Superposition theorem - Thevenin's theorem - Norton's theorem - Reciprocity theorem - Maximum power transfer theorem.

#### UNIT 3 RESONANCE AND COUPLED CIRCUITS

Average and RMS values of Sinusoidal Current and Voltage – Resonance: Series and Parallel resonance - Q factor, Bandwidth and Selectivity - Coupled circuits: Self-inductance, Mutual inductance - Dot rule - Coefficient of coupling - Series and Parallel connection of coupled inductors - Single tuned coupled circuit.

## UNIT 4 TRANSIENT RESPONSE ANALYSIS USING LAPLACE TRANSFORM 12

Steady State and Transient Response - DC Response of an R-L circuit, R-C circuit and R-L-C circuit using Laplace Transform Techniques - Sinusoidal Response of R-L circuit, R-C circuit and R-L-C circuit using Laplace Transform Techniques.

#### UNIT 5 TWO PORT NETWORKS

Two port networks, Open Circuit Impedance (Z) Parameters, Short circuit Admittance (Y) Parameters, Transmission (ABCD) Parameters, Inverse Transmission (A'B'C'D') Parameters, Hybrid (h) Parameters, Inverse Hybrid (g) Parameters, Relationships between different Parameters, Interconnection of two-port Networks. Symmetrical properties of T and  $\pi$  networks.

#### **TEXT BOOKS:**

- 1. Shyammohan S.P., Sudhakar A, "Circuits and Network Analysis & Synthesis", Tata McGraw Hill, 5<sup>th</sup> edition, New Delhi, 2015.
- 2. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 9<sup>th</sup> edition, New Delhi, 2020.

**TOTAL : 60 PERIODS** 

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#### **REFERENCES:**

- 1. Chakrabarti A, "Circuits Theory Analysis and Synthesis", Dhanpath Rai & Co, 7<sup>th</sup> edition, New Delhi, 2018.
- 2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", McGraw Hill Education, 5<sup>th</sup> edition, New Delhi ,2013.
- 3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 5<sup>th</sup> edition, 2013.

#### e-Resources:

- 1. http://nptel.ac.in/courses/108102042/ "Circuit Theory", Prof.S.C.Dutta Roy, IIT Delhi.
- 2. http://nptel.ac.in/courses/117106101/ "Basics of electrical circuits", Prof Nagendra Krishnapura, IIT Madras.

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

- CO1 Analyze electrical circuits using mesh and nodal analysis.
- CO2 Apply network theorems to analyze electrical circuits.
- CO3 Analyze the phenomenon of resonance in RLC circuits.
- CO4 Derive the transient response of electrical circuits subjected to DC and AC with sinusoidal excitations.
- CO5 Analyze the two-port network using network parameters.

Cos/POs	PO 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	3	2		1	1	1				1	1		3
CO 2	2	3	2		1	1	1				1	1		3
CO 3	2	3				1	1	1		1		1		3
<b>CO 4</b>	2	3	2			1	1	1				1		3
CO 5	2	3				1	1					1		3

#### Mapping of COs with POs and PSOs

22HST21

#### **Pre-requisites : Nil**

#### **UNIT 1** WEAVING AND CERAMIC TECHNOLOGY

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

TAMILS AND TECHNOLOGY

(For the students admitted in AY 2022-2023)

### UNIT 2 DESIGN AND CONSTRUCTION TECHNOLOGY

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

### UNIT 3 MANUFACTURING TECHNOLOGY

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

### UNIT 4 AGRICULTURE AND IRRIGATION TECHNOLOGY

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

### UNIT 5 SCIENTIFIC TAMIL & TAMIL COMPUTING

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

### Total : 15 PERIODS

### **TEXT BOOKS:**

- தமிழக வரலாறு மக்களும்பண்பாடும் மக.மக. பிள்மள (தவளியீடு: தமிழ்நொடுபொடநூல்மற்றும் கல்வியியல்பணிகள்கழகம்).
- 2. கணினித்தமிழ் முமனவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
- **3.** கீழடி மவமகநதிக்கமரயில்ெங்ககொலநகரநொகரிகம் (ததொல்லியல்துமற தவளியீடு)
- **4.** தபொருமந ஆற்றங்கமரநொகரிகம். (ததொல்லியல்துமறதவளியீடு)
- 5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL (in print)
- **6.** Social Life of the Tamils The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

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- 7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
- 8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
- 9. Keeladi 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
- **10.** Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
- **11.** Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
- 12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) Reference Book.

#### 22ECL31

#### ANALOG ELECTRONICS LABORATORY

**Pre-requisites :** 22ECL21 – Electron Devices Laboratory

#### Preamble

This course is used to design and analyses of amplifiers, power amplifiers, feedback amplifiers, oscillators, tuned amplifiers and multivibrators and to determine the performance characteristics of electronic circuits. This course encourages the students to learn simulation software used in circuit design.

#### LIST OF EXPERIMENTS

#### **Design and construct the following experiments**

- 1. Differential Amplifiers.
- 2. Class A and Class B Power Amplifiers.
- 3. Current Series Feedback Amplifiers.
- 4. RC Phase Shift and Colpitts Oscillators.
- 5. Integrator and Differentiator.
- 6. Clippers and Clampers.

#### Design and simulate the following experiments

- 7. CS MOSFET and Single Tuned Amplifiers.
- 8. Cascade and cascode Amplifiers.
- 9. Schmitt Trigger and Astable Multivibrator.
- 10. Voltage and Current Time Base Circuit.

#### **TOTAL : 45 PERIODS**

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

- CO1 Design and test the amplifier and feedback amplifiers using voltage divider bias and determine the gain and bandwidth for with feedback and without feedback.
- CO2 Experiment and test the differential amplifier to calculate common mode rejection ratio. To construct varies power amplifiers and sketch the input and output waveforms.
- CO3 Design and Experiment the RC and LC oscillators using voltage divider bias and determine its frequency of oscillation.
- CO4 Demonstrate the characteristics of wave shaping circuits using active and passive components.
- CO5 Design and simulate amplifier, tuned amplifiers, Schmitt trigger, multivibrators and time base circuits using BJT and obtain the output waveform.

### Mapping of COs with POs and PSOs

	PO	PSO	PSO											
COS/POS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	2	2	3	3	1	1		3	1	1	1	2	3
CO 2	2	2	2	3	2	1	1		3	1	1	1	2	3
CO 3	2	2	2	3	2				3				2	3
CO 4	2	2	2	3	3				2				2	3
CO 5	2	2	2	3	3	1	1		2	1	1	1	2	3

### 22ECL32 DIGITAL ELECTRONICS LABORATORY L T P C

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#### **Pre-requisites: Electron Devices Laboratory**

#### Preamble

The course aims at experimentation and exploring designs with combinational and sequential logic. The course aims at Simulation of digital system and verifies their functionality using the Hardware description Language.

#### LIST OF EXPERIMENTS

#### Hardware Experiments

- 1. Design and implementation of Adders and Subtractors using logic gates.
- 2. Design and testing of Adder / Subtractor Circuits using 7483.
- 3. Design and implementation of code converters using logic gates.
  - (i) BCD to excess-3 code and vice versa.
  - (ii) Binary to gray and vice-versa.
- 4. Design and implementation of Multiplexer and Demultiplexer.
- 5. Design and Implementation of Encoder and Decoder.
- 6. Design and Implementation of 4-bit Magnitude Comparator using IC7485.
- 7. Design and Implementation of Synchronous and Asynchronous Counters using flip flops.
- 8. Design and Implementation of Shift Registers.

#### Simulation using Verilog HDL

9. Simulation of Combinational Circuits using Verilog HDL.

10. Simulation of Sequential Circuits using Verilog HDL.

### **TOTAL: 45 PERIODS**

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

- CO1 Experiment and test adders, subtractors and code converters.
- CO2 Experiment and test multiplexer, demultiplexer, encoders and decoders, Magnitude Comparator.
- CO3 Experiment and test synchronous and asynchronous counters.
- CO4 Experiment and test Shift registers.
- CO5 Write Verilog HDL Program for Combinational and Sequential Circuits and Simulate using IDE tool.

	PO	<b>PO1</b>	<b>PO1</b>	<b>PO1</b>	PS	PS								
Cos/POs	1	2	3	4	5	6	7	8	9	0	1	2	01	02
C01	2	2		3	2									3
CO2	2	2	2	3	2				2					3
CO3	2	2	2	3	2	2	2		2					3
CO4			2	3	2	2	2				1	1		3
CO5				3	3	2	2		2	1	1		1	3

Mapping of COs with POs and PSOs

#### 22ITT32 DATA STRUCTURES USING PYTHON L Т

#### **Pre-requisites** : Python Programming, Python Programming Laboratory **Preamble**

Data structure is an arrangement of data in computer's memory in such a way that it could make the data quickly available to the processor for required calculations. Lists, arrays, stacks, queues, heaps, trees, and graphs are the more commonly used data structures. Choosing an appropriate data structure to solve the given problem greatly influences the characteristics of the obtained solution.

### **UNIT 1 ABSTRACT DATA TYPES**

Abstract Data Types (ADTs) - ADTs and classes - Introduction to OOP concepts - classes in Python -Inheritance.

#### **UNIT 2 LINEAR STRUCTURES**

List ADT - Array-based Implementations - Linked List Implementations - Singly Linked Lists -Circularly Linked Lists - Doubly Linked Lists - Applications of Lists - Stack ADT - Queue ADT -Applications of Stacks and Queues.

### UNIT 3 TREES

Tree ADT - Tree Traversals - Binary Tree ADT - Expression trees - Binary Search Tree ADT - AVL Trees. Binary Heap - Heap Sort.

### **UNIT 4 GRAPHS**

Graph Definition - Representation of Graphs - Types of Graph - Breadth-first traversal - Depth-first traversal - Topological Sort - Dijkstra's algorithm - Minimum Spanning Tree - Prim's algorithm -Kruskal's algorithm.

### **UNIT 5 SEARCHING, SORTING AND HASHING**

Searching - Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort. Hashing - Hash Functions - Separate Chaining - Open Addressing - Rehashing - Extendible Hashing.

#### **TEXT BOOKS:**

- Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures and 1. Algorithms in Python" (An Indian Adaptation), Wiley, 2021.
- Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python" Springer Edition 2. 2015.

#### **REFERENCES:**

- 1. Narasimha Karumanchi, "Data Structures and Algorithmic Thinking with Python" Careermonk, 2015
- 2. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011.
- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to 3. Algorithms", Third Edition, PHI Learning, 2010.

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**Total : 45 Periods** 

#### e-RESOURCES:

- 1. https://onlinecourses.nptel.ac.in/noc22\_cs26/preview, "Programming, Data Structures and Algorithms Using Python", Prof. Madhavan Mukund, IIT-Bombay.
- 2. https://nptel.ac.in/courses/106106133, "Programming, Data structures and Algorithms", Prof. Hema A Murthy, Dr. N S. Narayanaswamy, Prof. Shankar Balachandran, IIT Madras.

**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Explain ADT and Create a class using Python to solve the given problem.
- CO2 Create list, stack and queue ADT for a given set of elements using array and linked list implementation and apply specific ADT for a given application.
- CO3 Construct a tree for a given list of data by ensuring tree properties and analyze inorder, preorder, postorder traversal for a constructed tree.
- CO4 Implement a suitable shortest path algorithm and identify the minimum spanning tree for the given graph such that the sum of the edges weights is minimum.
- CO5 Apply a suitable searching, sorting and hashing algorithms for a given list of data considering the size and ordering of data.

Cos/POs	PO 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1		1	1			1		1		
CO2	3	2	2	1		1	1			1		1		
CO3	3	2	2	1		1	1			1		1		
CO4	3	2	2	1		1	1			1		1		
CO5	3	2	2	1		1	1			1		1		

#### Mapping of COs with POs and PSOs

#### **22ECT41**

#### Pre-requisites : 22MAT32- Transform Techniques and Probability Theory

#### **Preamble**

Electromagnetic Fields provide students with an introduction to the fundamentals of electro statics, magneto statics, and electromagnetic waves and this course lays the foundations of electromagnetism and its practice in modern communications such as antenna, wireless and fiber optics etc.,

#### **UNIT 1 STATIC ELECTRIC FIELDS**

Vector Algebra - Coordinate Systems - Vector Differential operator - Gradient - Divergence - Curl -Divergence theorem - Stokes theorem - Coulombs law - Electric field intensity - Charge distributions -Electric flux density - Gauss law and its applications - Gauss divergence theorem - Absolute Electric potential – Potential difference – Calculation of potential differences for different configurations. Electric dipole – Electrostatic Energy and Energy density – Poisson's equation – Laplace's equation.

#### **UNIT 2 STATIC MAGNETIC FIELDS**

Biot-Savart Law - Magnetic field Intensity - Estimation of Magnetic field Intensity for straight and circular conductors - Ampere's Circuital Law - Point form of Ampere's Circuital Law - Magnetic flux and magnetic flux density - Magnetic boundary conditions involving magnetic fields - The Scalar and Vector Magnetic potentials – Energy stored in Magnetic fields.

#### **UNIT 3 ELECTRIC AND MAGNETIC MATERIALS**

Conductors and dielectrics in Static Electric Field - Current and current density - Continuity equation-Polarization - Boundary conditions - Capacitance: Parallel plate - Coaxial and Spherical capacitors -The nature of magnetic materials – Magnetization and permeability – The magnetic circuit – Inductance: Basic expressions for self and mutual inductances – Inductance evaluation for solenoid – toroid – coaxial cables and transmission lines.

#### **UNIT 4 TIME VARYING FIELDS**

Fundamental relations for Electrostatic and Magneto static fields - Faraday's law for Electromagnetic induction - Transformer emf - Motional Electromotive forces - Differential form of Maxwell's equations – Integral form of Maxwell's equations – Electromagnetic boundary conditions.

#### **UNIT 5 ELECTRO MAGNETIC WAVES**

Electromagnetic Wave equations: conducting medium, free space. Uniform plane wave - intrinsic impedance - The Poynting vector and Power considerations, Time-harmonic fields - Polarization: Linear, circular and elliptical polarization.

#### **Total: 45 PERIODS**

#### **TEXT BOOKS:**

William H Hayt and Jr John A Buck, "Engineering Electromagnetics", McGraw-Hill Publishing 1. Company Ltd, New Delhi, 8th Edition 2014.

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 M.N.O.Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford(Asian Edition), 2015

#### **REFERENCES:**

- 1. John D Kraus and Daniel A Fleisch, "Electromagnetics with Applications", McGraw Hill, 5th Edition 2010.
- 2. Edward C. Jordan & Keith G. Balmain, Electromagnetic waves and Radiating Systems, Second Edition, Prentice-Hall Electrical Engineering Series, 2012.
- 3. B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011

#### e-Resources:

- 1. NPTEL video http://nptel.ac.in/courses/108106073/1, "ElectroMagnetic Fields", Prof. HarishankarRamachandra, IIT Madras.
- 2. NPTEL video http://nptel.ac.in/courses/117103065/1, "ElectroMagnetic Fields", Dr. Ratnajit Bhattacharjee, IIT Guwahati.

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

- CO1 Apply vector calculus to static electric fields and find the potential for finite and infinite line, circular disc and infinite sheet.
- CO2 Calculate magnetic flux density for straight and circular conductors using Biot-Savart Law.
- CO3 Estimate the capacitance of parallel plate, coaxial cable and sphere and inductance of solenoid, toroid, coaxial cables and transmission lines.
- CO4 Analyze Maxwell's equations in both integral and differential form.
- CO5 Analyze the nature of electromagnetic wave propagation in conducting medium and determine the value of intrinsic impedance.

Cos/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	3	2	2	2				1			1	3	1
CO 2	2	3	2	2	2								3	
CO 3	2	3	2	2	2								3	
CO 4	2	3	2	2	2					1	1		3	1
CO 5	2	3	2	2	2	1	1						3	1

#### Mapping of COs with POs and PSOs

**22ECT42** 

#### Pre-requisites:22MAT31- Transform Techniques

#### **Preamble**

Control theory is a powerful technique used for the analysis and design of linear and nonlinear, time-invariant or time varying MIMO systems. This course aims at deriving transfer function model to linear, nonlinear and time invariant systems. It provides an adequate exposure in state space analysis, MIMO system and stability analysis. Control System applications covers the uses of control systems, both in the common and in the uncommon areas of our lives.

**CONTROL SYSTEMS** 

#### UNIT 1 CONTROL SYSTEM MODELING

Basic Elements of Control System - Open loop and Closed loop systems - Transfer function: Modeling of Electric systems - Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph.

#### **UNIT 2 TIME RESPONSE ANALYSIS**

Standard Test Signals-Time response analysis of First Order Systems - Impulse and Step Response analysis of second order systems -Effects of poles and zeros- Steady state errors - P, PI, PD and PID Controllers.

#### UNIT 3 FREQUENCY RESPONSE ANALYSIS

Frequency Response, Frequency domain specifications: resonant peak, resonant frequency, bandwidth, cut-off rate, Phase margin, Gain margin - Bode Plot, Polar Plot, Nichols Plot -Frequency Domain specifications from the plots: Gain crossover frequency, Phase crossover frequency-Constant M and N Circles.

#### **UNIT 4 STABILITY ANALYSIS**

Stability - Routh-Hurwitz Criterion - Root Locus Technique - Construction of Root Locus -Stability – Dominant Poles – Application of Root Locus Diagram – Nyquist Stability Criterion – Relative Stability.

#### **UNIT 5 STATE VARIABLE ANALYSIS**

State space representation of Continuous Time systems - State equations - Transfer function from State Variable Representation - Solutions of the state equations - Concepts of Controllability and Observability- Kalman's Test.

#### **TEXT BOOKS:**

- J.Nagrath and M.Gopal, Control System Engineering, New Age International Publishers, 6<sup>th</sup> 1. Edition.2017.
- Benjamin C. Kuo and Farid Gol Naraghi, Automatic Control Systemsl, John Wiley 2. Publications, 9th edition, 2014.

#### **REFERENCES:**

- A.Nagoorkani, Control Systems, RBA Publications, 3rd edition, 2015. 1.
- K. Ogata, Modern Control Engineering, 5th edition, Pearson Education, New Delhi, 2003. 2.

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#### **Total: 60 PERIODS**

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3. R. Anandha, Natarajan and B. Ramesh Babu, Control System Engineering<sup>II</sup>, Scitech Publication, 4th Edition, 2014.

#### e-Resources:

- 1. NPTEL web course https://nptel.ac.in/courses/107106081 . "Control systems", Prof. C.S. Shankar Ram, IIT Madras.
- 2. NPTEL video https://onlinecourses.nptel.ac.in/noc22\_ee31, "Control Engineering", Prof. Ramkrishna Pasumarthy, IIT Madras.

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

- CO1 Determine transfer functions for electrical and mechanical systems by using Differential equation method, Block Diagram Reduction technique and signal flow graph.
- CO2 Analyze transient and steady state response of LTI systems through time domain parameters delay time, rise time, peak time and steady state errors.
- CO3 Analyze the frequency response of control systems using graphical methods Bode plot, Polar plot, Nichols plot and Constant M and N circles systems by measuring frequency domain parameters from the plots.
- CO4 Test the stability of the system using Routh-Hurwitz, Nyquist stability criterion methods and relative stability of the system using Root Locus techniques with dominant poles.
- CO5 Determine state-space model for the LTI system from transfer function, Block diagram, Signal Flow Graph and Differential equation representations and verify the controllability, observability and stability of the systems using state equations.

Cos/POs	<b>PO</b> 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 0 1	PS O 2
CO 1	3	3	2	2	-	2	-	1	1	-	1	1	3	1
CO 2	3	3	2	2	-	2	-	-	-	1	-	-	3	-
CO 3	3	3	2	2	2	2	1	-	-	-	1	1	3	1
CO 4	3	3	2	2	2	2	-	-	-	-	1	-	3	1
CO 5	3	3	2	2	2	-	-	-	-	-	-	1	3	-

#### Mapping of COs with POs and PSOs

22ECT43

#### **Preamble:**

Digital Signal Processing provides an introduction to the basic concepts of signal processing methods and to acquire knowledge of analysis of systems using various transformation techniques. It provides students to realize different filter structures and also to develop algorithms for signal processing.

DIGITAL SIGNAL PROCESSING

#### UNIT 1 DISCRETE FOURIER TRANSFORM

Discrete Fourier transform (DFT) – Properties of DFT – Fast computation of DFT – Radix-2 Decimation-in-Time (DIT) Fast Fourier transform (FFT), Decimation-in-Frequency (DIF) Fast Fourier transform (FFT) – Linear Filtering for long data sequences - overlap save and overlap add method.

#### UNIT 2 INFINITE IMPULSE RESPONSE FILTERS

Characteristics of practical frequency selective filters. Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters - Impulse invariance method, Bilinear transformation - Structure of IIR filter - direct form I, direct form II, Cascade, Parallel realizations.

### UNIT 3 FINITE IMPULSE RESPONSE FILTERS

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - Direct form, Cascade and linear phase structure

### UNIT 4 FINITE WORD LENGTH EFFECTS

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization – Principles of scaling.

### UNIT 5 DSP APPLICATIONS

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization.

### **TEXT BOOKS:**

- John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing Principles, Algorithms & Applications", Pearson Education / Prentice Hall, Fifth Edition, 2021.
- 2. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", Pearson, 8th Indian Reprint, 2021.

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**TOTAL : 60 PERIODS** 

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#### **REFERENCES:**

- 1. Emmanuel C.Ifeachor, & Barrie.W.Jervis, "Digital Signal Processing", Pearson Education / Prentice Hall, Second Edition, 2002.
- 2. Sanjit K. Mitra, "Digital Signal Processing A Computer Based Approach", Mc Graw Hill, 4th edition 2013.
- 3. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

#### e-RESOURCES:

- 1. NPTEL Video: http://www.nptelvideos.in/2012/12/digital-signal-processing.html, "Digital Signal Processing", Prof. S.C Dutta Roy, IIT Delhi.
- 2. NPTEL Video: http://www.nptelvideos.in/2012/11/digital-signal-processing.html, "Digital Signal Processing", Prof.T.K.Basu, IIT Kharagpur.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Compute the DFT of the discrete-time sequence to determine the frequency spectrum by using FFT algorithms.
- 2. Design a digital IIR filter from the analog specifications by applying impulse invariance and bilinear transformation techniques.
- 3. Design an FIR filter for given specifications by using windowing and frequency sampling techniques.
- 4. Illustrate the finite word length effects involved in digital filter design.
- 5. Describe the multiple sampling rate conversion process by a suitable rational factor.

#### **CO-PO Mapping:**

Course	PO	PSO	PSO											
Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	1	1	1	1	1	2	1	1	1	3	1
CO2	2	3	2	1	1	-	-	-	-	1	-	1	3	-
CO3	2	3	2	1	1	1	1	1	2	1	1	1	3	1
CO4	2	3	2	1	1	1	1	1	2	1	1	1	3	1
CO5	2	3	2	1	1	1	1	1	-	1	-	1	3	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-" No correlation

#### 22ECT44 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS L T P

**Pre-requisites :** 22ECT34 & Circuit Analysis

#### Preamble

Linear Integrated Circuits introduces the basic building blocks of the Integrated circuits along with fundamental concepts of electronic circuits like operational amplifiers, rectifiers & timers and acquire the knowledge in analysis and design IC based circuits. Linear IC applications play vital role in the electronic field starting from home appliances to Super computers.

#### UNIT 1 OPERATIONAL AMPLIFIERS

Basic information of Operational Amplifier – Ideal Operational Amplifier – Operational Amplifier internal circuit: Differential Amplifier, Constant Current Source, Active Load –DC characteristics: input bias, offset current, input offset voltage – Compensation for input bias, offset current, input offset voltage – Thermal drift – AC characteristics: Frequency Response, Stability of an Operational Amplifier, Frequency Compensation, Slew rate – Internal diagram of IC 741.

#### UNIT 2 APPLICATIONS OF OPERATIONAL AMPLIFIERS

Inverting Amplifier – Non-inverting Amplifier – Voltage follower – Adder – Subtractor – Difference Amplifier – Instrumentation Amplifier: Three Operational Amplifier Instrumentation, ICAD620-V-to-I and I-to-V converter – Op-Amp Circuits using diodes: Half wave Rectifier, Full wave Rectifier, Peak Detector, Clipper, Clamper-Log and Antilog amplifier – Differentiator – Integrator – Comparator – Schmitt trigger.

#### UNIT 3 ACTIVE FILTERS AND PLL

First order Low Pass Filter – Second Order Low Pass Filter – First order High Pass Active Filter – Block diagrams of first Order Band Pass Filter and Band stop filter – PLL: Basic Principles, Phase Detector, Voltage Controlled Oscillator – PLL Applications – Frequency Multiplication/Division – AM detection – FM detection – FSK modulation and demodulation.

#### UNIT 4 DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS

DAC/ADC Specifications – D/A converter: weighted resistor type, R-2R Ladder type, sample-and-hold circuits – A/D Converters: Flash type, Successive Approximation Converter, Dual Slope ADC – Oversampling A/D Converters.

#### UNIT 5 555 TIMER AND VOLTAGE REGULATORS

Timer IC 555- Functional block diagram and description, Astable and Monostable multivibrator, IC Voltage regulators: Three terminals fixed (LM78XX and LM79XX series) and Adjustable voltage regulators (LM317), Switched capacitor filter – Single supply op-amp – MOS input op-amp.

#### **TEXT BOOKS:**

- 1. D.RoyChoudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 4<sup>th</sup> Edition, 2017.
- 2. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Pearson Education, Sixth Edition, 2015.

#### **REFERENCES:**

- 1. Ramakant A. Gayakwad, "OP-AMP and Linear Ics", Pearson Education, 4<sup>th</sup> Edition, 2015.
- 2. S.Salivahanan& V.S. KanchanaBhaskaran, "Linear Integrated Circuits", McGraw Hill, 2<sup>nd</sup> Edition, 2014.
- 3. K.R.Valluvan, P.Senthil Kumar, "Linear Integrated Circuits", Charulatha Publications, 1<sup>st</sup> Edition, 2019.

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**Total: 45 PERIODS** 

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#### e-Resources:

- 1. NPTEL Video, http://nptel.ac.in/courses/117107094/5, "Analog Circuits", Prof. PramodAgarwal, IIT Roorkee.
- 2. NPTEL Video, http://nptel.ac.in/courses/117106030/45, "Analog Integrated Circuit Design", Prof. NagendraKrishnapura, IIT Madras.

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

- CO1 Analyze the performance of operational amplifier with active load and evaluate the performance of opamp by dominant pole and pole zero compensation techniques.
- CO2 Design inverting, non-inverting, instrumentation amplifiers using operational amplifier and estimate the gain and obtain the output characteristics of clipper, clamper and peak detector using operational amplifier.
- CO3 Design active filters using op-amp IC741 and examine the cutoff frequency and analyze the operation of AM detector, FM Detector, FSK modulator & demodulator using PLL.
- CO4 Analyze the performance of weighted Resistor, R-2R ladder type DAC using operational amplifier and evaluate the performance of Flash type, Successive approximation and dual slope ADC with respect to techniques and conversion time.
- CO5 Design astable multivibrator and monostable multivibrators using 555 Timer IC for the given specifications.

Cos/Pos	PO 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	2	3	2	2	1	1			1	1			3
CO 2	2	2	3	2	2	1	1		1		1	2	2	3
CO 3	2	2	3	2	2	1	1		1		1	2	2	3
CO 4	2	2	3	2	2	1	1			1	1	2	2	3
CO 5	2	2	3	2	2	1	1			1	1			3

#### Mapping of Cos with Pos and PSOs

**Pre-requisites : 22ECT11- Semiconductor Devices** 

### **Preamble**

22ECT45

This course aims at designing Analog and Digital Communication Systems that are used for transmission of information from the source to the destination. A detailed framework for analog and digital communication techniques are addressed.

ANALOG AND DIGITAL COMMUNICATION

#### **UNIT 1 ANALOG MODULATION**

Elements of communication systems - Communication channels - Modulation - Types - Need for Modulation. Principles of Amplitude Modulation Systems - Super heterodyne Receiver - Angle Modulation, Representation of FM and PM signals, Generation and detection of FM- Comparison of various modulation systems.

#### **UNIT 2 NOISE & PULSE MODULATION**

Noise - Types: External and internal Noise - Noise in amplitude modulation systems, Noise in Frequency modulation systems.

Low pass sampling - Aliasing- Signal Reconstruction- Quantization - Uniform & non-uniform quantization - Logarithmic Companding -PAM, PPM, PWM, PCM.

#### **UNIT 3 WAVEFORM CODING & BASEBAND TRANSMISSION**

DPCM - Delta Modulation - ADPCM & ADM principles - Line Coding - Unipolar / Polar RZ & NRZ -Bipolar NRZ – Manchester – ISI – Nyquist criterion for distortion less transmission – M-ary schemes – Eye pattern.

#### **UNIT 4 DIGITAL MODULATION SCHEME**

Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK, BFSK, & QPSK - QAM - Carrier Synchronization - Principle of DPSK- Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

#### **UNIT 5 SOURCE AND ERROR CONTROL CODING**

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes, Viterbi Decoder.

**Total: 45 PERIODS** 

### **TEXT BOOKS:**

- George.Kennedy and Bernard Davis, "Electronic Communication Systems", McGraw Hill, 5th 1. Edition. 2011.
- S. Haykin, "Digital Communications", Wiley India Edition, Reprint 2010. 2.

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#### **REFERENCES:**

- 1. B.P.Lathi, "Modern Digital and Analog Communication Systems", Oxford University Press, 3rd Edition, 2007.
- 2. H P Hsu, Schaum Outline Series, "Analog and Digital Communications", McGraw Hill Education 2009.
- 3. Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, Pearson Education, 2009

#### e-Resources:

- 1. http://nptel.ac.in/courses/117101051 /, "Quantization, PCM and Delta Modulation", Prof. Bikash Kumar Dey, IIT, Bombay.
- 2. http://www.nptelvideos.in/2012/11/ digitalcommunication.html, "Digital Communication", Prof. T.K. Basu, Department of Electrical Engineering, IIT Kharagpur.

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

- CO1 Compare and contrast amplitude and angle modulation by analyzing its performance characteristics.
- CO2 Summarize the pulse modulation schemes PAM, PWM, PPM, and PCM by analyzing the noise.
- CO3 Analyze DPCM, DM, and ADPCM & ADM waveform coding techniques using SNR.
- CO4 Analyze the performance of BPSK, BFSK, QPSK, DPSK and QAM using bit error rate and power spectral density.
- CO5 Compare and contrast various error control coding techniques for coding efficiency of lossless data compression.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	3	2	2	2	1		1	1	1		3	1
CO 2	3	2	3	2	2	2					1	1	3	
CO 3	3	1	2	2	2	2			1		1		3	1
CO 4	3	2	2	2	1	1	1		1		1	1	3	1
CO 5	3	2	3	2	2	2					1		3	

#### Mapping of COs with POs and PSOs

#### 22ITL32

### DATA STRUCTURES LABORATORY L T P C

0 0 2 1

#### Preamble:

This laboratory course is intended to provide students with opportunities to get hands on training to implement various data structures like lists, arrays, stacks, queues, heaps, trees, and graphs using Python programming language.

#### LIST OF EXPERIMENTS

- 1. Program to implement Singly Linked List of ordered integers (ascending/descending) with insert, search and display operations.
- 2. Program to simulate Stack using array and linked list.
- 3. Program to simulate Queue using array and linked list.
- 4. Program to traverse a binary tree in preorder, in-order and post-order.
- 5. Program to insert, delete and search for a node in a Binary Search Tree.
- 6. Program for graph traversals by applying: (a) Breadth First Search. (b) Depth First Search.
- 7. Consider the motor racing game in which there are n participants. Get the points scored by each participant. Write a program to sort the positions of players in ascending order based on points scored using heap sort and print the highest score.
- 8. Program to search for a character in a given message using linear search technique.
- 9. A person has registered for voter id, he received a voter number and he need to check whether it exist in the voter list or not. Use binary search to check whether the voter number exist in the list or not.
- 10. For the given route map with cost of transportation between different cities, find the shortest route from a source to all the other cities using Dijkstra's Algorithm.
- 11. For the given network identify Spanning tree to connect the points in the network with minimum cost.

#### SOFTWARE

• Python 3 interpreter / open source IDE

#### **TOTAL: 45 PERIODS**

#### **Course Outcomes: Upon completion of the course, students will be able to:**

- 1. Develop a python program to simulate stack and queue data structures using array and linked list. (1,2,3)
- 2. Demonstrate the traversals of binary tree, binary search tree and a graph for a given set of elements. (4,5,6)
- 3. Develop a python program to arrange the players' position in ascending order using heap sort. (7)
- 4. Write a Python program to search for a given element in a tree using linear and binary search. (8,9)
- 5. Implement a suitable shortest path algorithm for identifying minimum path cost for the given real world problem. (10, 11)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	3	2	1	-	-	1	-	-	1	-	-
CO2	2	3	2	3	2	1	-	-	1	-	-	1	-	-
CO3	2	3	2	3	2	1	-	-	1	-	-	1	-	-
CO4	2	3	2	3	2	1	-	1	1	-	-	1	-	-
CO5	2	3	2	3	2	1	-	1	1	-	-	1	-	-

Mapping of COs with POs and PSOs

#### 22ECL41 DIGITAL SIGNAL PROCESSING LABORATORY

#### L T P C 0 0 2 1

#### **Preamble:**

The course will give the practical aspects of the Generation of elementary Discrete-Time sequences, Convolution, Discrete and Fast Fourier Transform, Design of Finite and Infinite Impulse Response Filters, and Sampling by using simulation tools. As a part of this course, the students will be trained to design digital filters using Bilinear and one-to-one mapping methods.

#### LIST OF EXPERIMENTS

- 1. Generation of elementary Discrete-Time sequences
- 2. Linear convolution
- 3. Circular convolution
- 4. Discrete Fourier Transform.
- 5. Fast Fourier Transform.
- 6. Design of IIR Butterworth filter using bilinear transformation method.
- 7. Design of FIR filter using Fourier Series technique.
- 8. Design of FIR filter using windowing techniques.
- 9. Upsampling by an integer factor I.
- 10. Downsampling by an integer factor D.

#### TOTAL: 45 PERIODS

#### **Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Generate unit impulse, unit step, ramp, and exponential Discrete Time Elementary Sequences and simulate the digital signal processing operations, linear convolution, and circular convolution.
- 2. Determine frequency response to a discrete-time sequence using Discrete Fourier and Fast Fourier Transform by plotting magnitude and phase response.
- 3. Design a digital Infinite Impulse Response Butterworth filter by applying Bilinear Transformation techniques and plotting the pole-zero diagrams and frequency response using the filter visualization tool.
- 4. Design and simulate digital Finite Impulse Response filter by applying the Fourier series and windowing technique and plot the pole-zero diagram and frequency response using the filter visualization tool.
- 5. Simulate Upsampling and Downsampling operations of a given input sequence by an integer factor.

Course	PO	PSO	PSO											
Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	3	3	-	-	-	2	1	1	1	2	-
CO2	1	1	1	3	3	-	-	-	2	1	1	1	2	-
CO3	1	1	1	3	3	-	-	-	2	1	1	1	2	-
CO4	1	1	1	3	3	-	-	-	2	1	1	1	2	-
CO5	1	1	1	3	3	-	-	-	2	1	1	1	2	-

#### **CO-PO Mapping:**

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) "-" No correlation

#### 22ECL42 COMMUNICATION SYSTEMS LABORATORY

### L T P C 0 0 2 1

#### **Preamble:**

The purpose of this course is to give hands on training to the students in understanding the theory of analog and digital communication systems. This gives the students to understand the communication system concepts through simulation.

#### LIST OF EXPERIMENTS

- 1. Signal Sampling and reconstruction.
- 2.AM Modulator and Demodulator.
- 3.FM Modulator and Demodulator.
- 4. Pulse Code Modulation and Demodulation.
- 5.Delta Modulation and Demodulation.

6.Line coding schemes.

- 7. Time Division Multiplexing.
- 8. Simulation of Signal constellations of BPSK and QPSK
- 9. Simulation of ASK, FSK and PSK Generation and Detection Schemes.
- 10. Simulation of Linear Block Control Coding Schemes.

#### **TOTAL: 45 PERIODS**

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Experiment and test the sampling circuit
- 2. Experiment and test AM FM modulation and demodulation circuits.
- 3. Experiment and test PCM, DM& line coding circuits.
- 4. Simulate the waveforms of ASK, FSK and BPSK modulation technique using Scilab.
- 5. Simulate Error control by implementing liner block code using Scilab.

#### **CO-PO Mapping:**

Course	PO	PSO	PSO											
outcomes	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	3	3	3	3				1	1	1	2	
CO 2	3	3	3	3	3	2				1	1	1	2	
CO 3	3	3	3	3	3	2				1	1	1	2	
CO 4	3	3	3	3	3	2				1	1	1	2	
CO 5	3	3	3	3	3	2				1	1	1	2	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-"No correlation

# 22MCL04ENGLISH FOR PROFESSIONALSL T P C(Students admitted during 2022-2023 only)0 0 2 0

#### Preamble :

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Essential English for Professionals aims at enabling the learners to communicate effectively and appropriately in professional contexts by exposing them to LSRW tasks.

#### UNIT 1 LISTENING

Listening to Casual Conversation- Note-Taking on TED Talks – Summarizing

#### UNIT 2 READING

Poem - Robert Frost's Road Not Taken- Decision Making- Biographies of Famous Personalities - Reading and Note Making on News Articles

#### UNIT 3 WRITING 5 Letter Writing - Letters Seeking Permission- Letters Seeking Apology - Letters Requesting Certificates – Analytical Writing

#### UNIT 4 SPEAKING

Watching Presentations - Presentation Techniques - Group Presentation - Group Discussion

#### UNIT 5 VERBAL ABILITY

Parajumbles - Sentence Completion - Identifying Common Errors

#### **REFERENCES:**

#### **TOTAL: 30 PERIODS**

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- M Ashraf Rizvi "Effective Technical Communication", Tata McGraw-Hill, 2<sup>st</sup> Edition, New Delhi, 2018.
- 2. Meenakshi Raman and Sangeetha Sharma., "Technical Communication: English Skills for Engineers" Oxford University Press, 1<sup>st</sup> Edition, New Delhi, 2008.

#### e. RESOURCES :

- 1. https://agendaweb.org/listening/audio-books-mp3.html
- 2. https://www.ndtv.com/world-news
- 3. http://learnenglishteens.britishcouncil.org/skills/reading
- 4. https://www.bbc.com/

Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Analyze the given listening material and answer the questions correctly employing listening techniques.
- CO2 Analyze the given reading material and answer the questions correctly employing reading techniques.
- **CO3** Write within the stipulated time syntactically and semantically correct sentences to present ideas in the form of essays and letters.
- **CO4** Take part effectively in group discussion, conforming to professional norms and to give extemporaneous presentation.
- **CO5** Identify within the stipulated time syntactically and semantically correct sentences for a variety of language exercises.

## **CO-PO Mapping:**

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	РО	PO	РО	PSO	PSO
									9	10	11	12	1	2
CO 1	-	-	-	-	3	-	-	-	-	3	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 4	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 5	-	-	-	-	-	-	-	-	-	3	-	1	-	-

#### VCET, B.E-ECE, R2022 Curriculum and Syllabus

### **TEXT BOOKS:**

Herbert Schildt, "Java: The Complete Reference", 11 th Edition, McGraw Hill Education, New 1. Delhi, 2019

## **Pre-requisites: -**

### Preamble

**22ITT31** 

This course focuses on the fundamentals of object-oriented programming and Java programming language. Students will also be able to understand the fundamentals of packages, inheritance, and interfaces. The ability to create Java applications with threads, generic classes, exceptions, and I/O streams will be taught to the students. Additionally, using JAVAFX, students will be able to create graphic user interface applications.

**OBJECT ORIENTED PROGRAMMING USING JAVA** 

### **UNIT 1 INTRODUCTION TO OOP AND JAVA**

Overview of OOP - Object oriented programming paradigms - Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators - Control Statements - Programming Structures in Java - Defining classes in Java - Constructors-Methods -Access specifiers - Static members- JavaDoc comments- I/O Basics - Reading and Writing Console I/O.

### **UNIT 2 INHERITANCE, PACKAGES AND INTERFACES**

Overloading Methods - Objects as Parameters - Returning Objects - Static, Nested and Inner Classes. Inheritance: Basics- Types of Inheritance -Super keyword -Method Overriding - Dynamic Method Dispatch -Abstract Classes - final with Inheritance. Packages and Interfaces: Packages - Packages and Member Access -Importing Packages - Interfaces.

#### **UNIT 3 EXCEPTION HANDLING AND MULTITHREADING**

Exception Handling basics - Multiple catch Clauses - Nested try Statements - Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads - Priorities - Synchronization - Inter Thread Communication Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

### **UNIT 4 FILE I/O, GENERICS, STRING HANDLING**

Reading and Writing Files. Generics: Generic Programming - Generic classes - Generic Methods -Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

#### UNIT 5 JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton - RadioButtons - ListView - ComboBox - ChoiceBox - Text Controls - ScrollPane. Layouts - FlowPane - HBox and VBox - BorderPane - StackPane - GridPane. Menus - Basics -Menu – Menu bars – MenuItem.

### **Total: 45 Periods**

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2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1 st Edition, McGraw Hill Education, New Delhi, 2015

#### **REFERENCES:**

- 1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11 th Edition, Prentice Hall, 2018 e-RESOURCES:
- 1. https://archive.nptel.ac.in/courses/106/105/106105191/
- 2. https://www.w3resource.com/java-tutorial/java-object-oriented-programming.php

**Course Outcomes:** Upon completion of this course, students will be able to

- CO1 Apply the concepts of classes and objects to solve simple problems.
- CO2 Demonstrate the principles of inheritance, packages and interfaces in Java programming for a real world problem.
- CO3 Apply exception handling mechanisms and multithreaded model to solve real world problems using Java.
- CO4 Develop a Java application using I/O packages, string classes, generics concepts for the given problem.
- CO5 Integrate the concepts of event handling, JavaFX components and controls for developing GUI based applications.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	3	2	3	1	1	1					2		
CO2	2	3	2	3	1	1	1					3		
CO3	2	3	2	3	1	1	1					2		
CO4	2	3	2	3	1	1	1					3		
CO5	1	3	2	3	1	1	1					2		

#### Mapping of COs with POs and PSOs
#### 22ECT51 WIRELESS AND MOBILE COMMUNICATION

# Pre-requisites:22ECT45 & Analog and Digital Communication

# **Preamble:**

This course aims to provide an overview of mobile communication systems and also deals with principles of multiple access techniques, propagation mechanisms, modulation techniques, speech coding techniques, and cellular standards.

#### MULTIPLE ACCESS TECHNIQUES AND CELLULAR RADIO UNIT 1 CONCEPT

Multiple Access Techniques: FDMA- TDMA- spread spectrum multiple access- CDMA- SDMA-CSMA protocols. Cellular Concept: Frequency reuse- channel assignment- hand-off strategies-Interference and system capacity- trunking and grade of service- Improving Coverage and capacity in Cellular systems

# UNIT 2 RADIO WAVE PROPAGATION

Mobile Radio Propagation: Free space propagation model- Propagation mechanisms- reflection – Ground reflection(Two-Ray) model -diffraction- scattering- practical link budget design using path loss models

#### **MODULATION & DIVERSITY TECHNIQUES FOR MOBILE** UNIT 3 RADIO

Modulation Techniques: Overview of digital modulation, Binary frequency shift keying-Minimum Shift Keying- Gaussian MSK, Diversity techniques- practical diversity considerations, polarization diversity frequency diversity, time diversity, RAKE receiver

#### SPEECH CODING TECHNIQUES UNIT 4

Characteristics of speech signals - Vocoders- Linear Predictive Coders- Choosing Speech Codecs for Mobile Communication- GSM Codecs- USDC Codec - Performance evaluation of Speech Coders

#### UNIT 5 WIRELESS CELLULAR SYSTEMS AND STANDARDS

AMPS overview – GSM: GSM-services and features – Architecture – Channels types and Frame structure- GPRS Architecture - WCDMA-Layer architecture- Case study: Comparison of 2G, 3G, 4G LTE, and 5G networks.

# **TEXTBOOKS:**

- T.S.Rappaport, "Wireless Communications: Principles and Practice", Second Edition, 1. Pearson Education, Reprint, 2018.
- 2. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2017.

# **REFERENCES:**

- Vijay K Garg, "Wireless Network Evolution 2G to 3G", Pearson Education, New Delhi, 1. 2012
- 2. Dharma Prakash Agarwal and Qing An Zeng, "Introduction to Wireless and Mobile Systems", 3<sup>rd</sup> Edition, Cengage Learning, 2015
- William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 3. TMH. 2017.

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TOTAL : 45 PERIODS

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## e-RESOURCES:

- 1. Nptel Video: https://archive.nptel.ac.in/courses/117/102/117102062/, "Wireless Communi cation", Prof. Ranjan Bose, IIT Delhi.
- 2. Nptel Video: https://onlinecourses.nptel.ac.in/noc21\_ee66/preview, "Introduction to Wireless and Cellular Communications", Prof. R. David Koilpillai, IIT Madras.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Compare and contrast various multiple access schemes used to allow many mobile users to share simultaneously a finite amount of radio spectrum.
- 2. Calculate the received signal strength in the mobile station using a two-ray ground reflection model
- 3. Analyze the performance of BFSK, MSK, and GMSK using bit error rate and power spectral density
- 4. Elaborate the quality of Speech Codec to achieve a high data compression ratio for efficient digital transmission
- 5. Categorize the evolution and development of various generations of mobile wireless technology along with their significance and advantages over the other.

CO-PO	Mapping:
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Cos/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	РО 7	PO 8	РО 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C01	3	3	2	2	1	2		1	1		1	1	3	1
CO2	3	3	2	2	1	2				1			3	
CO3	3	3	2	2	2	2	1				1	1	3	1
CO4	3	3	2	2	2	2		1			1		3	1
CO5	3	3	2	2	2	1						1	3	

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

# Pre-requisites: 22ECT33 - Digital Electronics

## **Preamble:**

22ECT52

This course provides students to gain knowledge about the architecture and programming of 8086 microprocessor and 8051 microcontroller and make them capable of writing assembly language programs using 8086 and 8051.

MICROPROCESSOR AND MICROCONTROLLER

# UNIT 1 8086 PROCESSOR ARCHITECTURE

Introduction to microprocessor - Register Organization – Architecture of 8086 – Memory segmentation – Memory Banking – Pin Diagram of 8086 – Minimum Mode Configuration– Maximum Mode Configuration.

# UNIT 2 8086 INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING 9

Addressing modes of 8086 - Instruction encoding formats and instruction set - Assembler directives and operators – 8086 programming and debugging of assembly language program– Assembly language example programs –Interrupt structure of 8086.

# UNIT 3 PERIPHERALS AND THEIR INTERFACING WITH 8086

Programmable peripheral Interface 8255 – Interfacing of ADC0809 and DAC 0808 using 8255 – Matrix keyboard and seven segment display interfacing using 8255 – Stepper motor Interface – Programmable interval timer 8254.

### UNIT 4 THE 8051 MICROCONTROLLER ARCHITECTURE

8051 Architecture – 8051 flag bits and PSW register – 8051 Memory organization – Structure of internal ROM and RAM – 8051 registers –Addressing modes – 8051 instruction set – 8051 Timer section and Programming – Serial Port programming - 8051 I/O programming

### UNIT 5 PERIPHERALS AND INTERFACING WITH 8051

Interrupts – Seven segment display interfaces – keyboard interfacing - Parallel ADC0804 and ADC0809 interfacing – Serial ADC Interfacing– DAC interfacing – Interfacing with Temperature Sensors – Relays and opt isolators interfacing – Stepper motor interfacing – DC motor interfacing and PWM.

# **TEXT BOOKS:**

- 1. A.K.Ray and K.M Bhurchandi, "Advanced Microprocessors and Peripherals", McGraw Hill Education, 3<sup>rd</sup> Edition 2012.
- 2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Pearson Education, 2<sup>nd</sup> Edition, 2013.

### **REFERENCES:**

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family Architecture, Programming and Design", Prentice Hall of India, 2015.

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**TOTAL: 45 PERIODS** 

- 2. A. Nagoor Kani "8086 Microprocessors and its Applications", Mc Graw Hill India, 2013.
- 3. Kenneth J.Ayala, "8051 Microcontroller: Architecture, Programming and Applications", Thomson publishers, 2011.

# e-Resources:

- 1. NPTEL video: <u>https://swayam.gov.in/nd1\_noc20\_ee42/</u>, "Microprocessors And Microcontrollers", Prof. Santanu Chattopadhyay, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur.
- 2. NPTEL video: <u>https://swayam.gov.in/ nd1 noc20 ee11</u>, "Microprocessors and Interfacing", Prof. Shaik Rafi Ahamed, Department of Computer Science and Engineering, Indian Institute of Technology IIT Guwahati.

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

- CO1 Analyze the activities performed in T-States of fetch, read, write, interrupt timing diagram of 8086 Microprocessor in the Minimum and Maximum Mode.
- CO2 Develop Assembly programs using 8086 Instruction set.
- CO3 Design circuits to interface keyboard, seven segment display, ADC,DAC and stepper motor with 8086 Microprocessor system.
- CO4 Develop Assembly programs using 8051 Instruction set.
- CO5 Design circuits to interface ADC, relays, opto-isolators, DC motor and stepper motor with 8051Microcontroller system.

Cos/POs	PO1	PO 2	PO 3	<b>PO</b> 4	РО 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	РО 11	PO 12	PSO 1	PSO 2
CO 1	2	3	3	1	1								3	
CO 2	2	3	3	1	1								3	
CO 3	2	3	3	2	2						2		3	2
CO 4	2	3	3	2	2						2	1	3	2
CO 5	1	3	3	2	2	1	1		1	1	2	1	3	2

# Mapping of COs with POs and PSOs

# 22ITL31 OBJECT ORIENTED PROGRAMMING LABORATORY L T P C

# **Preamble:**

The goal of the course is to give students the ability to construct software using Java programming for practical applications. The ideas of classes, packages, interfaces, inheritance, exception handling, and file processing will be understood and applied by the students. Students are also capable of creating applications using event handling and general programming.

# LIST OF EXPERIMENTS

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)

2. Develop stack and queue data structures using classes and objects.

3. Develop a java application with an Employee class with Emp\_name, Emp\_id, Address, Mail\_id, Mobile\_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.

4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape.

5. Solve the above problem using an interface.

6. Implement exception handling and creation of user defined exceptions.

7. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.

8. Write a program to perform file operations.

9. Develop applications to demonstrate the features of generics classes.

10. Develop applications using JavaFX controls, layouts and menus.

# SOFTWARE

- Operating Systems: Linux / Windows
- Front End Tools: Eclipse IDE / Netbeans IDE

**TOTAL: 45 PERIODS** 

0 0 2 1

# Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Develop simple Java programs to implement searching, sorting and linear ADT.
- CO2 Design and develop Java programs using stack, queue ,inheritance and abstract class.
- CO3 Develop simple applications to demonstrate the use of exceptions and multithreading.
- CO4 Implement files and generics concepts for the given problem.
- CO5 Create GUIs and event driven programming applications for real world problems.

# Mapping of COs with POs and PSOs

COs/PO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2	1	-	1	1	-	1	2	2	2	-	-
CO2	2	1	3	1	-	1	1	-	2	3	3	2	-	-
CO3	2	2	1	2	1	1	1	-	1	2	1	3	-	-
CO4	2	2	1	3	-	1	1	-	3	1	1	1	-	-
CO5	1	3	3	1	3	2	2	-	1	1	1	1	-	-

# 22ECL51MICROPROCESSOR AND MICROCONTROLLERLTPCLABORATORY0021

# Pre-requisites : 22ECL32 - Digital Electronics Laboratory

# Preamble:

Microprocessors and Microcontrollers laboratory course helps the students to develop their knowledge on processor architecture and the programming skills. This laboratory course provides hands-on experience to arithmetic and logic operations, data transfer, interface I/O devices, perform A/D and D/A conversions and interrupt handling.

# LIST OF EXPERIMENTS

# 8086 ASSEMBLY LANGUAGE PROGRAMMING USING ASSEMBLER

- 1. Arithmetic, Logic Operations, Palindrome and Factorial.
- 2. Sorting, Searching, string manipulations and Block Data Transfer.

# 8051 ASSEMBLY LANGUAGE PROGRAMMING USING KEIL UVISION

- **3.** Arithmetic, Logic Operations and Code conversion.
- 4. Block data transfer between internal and external memory including overlapping blocks.
- **5.** Interrupts Handling.

# INTERFACING EXPERIMENTS WITH 8051

- 6. Stepper Motor and Speed Control of DC Motor using PWM technique.
- 7. Temperature measurement using ADC.
- **8.** Waveform generation using DAC.
- 9. Keyboard and seven segment display interface.
- **10.** Time delay and event counter.

# **TOTAL : 45 PERIODS**

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

- CO1 Write assembly language programs for 8086 microprocessor and test using trainer kits with Macro assembler.
- CO2 Write assembly language programs for 8051 microcontroller using trainer kits.
- CO3 Experiment & test stepper motor and DC motor using 8051 microcontroller with Keil uVision
- CO4 Experiment & test application with ADC & DAC using 8051 microcontroller with Keil uVision
- CO5 Experiment & test keyboard, display, time delay and event counter using 8051 microcontroller with Keil uVision

Mapping of COs with	POs and PSOs
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Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	2	2	3	3	1	1	Ū	3	1	1	1	2	3
	2	2	2	2	2	1	1		2	1	1	1	2	2
	Δ	2	Δ	5	Δ	1	1		5	1	1	1	Δ	5
CO 3	2	2	2	3	2				3	1		1	2	3
<b>CO 4</b>	2	2	2	3	3				3	1		1	2	3
CO 5	2	2	2	3	3	1	1		3	1	1	1	2	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

# 22MCT05 APTITUDE AND LOGICAL REASONING L T P C

# 2000

# **Preamble:**

**Aptitude tests** are used to determine an individual's ability/potential to succeed in a certain task, with no prior knowledge or training and are frequently used as part of a pre-employment assessment. Aptitude tests are a proven tool used to identify those who are best equipped to carry out any given role.

A **logical reasoning test** is a form of testing that is widely used by corporate employers to help assess candidates during their recruitment process.

**Course Outcomes :**Upon completion of the course, students will be able to

- 1. Solve the given equation using appropriate simplification methods and compute time, work, capacity and identify the pattern by analyzing the given problem/scenario
- 2. Apply aptitude method of ratio and proportion to solve the given scenario.
- 3. Calculate time, speed, distance by applying suitable aptitude method for the given problem statement.
- 4. Calculate percentage and profit & loss for the given problem statement and Compute simple interest, compound interest for the given problem/scenario.
- 5. Use their logical thinking abilities to solve given problem involving direction sense, seating arrangement and coding & decoding.

UNIT 1	Unitary methods	6
Number Syste	em, Time and Work, Pipes And Cisterns	
UNIT 2	Numerical Computation	6
Ratio and Pro	portion, Problems on Ages	
UNIT 3	Numerical Estimation I	6
Time and Dis	tance, Problems on Trains, Boats and Streams	
UNIT 4	Numerical Estimation II	6
Percentage, P	rofit and Loss, Simple Interest and Compound Interest	
UNIT 5	Logical Reasoning	6
Direction Sen	se, Seating Arrangements, Coding and Decoding	

# **REFERENCES:**

- 1 Dr.R.S.Aggarwal, "Quantitative Aptitude for Competitive Examination", S.Chand Publications, 2022
- 2 Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S.Chand Publications, 2022

**30 PERIODS** 

TOTAL :

### VCET, B.E-ECE, R2022 Curriculum and Syllabus

# ECONOMICS AND MANAGEMENT FOR ENGINEERS

# **Preamble:**

**22ECT61** 

This course gives the ideas of Economics in terms of demand and supply analysis. This course enables the students to analyze the theory of production as well as the cost parameter using the Elasticity concept. This course helps the students in managing and planning the situation with the help of various strategies to support their decision making.

# UNIT 1 INTRODUCTION TO ECONOMICS

Introduction to Economics – Scope of Economics – Positive and Normative Science – Methodology of Economics – Economic Laws - Economy and its basic problems: Economy and its working – Kinds of economy systems – Basic problems of economy.

# UNIT 2 DEMAND AND SUPPLY ANALYSIS

The Law of Demand – The Law of Supply – Elasticities of Demand and Supply: Price Elasticity of Demand - Price Elasticity and Consumption Expenditure- Cross Elasticity of Demand – Income Elasticity of Demand – The Elasticity of Price Expectations – The uses of Elasticity– Price Elasticity of Supply.

# UNIT 3 THEORY OF PRODUCTION AND ANALYSIS OF COST

Meaning of Production – Production concepts – Production Function – Laws of Production – Cost Concepts - Short-Run Cost Output Relations – Long Run Cost output relations – Economics of Scale.

# UNIT 4 INTRODUCTION TO MANAGEMENT

Management: An Overview – Management Defined – Managerial skills – Managerial roles – Management responsibilities – Management functions. Evolution of Management: Classical approaches to Management – Contemporary Management Perspectives.

# UNIT 5 PLANNING

Planning and Forecasting: Importance of Planning – Principles of effective Planning – Planning process– Types of Plans - Strategic Planning: Strategic Planning process – Rational decision making.

# **TOTAL : 45 PERIODS**

# **TEXT BOOKS:**

1.D.N.Dwivedi, "Principles of Economics, Second Edition", Vikas Publishing House (P) Limited, New Delhi, 2012

2. J.S.Chandan, "Management Concepts and Strategies", Vikas Publishing House (P) Limited, New Delhi, 2003.

# **REFERENCES:**

1. Ranbir Singh, "Principles of Engineering Economics and Management", S. K.Kataria & Sons, New Delhi, 2013.

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2. Manish Varshney and Vidhan Banerjee, "Engineering and Managerial Economics", CBS Publishers and Distributors Pvt. Ltd., First Edition, 2015.

# e-Resources:

1. NPTEL Videos: https://nptel.ac.in/courses/110101005/, "Managerial Economics", Prof.Trupti Mishra, S.J.M. School of Management, IIT Mumbai.

2. NPTEL Videos: https://nptel.ac.in/courses/122106031/slides/3\_1s.pdf, Dr.M. Thenmozhi, IIT Madras.

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

- CO1 Summarize how to solve economic problems in engineering discipline by satisfying the economic laws.
- CO2 Discuss the demand and supply for a market analysis using Price elasticity, Cross elasticity and Income elasticity.
- CO3 Interpret short run and long run costs in the process of production for carrying out a business.
- CO4 Apply managerial skills to make decisions and solve problems for achieving organizational objectives.
- CO5 Express the principles of effective planning for survival and success of all organizations using standing and single use planning methods.

Cos/POs	РО 1	PO 2	PO 3	РО 4	РО 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	РО 11	PO 12	PS 0 1	PS O 2
CO 1		3				2	1			1		3		
CO 2	2	3				2	1			1		3		
CO 3	2	3				2	1			1		3		
CO 4		3				2	1			1		3		
CO 5		3				2	1			1		3		

# Mapping of COs with POs and PSOs

# Pre-requisites: 22ECT45 & Analog and Digital Communication

# **Preamble:**

**22ECT62** 

This course provides an introduction to computer networks, with a special focus on the Internet architecture and protocols which include layered network architectures, addressing, naming, forwarding, routing, communication reliability, the client-server model, web and email protocols

**COMPUTER COMMUNICATION NETWORKS** 

# UNIT 1 DATA COMMUNICATION AND PHYSICAL LAYER

Data Communications – Networks – Networks models – OSI model – Layers in OSI model – TCP / IP protocol suite – Addressing – Guided and Unguided Transmission media. Switched networks: Circuit switched networks– Packet switched networks

# UNIT 2 DATA LINK LAYER

Data link layer services – Framing – Flow control and error Control – Protocols for Noiseless and Noisy Channels – HDLC– Random Access Protocol: CSMA/CA & CSMA/CD– Wired LAN: Ethernet (IEEE 802.3) – Wireless LANs: IEEE 802.11 and Bluetooth.

# UNIT 3 NETWORK LAYER

Internet Protocol: Internetworking – IPv4, IPv6 – Logical addressing: IPv4, IPv6 addresses – Address mapping – ARP, RARP, DHCP, ICMP– Routing: Unicast Routing Protocols: DVR, LSR – Multicast Routing Protocols: DVMRP.

# UNIT 4 TRANSPORT LAYER

Overview of Transport layer – User Datagram Protocol – Transmission Control Protocol – Congestion Control –Congestion Avoidance: DECbit, RED – Quality of services – Techniques to improve QoS.

# UNIT 5 APPLICATION LAYER

Domain Name System – File Transfer – Web Services and SNMP – HTTP – Electronic Mail: SMTP, POP3.

# **TEXT BOOKS:**

- 1. Behrouz A. Forouzan, "Data communications and Networking", McGraw Hill, Sixth Edition, 2022.
- 2. Larry L. Peterson, Bruce S. Davie, "Computer Networking: A Systems Approach", Morgan Kaufmann Publishers, Sixth Edition, Aug 2018.

# **REFERENCES:**

- 1. James.F. Kurouse & W.Rouse "Computer Networking: A Top down Approach Featuring", Pearson Education, 3rd Edition, 2010.
- 2. Wayne Tomasi, "Introduction to Data communication and Networking", Pearson Education", 1<sup>st</sup> Edition, 2007.

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**TOTAL: 45 PERIODS** 

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3. Alberto leon-Garcia, Indra Widjaja, Leon-Garcia Albert, "Communication Networks", McGraw Hill Education, 2<sup>nd</sup> Edition,2004

## e-Resources:

- 1. NPTELvideo:http://nptel.ac.in/courses/106105081/1, "Computer Networks",Prof.Sujoy Ghosh, IIT Kharagpur.
- 2. NPTELvideo:http://nptel.ac.in/courses/106106091/,"Computer Networks", Prof.Hema A murthy, IIT Madras.

**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Identify and explain the design issues at the physical layer with respect to the Bandwidth of transmission medium, Switching technologies, types of transmission medium, Mode of transmission and modulation.
- CO2 Analyze the main functions and the design issues at the data link layer in the OSI model.
- CO3 Identify and explain how to implement suitable routing strategies for a given network.
- CO4 Apply an appropriate access control, congestion control and congestion avoidance technique for a given traffic scenario.
- CO5 Identify and explain a suitable application layer protocol based on application requirements

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 0 1	PS O 2
CO 1	2	2	3	2	2	1	1	1		1		1	3	1
CO 2	2	2	3	2	2	1	1	1		1		1	3	1
CO 3	2	2	3	2	2	1	1	1	1	1	1	1	3	1
CO 4	2	2	3	2	2	1	1	1	1	1	1	1	3	1
CO 5	2	2	3	2	2	1	1	1		1		1	3	1

#### Mapping of COs with POs and PSOs

**Pre-requisites: 22ECT33 & Digital Electronics Preamble:** 

This course introduces the fundamentals of IC fabrication techniques and processes and implementation of digital circuits through the CMOS Transistors. The design of combinational circuits comprises of static logic design using static CMOS, pass transistors, transmission gates and Cascode Voltage Switch logic. The dynamic and domino logic structures are included in the design of dynamic latches and registers. This course also explains the full custom and semi custom design evolved in the design of digital IC. The course helps the students to improve the speed of the circuits using pipelining and parallel processing techniques.

CMOS VLSI Design

#### UNIT 1 **CMOS TECHNOLOGY**

Introduction to MOS Transistors - Electrical properties: Ideal I-V Characteristics ,C-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics - Scaling and its Types -Layout: Stick Diagrams and Layout Design Rules - Basic CMOS Fabrication Process.

#### CMOS LOGIC CIRCUIT DESIGN UNIT 2

Combinational circuit Design: Static CMOS - Ratioed Circuits - Cascode Voltage Switch logic -Pass Transistors – Transmission Gates – Tristate Logic – Dynamic CMOS – Domino Logic Sequential circuit Design: Static and Dynamic Latches and Registers.

#### **ARITHMETIC BUILDING BLOCKS** UNIT 3

Data path circuits – Adders: Ripple Carry Adders, Carry Look Ahead adders, Carry Select adders, Carry skip adders - Multipliers: Array Multipliers, Modified Booth Recoding-Wallace Tree -Dividers – Shifters.

#### **UNIT 4** MEMORY AND PROGRAMMABLE LOGIC DEVICES

Memory: SRAM, DRAM, ROM, EPROM, EEPROM, Flash -PLD and its Types: PLA Design -PAL Design – FPGA: ASIC and its Types, FPGA building block Architectures.

#### SYSTEM DESIGN USING VHDL UNIT 5

VHDL basic language Elements, VHDL operators, Signal assignments, Concurrent and sequential assignments, Entity Declaration, Architecture Body, Behavioral Modeling, Process statement, Loop control statements, Data flow Modeling, Concurrent Assignment statements, Block statements, Structural Modeling, Component declaration and Instantiation, VHDL description of combinational and sequential circuits.

# **TEXT BOOKS:**

- Neil Weste, David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 1. Pearson Publication, 4<sup>th</sup> Edition, 2011.
- 2. Jan Rabaey, AnanthaChandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Prentice Hall of India, Second Edition, 2003.
- 3. J. Bhasker, VHDL Primer, 3rd Edition, Addison Wesley, 1999.

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**TOTAL : 45 PERIODS** 

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# **REFERENCES:**

- 1. M.J. Smith, "Application Specific Integrated Circuits", Addision Wesley, 1997.
- 2. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Addision Wesley, Second Edition, 1993.
- 3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Prentice Hall of India, Third Edition, 2007.

# e-RESOURCES:

- 1. NPTEL video: https://onlinecourses.nptel.ac.in/noc19\_cs72/course "Hardware Modeling using Verilog", Prof. IndranilSen Gupta , IIT , Kharagpur
- 2. NPTEL video: <u>http://www.nptel</u>videos.in/2012/12/digital-vlsi-system-design.html, "Combinational and Sequential circuit design", Prof.S.Srinivasan, IIT, Madras.
- 3. NPTEL video: http://nptel.ac.in/courses/117101058/26, "Leakage Power Dissipation", Prof. Ajit Pal, IIT Kharagpur.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Design and draw layout and stick diagram for basic CMOS circuits.
- 2. Construct combinational and sequential circuits with static and Dynamic CMOS logic structures.
- 3. Interpret the arithmetic and logic circuits using CMOS transistors.
- 4. Design digital logic circuits using programmable logic devices and choose the suitable memory devices in the applications.
- 5. Design digital systems through VHDL language.

# Mapping of COs with POs and PSOs

Cos/POs	PO	PSO	PSO											
005/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	2	3	2	1		1		1	1				3
CO 2	2	2	3	2	2						2	1	1	3
CO 3	2	2	3	2	2	2	1				2	1	1	3
CO 4	2	2	3	1	2	2	1				2		1	3
CO 5	1	1	3	1	2	2	1		1	1	2	1		3

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

# 22ECL61 COMMUNICATION NETWORKS LABORATORY L T P C

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Pre-requisites: 22ECT45- Analog and Digital Communication

# Preamble:

This course will help to construct wired and wireless network model to transfer data from one point to another point. The course also aims at Implementation of distance vector, link state routing algorithms and Simulation of congestion control algorithms in Network simulator.

# LIST OF EXPERIMENTS

# **USING PYTHON**

- 1. Networking with Python : Socket Programming for communication
- 2. Produce Python socket programs for Echo/Ping/Talk commands
- 3. Realization of flow control mechanism over noisy channel

# USING NETWORK SIMULATOR

- 4. Analyze the functioning of network with CSMA / CA protocol and compare with CSMA/CD protocol
- 5. Implementation of distance vector routing algorithm
- 6. Implementation of Link state routing algorithm
- 7. Data Encryption and decryption techniques
- 8. Create a network with N number of nodes and run the simulation scenario through the Network Simulator
- 9. Write a TCL script to give mobility to nodes using DSR routing protocol

# USING PACKET ANALYZER

10 Packet capture and analysis using open source network protocol analyzer

# **TOTAL : 45 PERIODS**

# **Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Establish a Server -Client model over a wired network using Python Socket Programming
- CO2 Realize the data flow control mechanism over noisy channel.
- CO3 Analyze the performance of carrier sense multiple access collision detection and avoidance protocol using network simulator to transmit data in the network.
- CO4 Analyze the performance of routing algorithms using network simulator to find the shortest path.
- CO5 Write TCL script to establish data transfer between source and destination nodes using network simulator.

# Mapping of COs with POs and PSOs

	PO	PSO	PSO											
C08/F08	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	2	2	3	3	1	1		3	1	1	1	3	2
CO 2	2	2	2	3	2	1	1		3	1	1	1	3	2
CO 3	2	2	2	3	2				3				3	2
CO 4	2	2	2	3	3				2				3	2
CO 5	2	2	2	3	3	1	1	1	2	1	1	1	3	2

# 22ECL62 VLSI DESIGN LABORATORY L T P C

### Pre-requisites : 22ECL32 – Digital Electronics Laboratory

# **Preamble:**

The course will give practical aspect of simulating multiplexer and demultiplexer, encoder and decoder, comparators, counters and registers using VHDL. As a part of this course, the students will be trained to design the digital circuits using CMOS transistors and measure the physical parameters. By this course, the students will be trained tool and back end tool of designing prototype digital IC.

# LIST OF EXPERIMENTS

#### Simulation and implementation of Combinational Circuits using VHDL

- 1. Design Entry and simulation of Encoder and Decoder
- 2. Design Entry and simulation of Multiplexer and Demultiplexer
- 3. Design Entry and simulation of comparator
- 4. Design Entry and simulation of binary multiplier
- 5. Design Entry and simulation of High speed adders

# Simulation and implementation of sequential logic circuits using VHDL

- 6. Design Entry and simulation of counters and registers.
- 7. Design Entry and simulation of state machines.

# **Hardware Implementation**

8. Design and implementation of Parallel adder.

# IC Design Experiments using Spice tool

- 9. Design of simple CMOS inverter, NAND gate and NOR gate parasitic extraction and simulation.
- 10. Layout design of simple CMOS inverter

### **TOTAL : 45 PERIODS**

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

- CO1 Write VHDL code for the combinational circuits encoder and decoder, multiplexer and demultiplexer, comparator, multiplier and parity checker/generator and simulate using EDA simulator.
- CO2 Design sequential circuits synchronous/ asynchronous up/down counters, registers and verify the functionality by writing VHDL and simulate using EDA simulator.
- CO3 Import the digital logic modules into FPGA Boards, Synthesize, Place and Route the prototype digital ICs using ISE tool.
- CO4 Design CMOS Inverter, CMOS NAND and CMOS NOR gates and simulate using Spice tool.
- CO5 Draw layouts for the CMOS Inverter and extract the parasitic from the layouts of Digital IC Blocks using Spice tool.

Mapping	of COs	with POs	and PSOs
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Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	2	2	3	3	2	1		2	1	3	1	1	3
CO 2	2	2	2	3	3		1		2		3			3
CO 3	2	2	2	3	3				2		3		1	3
CO 4	2	2	2	3	3			1	2		3			3
CO 5	2	2	2	3	3	2	1	1	2	1	3	1	1	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

# 22ECL63

### **MINI PROJECT**

# L T P C 0 0 6 3

## **Preamble:**

This course helps the students to develop the ability to solve a specific problem right from its identification and literature review to the successful solution of the same. It enables the students to work in a team and involves themselves in self-learning. It motivates the students to apply their innovation concepts and bring out market ready product.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Apply engineering fundamentals to analyze domain-specific Issues to identify problem statements with objectives and scope.
- 2. Investigate the identified problem and review state of the art literature surveys to synthesis system requirements.
- 3. Identify the risk/impact/technique interpret the suitable standards related to the problem statement and design appropriate procedures/methods.
- 4. Develop modules using discipline specific tools and implement the modules to achieve valid conclusions.
- 5. Prepare documents related to their findings for a detailed presentation, Defend the findings, and conclude with oral / written presentation.

	РО	PSO	PSO											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
C01	3	3	2	2	2	2	2	2	3	3	3	3	3	3
CO2	2	3	3	3	2	2	2	2	3	3	3	3	3	3
CO3	2	3	3	3	3	2	2	2	3	3	2	3	3	3
CO4	2	3	3	3	3	3	2	2	3	3	3	3	3	3
CO5	2	3	3	3	2	3	2	3	3	3	2	3	3	3

# **CO-PO Mapping:**

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

course Communicative Skills Laboratory aims at developing effective oral and written communication

**RECEPTIVE SKILLS** UNIT 1

professional success and progress.

**LISTENING & READING** – Developing Listening & Reading Skills - Comprehension and Analysis – Listening & Reading for Main Idea - Specific Information - Cloze Test- Rearranging words and sentences

#### UNIT 2 **PRODUCTIVE SKILLS**

SPEAKING & WRITING - Group Discussion and Practice – Mock GD - Structure – Types -Techniques - Keywords - Vital qualities - Attitude and Opinion - Expository and Persuasive Paragraphs - Picture Description

ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS 4 UNIT 3 Orientation to International English Language Testing System (IELTS) and other Competitive Examinations - MCQs

#### UNIT 4 **CAREER SKILLS**

Types of Interviews - FAQ's - Mock Interviews - Body Language - Team Work - Managing Time -Managing Stress - Negotiation Skills - Networking – Profile Creation (Linked in, Portfolio)

#### UNIT 5 **VERBAL ABILITY**

Synonyms and Antonyms - Idioms and Phrases - Sentence Construction and Improvement-Paraphrasing - Contextual Vocabulary - Verbal Analogy

# **TOTAL : 30 PERIODS**

# **REFERENCES:**

- M Ashraf Rizvi "Effective Technical Communication", Tata McGraw-Hill, 2<sup>st</sup> Edition, New Delhi, 2018. 1.
- 2. Koneru Aruna 'Professional Communication' MC Graw Hill Education, Chennai, 2008.
- Upadhyay Meenakshi & Arun Sharma 'Comprehension Interpersonal & Communication Skills for 3. General Studies Civil Services Preliminary Examination' MC Graw Hill Education, New Delhi, 2012.

# e-RESOURCES:

- https://www.teachingenglish.org.uk/article/email-writing 1.
- 2. http://www.oxforddictionaries.com/words/writing-job-applications
- https://www.fresherslive.com/online-test/verbal-ability-test/questions-and-answers 3.
- www.cambridgeenglish.org 4.

22MCL06

**Preamble:** 

**Communication Skills Laboratory** 

(Fifth / Sixth Semester)

Communication Skill is a life skill necessary for all students of Engineering and Technology. The

to facilitate their success in competitive examinations, and recruitment screening thereby ensuring

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**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Respond quickly and correctly to questions from different types of scripts, exhibiting good comprehension and analyzing skills
- CO2 Participate effectively in formal group discussions and prepare professional e mails, persuasive and expository paragraphs to establish and meet organizational needs and goals.
- CO3 Fare well in IELTS and other English language assessment segments of competitive examinations within the stipulated time.
- CO4 Write effective résumés, and face interviews with communicative competence and confidence, with a good knowledge of career skills.
- CO5 Select appropriate vocabulary and idiomatic expressions, identify errors in syntax, and arrange sentences to make meaningful paragraphs, without any aid.

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1					3					3				
CO 2									3	3				
CO 3										3		1		
CO 4									3	3		1		
CO 5										3		1		

# Mapping of COs with POs and PSOs

# 22ECT71 EMBEDDED AND REAL TIME SYSTEMS

### Pre-requisites:22ECT52- Microprocessor and Microcontroller

## **Preamble:**

This course familiarizes the concepts of embedded system design and make students to learn the architecture and programming of ARM processor. This course Exposes the basic concepts of embedded programming and trains the students to analyze the concepts of real time operating systems.

# UNIT 1 INTRODUCTION TO EMBEDDED COMPUTING

Complex systems and microprocessors– Embedded system design process –Design example: Model train controller- Design methodologies- Design flows – Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques.

# UNIT 2 ARM PROCESSOR AND PERIPHERALS

Instruction sets preliminaries – ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps - Memory system mechanisms – CPU performance- CPU power consumption-Features of the LPC 214X Family Peripherals –The Timer Unit –Pulse Width Modulation Unit –UART -Block Diagram of ARM7 MCU.

# UNIT 3 EMBEDDED COMPUTING PLATFORM DESIGN

The CPU Bus-Memory devices and systems–Components for embedded programs- Models of programs-Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Analysis and optimization of program size-Program validation and testing.

# UNIT 4 PROCESSES AND OPERATING SYSTEMS

Introduction – Multiple tasks and multiple processes – Preemptive real-time operating systems-Priority based scheduling- Inter process communication mechanisms – Evaluating operating system performance-Power optimization strategies for processes – Example Real time operating systems-Windows CE.

# UNIT 5 REAL TIME SYSTEMS AND NETWORKS

Structure of a Real Time System – Estimating program run times – Task Assignment and Scheduling - Distributed embedded systems – MPSoCs and shared memory multiprocessors – Design Example - Audio player and Engine control unit.

### **TOTAL : 45 PERIODS**

# **TEXT BOOKS:**

- 1. Marilyn Wolf, "Computers as Components Principles of Embedded Computing System Design", Third Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2022.
- 2. Jane W.S.Liu, "Real Time Systems", Pearson Education, Third Indian Reprint, 2003.

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## **REFERENCES:**

- 1. Lyla B.Das, "Embedded Systems: An Integrated Approach", Pearson Education, 2013.
- 2. Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Cengage Learning, Third Edition, 2012
- 3. David. E. Simon, "An Embedded Software Primer", AddisonWesley Professional, 1st Edition, Fifth Impression, 2007

### e-Resources:

- 1. Nptel video: https://nptel.ac.in/courses/106/105/106105159/, "Introduction to Embedded Systems", Dr.AnubamBasu, Computer Science Engineering, IIT Kharagpur.
- NPTEL video: https://nptel.ac.in/courses/108/102/108102169/, "Introduction to Embedded System Design", Prof.Badri N Subudhi& Prof. Dhananjay V. Gadre, Electrical Engineering, IIT, Jammu

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

- CO1 Evaluate the major tools of abstraction in the embedded system design process.
- CO2 Implement the working functionality of LPC 214X Family Peripherals based on the hardware architecture, memory organization and other attributes of ARM processor.
- CO3 Analyze the hardware and software platform used for embedded computing.
- CO4 Explain how the process and the operating system used to build applications with more complex functionality and much greater flexibility to satisfy timing requirements.
- CO5 Classify the important features that are essential for the successful completion of large embedded system projects.

Cos/POs	PO 1	PO 2	PO 3	PO 4	РО 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	РО 11	PO 12	PS 0 1	PS O 2
CO 1	2	3	3	2	2	1					2	1	2	3
CO 2	2	3	3	2	1								2	3
CO 3	2	3	3	2	1						2			3
<b>CO 4</b>	2	3	3	2	2				1		2	1	2	3
CO 5	2	3	3	2	2	1	1			1	2	1	2	3

### Mapping of COs with POs and PSOs

# 22ECT72 MICROWAVE AND OPTICAL COMMUNICATION L T P C

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### **Pre-requisites: 22ECT45 & Analog and Digital Communication**

## **Preamble:**

This course exposes the basics of Microwave and Optical devices and components and explains various optical fiber modes configurations and various signal degradation factors associated with optical fiber.

# UNIT 1 MICROWAVE PASSIVE COMPONENTS

Scattering matrix - Concept of N port scattering matrix representation - Properties of S matrix-Microwave junctions - Tee junctions: Magic Tee, Directional couplers, Circulator, Isolator, Terminations, Attenuators, Phase shifters, Gyrator.

# UNIT 2 MICROWAVE GENERATION AND MEASUREMENT

Gunn diode: Modes of Operation, Two cavity Klystron Amplifier, Reflex Klystron oscillator - Traveling Wave Tube (TWT) amplifier- Magnetron oscillator - Measurement of VSWR – Power and Impedance Measurement.

# UNIT 3 OVERVIEW AND STRUCTURES OF OPTICAL FIBER

Advantages of Optical Fibers – Optical Spectral Bands: Electromagnetic Energy, Windows and Spectral bands – key elements of optical fiber systems – Basic optical laws and definitions: Refractive index, Reflection and refraction – optical fiber modes and configurations: Fiber types, Rays and modes, Step index fiber structure, Ray optics representation – mode theory for circular waveguides: key modal concepts, cutoff wavelength and V number – single mode fibers – graded index fiber structure.

# UNIT 4 ATTENUATION AND DISPERSION

Attenuation: Absorption, Scattering losses, Bending Losses, Core and Cladding losses – Signal Dispersion in fibers: Dispersion origins, modal delay, Group Delay, Material Dispersion, Wave guide Dispersion, Dispersion in SM fibers – Polarization Mode dispersion.

# UNIT 5 OPTICAL SOURCES AND PHOTODETECTORS

LED: LED Structures, Light source materials, Quantum efficiency and LED power, Modulation of an LED Lasers Diodes: Modes and Threshold conditions, Rate equations, External Quantum efficiency, Resonant frequencies. Physical Principles of photodiodes: The PIN Photo detector, Avalanche photodiodes. Case Study : Challenges and Opportunities of Optical Fibers in Wireless Communication Technologies

# **TOTAL : 45 PERIODS**

# **TEXT BOOKS:**

- 1. Samuel Y Liao, "Microwave Devices & Circuits", Prentice Hall of India, Third Edition, Seventh Impression, 2008
- 2. Gerd Keiser, "Optical Fiber Communications", Tata McGraw Hill Education Pvt Ltd, 4th Edition, 2011.

# **REFERENCES:**

- 1. Robert E Colin, "Foundations for Microwave Engineering", John Wiley & Sons Inc, Second Edition, Reprint 2013.
- 2. Annapurna Das and Sisir K Das,"Microwave Engineering", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2005.

3. John M. Senior, "Optical Fiber Communication", Pearson Education, Third Edition, 2013.

# e-RESOURCES:

- 1. NPTEL video <u>https://nptel.ac.in/courses/108101112/</u>, Lecture 1 Microwave Theory and Techniques Introduction, Prof. Girish Kumar. IIT Bombay.
- NPTEL video <u>http://nptel.ac.in/courses/117101002/3</u>, "Advanced Optical Communication", Prof. R. K. Shevgaonkar, IIT, Bombay.

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

- CO1 Measure the reflection and transmission coefficient of passive microwave components by using scattering parameters.
- CO2 Summarize the characteristics of microwave generators and amplifiers
- CO3 Discuss the characteristics of step index, Graded index fiber with single mode and multimode configuration and evaluate the total number modes entering into the fiber using V number.
- CO4 Estimate the material and waveguide dispersion loss in fiber optic cable using refractive index profile and interpret the propagation characteristics of an optical signal in fiber optic cables.
- CO5 Classify the performance of surface emitter and edge emitter LED using active region and estimate quantum efficiency and LED power.

Cos/POs	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO 11	PO 12	PSO 1	PSO2
CO 1	1	2	2	1	1	1	1		1			1	3	
CO 2	1	2	2		1			1	1		1		3	
CO 3	1	2	2		1	1			1			1	3	
<b>CO 4</b>	1	2	2	1	1				1				3	
CO 5	1	2	2		1		1		1	1	1		3	

# Mapping of COs with POs and PSOs

#### VCET, B.E-ECE, R2022 Curriculum and Syllabus

# **Pre-requisites:** Universal Human Values

## Preamble

Universal Human Values is a life skill necessary for all students of Engineering and Technology. The course aims to identify the values and skills, and to realize the need, basic guidelines, content and process of value education. Professional Ethics For Engineers deals with the human values, integrity and work ethics in the common world. This course is mainly concerned about the theories of ethics, which form the basis for the understanding and responsibility of the various groups encountered in Engineering.

# UNIT 1 INTRODUCTION TO UNIVERSAL HUMAN VALUES

Understanding the need, basic guidelines, content and process for Value Education. Self Exploration– Mechanism for self-exploration. Continuous Happiness and Prosperity- Basic Human Aspirations and its requirements for fulfillment of Human Aspirations understanding and living in harmony at various levels.

# UNIT 2 HARMONY IN ONESELF, FAMILY AND SOCIETY

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationships. Trust and Respect- values of relationship. Difference between intention and competence. Difference between respect and differentiation

# UNIT 3 HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL 3

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics. Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models.

# UNIT 4 ENGINEERING ETHICS

Senses of Engineering Ethics– Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and controversy – Models of professional roles –Professional responsibility - Moral reasoning - Theories about right action – Self-interest – Self respect – Duty ethics – Customs and religion.

# UNIT 5 ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation – Engineers as responsible experimenters – Role of codes- Codes of Ethics – Sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers (IETE) – A balanced outlook on law - Safe exits -The Bhopal gas tragedy and Challenger case study.

Total: 15

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# 22HST71 HUMAN VALUES AND PROFESSIONAL ETHICS L

# **TEXT BOOKS:**

- 1. Gaur R R, Sangal R, Bagaria G P, "A Foundation Course in Human Values and Professional Ethics". 3rd Revised Edition, 2023
- 2. Govindarajan M, Natarajan S and Senthil Kumar V. S, "Engineering Ethics", PHI Learning Pvt. Ltd, New Delhi, 2017.

## **REFERENCES:**

- 1. Banerjee B P, "Foundations of Ethics and Management", Excel Books. 2005.
- 2. Bajpai B L, "Indian Ethos and Modern Management", New Royal Book Co., Lucknow. Reprinted 2008.
- 3. Subramanian R, "Professional Ethics", Oxford university press, 2017.
- Course Outcomes: Upon completion of this course, students will be able to:
- CO1 Relate the significance of value inputs in a classroom and start applying them in their life and profession.
- CO2 Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.
- CO3 Interpret the value of harmonious relationships based on the trust and respect in their life and profession.
- CO4 Discuss the ethical issues related to Engineering.
- CO5 Discuss Engineer's work in the context of its impact on society.

COs/POs	РО 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1						2	3	2	2			2		
CO 2						3		3	1			2		
CO 3						2	2	3	3	3		2		
CO 4	1	2				3		2				2		
CO 5	2	2	1			3	2	2				2		

# Mapping of COs with POs and PSOs

# 22ECL71EMBEDDED LABORATORYLTPC

0 0 2 1

# $\label{eq:pre-requisites: 22ECL51-Microprocessor and Microcontroller \ Laboratory$

# **Preamble:**

Embedded systems laboratory course helps the students to develop their knowledge on ARM Processor architecture and the programming skills. This laboratory course provides hands-on experience to interface an ARM based microcontroller with LED, LCD, ADC, DAC, Keypad and Temperature sensors.

# LIST OF EXPERIMENTS

- 11. Programming of LED and LCD display interface using LPC214X Microcontroller.
- 12. Interfacing ADC and DAC peripherals with ARM Microcontroller.
- 13. Programming of Buzzer, Relay and Temperature Sensors using LPC214X Microcontroller.
- 14. Interfacing of temperature sensor with ARM Microcontroller.
- 15. Programming of matrix keypad interface using LPC214X Microcontroller.
- 16. Interrupt Programming using ARM Microcontroller.
- 17. Timer and UART Programming using LPC214X Microcontroller.
- 18. Stepper Motor Interface with ARM Microcontroller.
- 19. DC motor speed control using PWM.
- 20. Implementing wireless Communication using Zigbee Protocol

# **TOTAL : 45 PERIODS**

**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Program ARM microcontroller in C using Integrated Development Environments.
- CO2 Interface ARM microcontroller with A/D and D/A convertors
- CO3 Interface ARM microcontroller with switch, matrix keypad, LCD display and Sensors.
- CO4 Interface ARM microcontroller with stepper motor and DC motor.
- CO5 Implement zigbee Protocol with ARM based microcontroller

	PO	PSO	PSO											
COS/POS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	2	1	3	2				2	1	1	1		3
CO 2	2	2	2	3	2				2		2			3
CO 3	2	2	2	3	2				2		2			3
CO 4	1	1	2	3	2				2		2			3
CO 5	1	1	2	3	2	1	1	1	2		1		1	3

# Mapping of COs with POs and PSOs

# 22ECL72 MICROWAVE AND OPTICAL COMMUNICATION LABORATORY

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# **Preamble:**

This course imparts the knowledge on performance parameters of optical source and detector. This course assists the students in obtaining better understanding of the operation of microwave components.

# LIST OF EXPERIMENTS

- 1. Reflex klystron or Gunn diode characteristics
- 2. Directional Coupler Characteristics
- 3. Radiation Pattern of Horn Antenna.
- 4. S-parameter Measurement of Isolator.
- 5. Attenuation and Power Measurement
- 6. Measurement of connector and bending losses.
- 7. Numerical Aperture determination for Fibers.
- 8. Fiber optic Analog and Digital Link.
- 9. Attenuation Measurement in Fibers.
- 10. Design a Microstrip patch antenna using HFSS.

# **TOTAL : 45 PERIODS**

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Experiment and determine numerical aperture and mode characteristics of optical fiber.
- 2. Experiment and determine VI characteristic of optical fiber light sources.
- 3. Experiment and determine different kind of losses in optical communication system.
- 4. Identify the microwave components and test Gunn diode & Reflex Klystron Characteristics.
- 5. Design and analyze the performance of Microstrip Patch antenna using HFSS.

# Mapping of COs with POs and PSOs:

	PO	РО	PSO	PSO										
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	3	2				3	1			3	
CO2	2	2	2	3	2				3				3	
CO3	2	2	2	3	2				3				3	
CO4	1	1	2	3	1				3				3	1
CO5	1	1	2	3	1	1	1		3		1	1	3	1

#### **22MCT07** INDIAN CONSTITUTION AND TRADITIONAL KNOWLEDGE LTPC 2000

Preamble: The course provides basic information on Indian Constitution and Indian Traditional knowledge. This is essential for all citizens and especially for engineers so that they become aware of Indian polity and governance. This also reminds the citizen about their obligation, adherence and up keeping of Constitutional rights.

### UNIT 1

Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy - Structure of the Indian Union: Federalism, Centre- Staterelationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha

# UNIT 2

Governor: Role and Position, CM and Council of ministers, State Secretariat: organisation, Structure and Functions District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, 6

### UNIT 3

Panchayatraj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Blocklevel: Organizational Panchayat: Position and role, Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy 6

### **UNIT 4**

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, StateElection Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

### UNIT 5

Basic structure of Indian Knowledge System-Modern Science and Indian Knowledge -Philosophical Tradition - Indian Linguistic Tradition (Phonology, morphology, syntax and semantics) – Indian Artistic Tradition

# **TEXT BOOKS:**

- 1. M.Rajaram, Indian Constitution, New Age International, 2009
- V.Sivaramakrishnan (Ed.) Cultural Heritage of India (Course Material), Bharatiya Vidya 2. Bhavan, Mumbai. 5<sup>th</sup> Edition,2014

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Outline the evolution of Indian constitution and Federal structure
- 2. List the functions of Centre, States and District Administrations
- 3. Elaborate the roles of Panchayatiraj
- 4. Explain the powers and roles of Election Commission
- 5. Illustrate the Indian traditional knowledge and elucidate their recovery

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### **TOTAL: 30 PERIODS**

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# Mapping of COs with POs and PSOs:

Course	РО	РО	РО	PO	PSO	PSO								
outcomes	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1						3	1	2	1	1		1		
CO 2						3	1	2	1	1		1		
CO 3						3	1	2	1	1		1		
CO 4						3	1	2	1	1		1		
CO 5						3	1	2	1	1		1		

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

# 22ECL81

### INTERNSHIP

#### **Preamble:**

This course helps the students to develop skills to carry out research and get connected with industry/laboratory/research institutes. It enables the students to get practical knowledge of the production process in the industry and develop skills to solve related problems.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Apply appropriate workplace behaviors in a professional setting.
- 2. Exhibit evidence of increased content knowledge appropriate to the job assignment.
- 3. Describe the nature and function of the organization.
- 4. Explain how the internship placement site fits into their broader career field.
- 5. Evaluate the internship experience to develop their personal, educational, and career needs.

	РО	PO	PO	РО	PO	PO	РО	PO	PO	PO	PO	PO	PSO	PSO
C05/F05	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	2	2	2	2	3	3	3	3	3	3
CO2	2	3	3	3	2	2	2	2	3	3	3	3	3	3
CO3	2	3	3	3	3	2	2	2	3	3	2	3	3	3
CO4	2	3	3	3	3	3	2	2	3	3	3	3	3	3
CO5	2	3	3	3	2	3	2	3	3	3	2	3	3	3

### Mapping of COs with POs and PSOs:

## 22ECL82

# **PROJECT WORK**

# **Preamble:**

This course helps the students to develop the ability to solve a specific problem right from its identification and literature review to the successful solution of the same. It enables the students to work in a team and involves themselves in self-learning. It motivates the students to apply their innovation concepts and bring out market ready product.

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Apply engineering fundamentals to analyze domain-specific Issues to identify problem statements with objectives and scope.
- 2. Investigate the identified problem and review state of the art literature surveys to synthesis system requirements.
- 3. Identify the risk/impact/technique interpret the suitable standards related to the problem statement and design appropriate procedures/methods.
- 4. Develop modules using discipline specific tools and implement the modules to achieve valid conclusions.
- 5. Prepare documents related to their findings for a detailed presentation, Defend the findings, and conclude with oral / written presentation.

Cos/POs	PO 1	PO 2	РО 3	РО 4	РО 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<u> </u>		2	2	2					2	2	2	2	2	2
	3	3	2	2	2	2	2	2	3	3	3	3	3	3
CO2	2	3	3	3	2	2	2	2	3	3	3	3	3	3
CO3	2	3	3	3	3	2	2	2	3	3	2	3	3	3
CO4	2	3	3	3	3	3	2	2	3	3	3	3	3	3
CO5	2	3	3	3	2	3	2	3	3	3	2	3	3	3

### Mapping of COs with POs and PSOs:

FC.			

- L.Gopinath, "Wireless Networks" Suchitra publications, First Edition, 2017.
- William Stallings, "Wireless Communications and Networks", 2nd Edition, Pearson/ Prentice 3. Hall India, 2007.
- 4. PahalavanK, Krishnamurthy P, "Principles of Wireless Networks - A Unified Approach", Prentice Hall, 2002.

VCET, B.E-ECE, R2022 Curriculum and Syllabus

#### **22ECE11** WIRELESS NETWORKS LTPC **Preamble:** 3 0 0 3

This course provides a preview of emerging wireless technologies, protocol stack and their 4G architectural impact on the future mobile Internet

#### UNIT 1 WIRELESS LAN

Introduction to Wireless LAN: Topologies - IEEE 802.11 WLAN: Architecture, Physical Layer, MAC SubLayer - IEEE 802.11 Standards: HIPERLAN, WiMAX: Physical layer, Mac layer.

#### UNIT 2 WIRELESS PERSONAL AREA NETWORKS

Introduction to Bluetooth: Architecture, Protocol Stack, Network Topology, Applications - Wireless Sensor Network: Architecture, Protocol Stack - Zigbee Technology: Components and Network Topologies.

#### UNIT 3 ADHOC WIRELESS NETWORKS

Characteristics of Adhoc Networks - Contention based MAC Protocols with scheduling mechanisms - Issues in designing a routing protocol - DSDR, WRP Routing Protocol.

#### UNIT 4 **MOBILE NETWORK AND TRANSPORT LAYER**

TCP Enhancements for Wireless Networks - Implementation of Wireless TCP - Mobile IP and Session Initiation Protocol.

#### FOURTH GENERATION SYSTEMS AND NEW WIRELESS UNIT 5 **TECHNOLOGIES**

Introduction -4G vision -4G features and challenges - Applications of 4G - 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

# **TEXT BOOK:**

- Vijay.K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 1. 2017
- Siva Ram Murthy C, Manoj B S, "Ad Hoc Wireless Networks: Architectures and Protocols", 2. Prentice Hall, 2017.

# **REFERENCES:**

- 1.
- P.Nicopolitidis, "Wireless Networks", Wiley student edition, 2012. 2.

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**TOTAL: 45 PERIODS** 

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#### e-RESOURCES:

- 1. YoutubeVideos:<u>https://www.youtube.com/watch?v=gE425k9XvR4&list=PL2kEo\_196iW7aO</u> <u>FNPOz5dSpP5uQe-zDOY&index=3</u>, "Wireless Networks", Networking and CCNA videos.
- 2. YoutubeVideos:<u>https://www.youtube.com/watch?v=4\_zSIXb7tLQ&list=PL7zRJGi6nMRzHky</u> <u>XpGZJg3KfRSCrF15Jg&index=17</u>,"Wireless LAN", Animated information technology videos.

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Analyze WLAN, Hiper LAN and WIMAX in wireless networks and select appropriate LAN for suitable application.
- 2. Apply Bluetooth and ZigBee technology to transfer the data between multiple devices for the real time applications.
- 3. Apply routing algorithms to route a packet from source to destination in a given AdHoc wireless networks.
- 4. Utilize the wireless TCP protocol in mobile network to transfer the data securely.
- 5. Demonstrate the characteristics of 4G mobile network to provide global mobility support anytime anywhere.

COs/POs	PO	PSO	PSO											
005/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	1	1	2	1	1					1			3	2
CO 2	1	1	2	1	1					1	1		3	2
CO 3	1	1	2	1	1					1	1		3	2
CO 4	1	1	2	1	1	1	1			1	1	1	3	2
CO 5	1	1	2	1	1	1	1	1	1	1		1	3	2

#### Mapping of COs with POs and PSOs:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

#### UNIT 1 INTRODUCTION Principle of Wireless Sensor Network-Introduction to wireless

of MAC and Routing Protocols and use of TinyOS and NS3 in WSN design.

Principle of Wireless Sensor Network-Introduction to wireless sensor networks-: Challenges and constraints, Comparison with Mobile ad hoc networks-Types of wireless sensor networks -Sample applications around the world

This course provides fundamentals of wireless sensor network design. The course gives the knowledge

## UNIT 2 ANATOMY OF A SENSOR NODE

Hardware components- Power consumption- operating systems and concepts: Memory Management-Interrupts- Tasks, Threads, and Events- Communication stack- Optimization goals and figures of merit:Quality of service - Scalability - Robustness - Gateway Concepts

### UNIT 3 RADIO COMMUNICATIONS

Radio waves and modulation/demodulation- Properties of wireless communications- Interference and Noise- Hidden Terminal Problem- Exposed Terminal Problem- Medium access protocols: Design Criteria for MAC- Time Division Multiple Access- Carrier Sense Multiple Access- Sensor MAC-Berkeley MAC- Optimizations of B-MAC

#### UNIT 4 LINK MANAGEMENT AND MULTI-HOP COMMUNICATIONS

Properties of wireless links- error control- naming and addressing- link estimation protocols- Topology control- Multi-hop Communications -Routing basics and metrics- Routing protocols.

## UNIT 5 OPERATING SYSTEMS AND SIMULATORS

Sensor network programming challenges –Node level software platforms : Operating system-TinyOS – Imperative language- nesC, Node level Simulators-NS2 & NS3, Role of COOJA Simulator in IoT.

### **TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

**Preamble:** 

- 1. Anna Forster, "Introduction to Wireless Sensor Networks", Wiley, 2017.
- 2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks", An Information Processing Approach", Elsevier, 2016.

#### **REFERENCES:**

- 1. Kazemsohraby, Danielminoli & Taiebznati "Wireless sensor Networks- Technology ,protocols and applications", Wiley, 2015
- 2. HolgerKarl , Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John Wiley Publication, 2013.

## 22ECE12 WIRELESS SENSOR NETWORK

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#### e-RESOURCES:

- 1. NPTEL video: https://nptel.ac.in/courses/106105160- "Wireless Ad Hoc and Sensor Networks", Prof. Sudip Misra ,IIT Kharagpur,
- 2. Article :https://www.researchgate.net/publication/348929817\_Role\_of\_COOJA\_Simulator\_in\_IoT

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Summarize the utility and application of Wireless sensor networks to overcome the challenges faced by Physical Environment.
- 2. Identify the quality of hardware and software components and topologies used in standalone and centrally coordinated wireless network.
- 3. Infer medium access control protocols that allow several users or transmitters to access a common medium or channel.
- 4. Illustrate different routing protocols to obtain maximum energy conservation from each node of the network.
- 5. Compare and contrast various network simulators to provide substantial support for simulation of different routing protocols over wired and wireless networks.

	PO	PSO	PSO											
COS/POS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	2	3	1		1	1					1	3	1
CO 2	2	2	3	1			1					1	3	1
CO 3	2	2	3	1	2			1		1	1	1	3	1
CO 4	2	2	3	1	2			1				1	3	1
CO 5	2	2	3		2						1	1	3	1

#### Mapping of COs with POs and PSOs:

1: Slight (Low) 2:

2: Moderate (Medium)

3: Substantial (High)

HIGH PERFORMANCE NETWORKS

#### Preamble:

**22ECE13** 

High-performance networks (HPNs) play a role in real-time data processing requirements like data center replication, datacenter disaster recovery, and high-performance distributed computing require high volume data transfer and low network latency. HPNs with dynamic connection capabilities make high performance network resources more accessible and manageable.

#### UNIT 1 INTRODUCTION

Review of OSI – TCP/IP: Multiplexing – Modes of Communication – Switching – Routing. SONET – DWDM – DSL – ISDN – BISDN – ATM.

#### UNIT 2 MULTIMEDIA NETWORKING APPLICATIONS

Streaming stored Audio and Video – Best effort service – protocols for real time interactive applications – Beyond best effort – scheduling and policing mechanism – integrated services – RSVP – differentiated services.

### UNIT 3 ADVANCED NETWORKS CONCEPTS

VPN – Remote Access VPN – site to site VPN – Tunneling to PPP – Security in VPN - MPLS operation Routing – Tunneling and use of FEC – Traffic Engineering – MPLS based VPN – overlay networks – P2P connections

### UNIT 4 TRAFFIC MODELLING

Little's theorem – Need for modeling – Poisson modeling and its failure – Non-Poisson models – Network performance evaluation.

### UNIT 5 NETWORK SECURITY AND MANAGEMENT

#### **TEXT BOOKS:**

- 1. J.F. Kurose & K.W. Ross, "Computer Networking A top down approach featuring the internet", Pearson, 8<sup>th</sup> edition, 2021.
- 2. Aunurag Kumar, D. Manjunath, Joy Kuri, "Communication Networking", Morgan Kaufmann Publishers, 2011.

### **REFERENCES:**

- 1. Nader F.Mir, "Computer and Communication Networks", Pearson Education , First edition, 2010.
- 2. LEOM GarCIA, WIDJAJA, "Communication networks", TMH seventh reprint, 2002
- 3. Walrand .J. Varatya, "High performance communication network", Morgan Kauffman Harcourt Asia Pvt. Ltd. 2nd Edition, 2000.

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**TOTAL : 45 PERIODS** 

#### e-Resources:

- 1. **NPTEL Video:** https://nptel.ac.in/courses/106/105/106105033/ "High performance Networks" Prof. Mathew Jacob, IIT Kharagpur.
- 2. Journal: http:// www.ece.gmu.edu/.../high performance communication networks\_1.pdf

**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Describe the functions of each layer in OSI model and different modes of communication to achieve high volume data transfer with low network latency.
- CO2 Apply various networking protocols in real time applications to design interactive multimedia software.
- CO3 Discuss the tunneling concepts of VPN to protect information over the internet.
- CO4 Evaluate the performance of network using Poisson and non-poison model.
- CO5 Compare the different attacks on networks and summarize the performance of firewalls and its protocol to secure network and management.

#### Mapping of COs with POs and PSOs:

COs/POs	PO 1	<b>PO</b> 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	3	2	2	1	1		2	1	1	1	3	
CO 2	3	2	3	2	2		1		2				3	2
CO 3	3	2	3	2			1	1					3	
CO 4	3	2	3		2		1						3	2
CO 5	3	2	3		2	1	1	1	2	1	1	1	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

#### **22ECE14** MODERN WIRELESS COMMUNICATION SYSTEMS L Т Р С

#### **Preamble:**

This course presents technological insight into 5G network and its associated technologies in wireless and mobile communication Systems. The course will enable the students to learn about the Architecture, Machine type communications, Radio access technologies and Antenna techniques used in 5G wireless communication systems.

#### **UNIT 1 INTRODUCTION TO 5G**

Mobile communication generation from 1G to 4G, 5G requirements -5G architecture :NFV, SDN, RAN-Functional architecture and 5G flexibility- 5G frequency bands

#### UNIT 2 USE CASES OF 5G

Machine Type Communications: fundamental techniques, URLLC-MTC, D2D communications: Radio Resource Management, Millimeter wave communication - hardware technologies.

#### UNIT 3 5G RADIO ACCESS TECHNOLOGY

Multicarrier with filtering: FBMC, NOMA - Radio access for dense Deployments: Radio access for V2X communication, Radio access for massive machine type communication.

#### **UNIT 4 SPECTRUM AND CHANNEL MODELS**

Spectrum access modes and sharing scenarios - 5G spectrum technologies, - Channel modeling requirements and scenarios - METIS channel models.

#### **UNIT 5 ANTENNA TECHNIQUES**

Massive MIMO : Single user MIMO , Multi user MIMO , Pilot design for massive MIMO - pilot-data trade-off and impact of CSI - Techniques to mitigate pilot contamination-Resource allocation and transceiver algorithms for massive MIMO - beam forming.

#### **TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

- Afif Osseiran, Jose F.Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications 1. Technology", Cambridge University Press, 1stEdition, 2016.
- Erik Dahlman, Stefan Parkvall, Johan Sko'ld, "5G NR: The Next Generation Wireless Access 2. Technology", Elsevier, 1<sup>st</sup> Edition, 2016.

#### **REFERENCES:**

- Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", 1st Edition, John Wiley & Sons, 1. 2015.
- 2. Patrick Marsch, Omer Bulakçı, Olav Queseth and Mauro Boldi, "5G System Design-Architectural and Functional Considerations and Long Term Research", 1st Edition, John Wiley & Sons, 2018.

#### e-Resources:

Web resource :https://www.rfwireless-world.com/Tutorials/5G-network-architecture.html 1.

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2. Web resource :https://www.intel.com/content/www/us/en/wireless-network/5g-use-cases applications.html

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

- CO1 Interpret the concepts of 5G network architecture by comparing generations from 1G to 4G.
- CO2 Infer the use cases and requirements for 5G with machine type communications and millimeter wave communication
- CO3 Comprehend the radio access technologies of V2X communication and massive MTC used in 5G wireless communication networks
- CO4 Apply the spectrum optimization techniques and propagation channel modeling scenarios for 5G wireless communication
- CO5 Comprehend massive MIMO implementation with resource allocation and transceiver algorithms in 5G networks.

COs/POs	PO 1	<b>PO</b> 2	PO 3	<b>PO</b> 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	2		1					2			3	
CO 2	3		2	2		1				2			3	
CO 3	3	2	2	2		1				1			3	
CO 4	3	2		2				2		1			3	
CO 5	3	3	2	2			1				1		3	

Mapping of COs with POs and PSOs:

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

## 22ECE15 INFORMATION THEORY AND CODING TECHNIQUE

#### Preamble:

This course provides a preview of understanding error control coding techniques and encoding, decoding of digital data streams and aware of compression and decompression techniques in text, audio, video format and learn the concept of multimedia communication

#### UNIT 1 INFORMATION ENTROPY FUNDAMENTALS

Uncertainty, Information and Entropy-Source coding theorem: Huffman coding, Shannon Fano coding, Run length encoding, Lempel-Ziv algorithm- Channel coding-Channel Capacity theorem.

### UNIT 2 DATA AND VOICE CODING

Differential pulse code modulation-Adaptive Differential pulse code modulation-Delta modulation-Adaptive delta modulation-Coding of speech signal at low bit rates.

### UNIT 3 COMPRESSION TECHNIQUES

Text compression: Huffman coding, Arithmetic coding - Image Compression: Graphics interchange format, Tagged image file format, JPEG standards.

### UNIT 4 AUDIO AND VIDEO CODING

Audio coding: Linear predictive coding, code excited LPC, Perceptual coding-Video compression: Principles, Introduction to H.261 & MPEG standards.

#### UNIT 5 ERROR CONTROL CODING

Linear block codes - Syndrome decoding - cyclic codes: systematic and non systematic form-Convolutional encoder: Tree codes, Trellis codes and Viterbi decoding algorithm.

#### **TOTAL: 45 PERIODS**

#### **TEXT BOOK:**

- 1. Simon Haykin, "Communication Systems", 5<sup>th</sup> Edition, John Wiley and sons, 2021.
- 2. Ranjan Bose, "Information theory coding and cryptography", Tata McGraw-Hill 2016
- 3. Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2009

#### **REFERENCES:**

- 1. J S Chitode, "Information Coding Techniques", Technical Publications, 2021
- 2. Arijit saha, "Information theory coding and cryptography", Pearson India -2013
- <sup>3.</sup> Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995

#### e-RESOURCES:

1. Nptel Videos: <u>https://nptel.ac.in/courses/108102117</u>, "Information theory, coding and Cryptography, Prof.Ranjan Bose , Department of Electrical Engineering, IIT Delhi.

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2. **Nptel Videos:** <u>https://www.youtube.com/watch?v=f8RvFlr5wRk&list=PLbMVogVj5nJRI\_hU-OyxRyHTsCg4iXCEd</u> "Information theory and coding", Prof.S.N.Merchant, Department of Electrical Engineering, IIT Bombay.

**Course Outcomes:** Upon completion of this course, students will be able to:

- 1. Analyze encoding algorithms and apply in suitable application.
- 2. Modulate speech signal at low bit rate using adaptive delta and pulse code modulation.
- 3. Compress text information and images using Huffman coding and JPEG standards.
- 4. Encode audio and video signals using Linear predictive coding and MPEG standards.
- 5. Apply different error control coding techniques for error detection and correction.

#### Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	3	3			1	1			1	2	2	3	2
CO 2	2	3	3	1		1	1			1	2	2	3	2
CO 3	2	3	3	1		1	1			1	2	2	3	2
CO 4	2	3	3			1	1			1	2	2	3	2
CO 5	2	3	3			1	1	1		1	2	2	3	2

1: Slight (Low)

2: *Moderate* (*Medium*)

3: Substantial (High)

"-"No correlation

### Asymmetric Encryption.

#### UNIT 4 NETWORK SECURITY

Transport level Security- Web Security, SSL, TLS, HTTPS, SSH- Wireless network security-E Mail security-PGP, S/ MIME, DKIM, IP Security.

#### **UNIT 5 SYSTEM LEVEL SECURITY**

Intrusion detection – password management – Malicious software – Viruses and related Threats: Virus Counter measures, worms, DDoS attacks-Firewall Design Principles - Trusted Systems.

#### **TEXT BOOKS:**

- William Stallings, "Cryptography and Network Security", Pearson Education, 8th Edition, 2023. 1.
- 2. Wade Trappe, Lawrence C Washington, "Introduction to cryptography with coding theory", Pearson, 3<sup>rd</sup> edition, 2020.

#### **REFERENCES:**

- Behrouz A Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2<sup>nd</sup> Edition, 2008. 1.
- Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, 3<sup>rd</sup> edition, 2013. 2.
- W.Mao, "Modern Cryptography- Theory and Practice", Pearson Education, Second Edition, 2007. 3.

#### **Preamble**

**22ECE16** 

This course describes the explosive growth in computer systems and their interconnections via networks. This in turn, has led to a heightened awareness of the need to protect data and resources from disclosure. This course explains the authenticity of data and messages, and to protect systems from network-based attacks and the disciplines of cryptography and network security.

**CRYPTOGRAPHY AND NETWORK SECURITY** 

#### **UNIT 1 NETWORK SECURITY CONCEPTS**

OSI Security Architecture - Classical Encryption techniques - Block Cipher Principles - Data Encryption Standard- Basic concepts in number theory and finite fields – Block Cipher Design Principles and Modes of Operation - Evaluation criteria for AES - AES Cipher - Triple DES.

Number Theory- Public Key Cryptography and RSA-Key Management - Diffie-Hellman key Exchange -Elliptic Curve Architecture and Cryptography - Confidentiality using Symmetric Encryption and

#### UNIT 2 PUBLIC KEY CRYPTOGRAPHY

UNIT 3 CRYPTOGRAPHIC AND DATA INTEGRITY ALGORITHMS

Applications of cryptographic hash functions- Simple Hash Functions- Requirements and security-Secured Hash Algorithm- Message Authentication requirements and functions – Message Authentication Codes - Security of MACs - HMAC- Digital Signatures - ElGamal Digital signature scheme- Schnorr Digital signature scheme - Digital Signature Standard.

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**TOTAL : 45 PERIODS** 

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#### e-Resources:

- 1. Nptel Video: https://nptel.ac.in/courses/106/105/106105031/ "Cryptography\_and\_Network Security", Dr.Mukhopadhyay, IIT-Kharagpur.
- 2. IEEE Explore: https://ieeexplore.ieee.org/document/9753967/"cryptography-and-network-security", Himanshu Arora; Tanuj Manglani; Geetanjli Bakshi; Shikha Choudhary.

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

- CO1 Encrypt and decrypt of the data using block cipher encryption techniques.
- CO2 Analyze public key signature and verify signatures using public key encryption and number theory methods.
- CO3 Find unauthorized modification in the data using hash and digital signatures methods.
- CO4 Compare and contrast the network threats with network security applications.
- CO5 Examine and detect intrusion, viruses, threats and worms in malicious software and password management system using firewall design.

COs/POs	PO 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	3	2		1	1		2	1	1	1	3	
CO 2	3	2	3	2	2		1	1	2				3	2
CO 3	3	2	3	2			1	1					3	
CO 4	3	2	3	2	2		1						3	2
CO 5	3	2	3	2	2	1	1	1	2	1	1	1	3	2

#### Mapping of COs with POs and PSOs:

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

#### **22ECE17**

#### **Preamble:**

This course presents the state-of-the-art in the field of Software defined and Cognitive Radio Systems. The course will enable the students to learn about the architecture, design methodologies, spectrum sensing and management techniques used in emerging wireless applications.

**COGNITIVE RADIO** 

#### UNIT 1 SOFTWARE DEFINED RADIO

Software Defined Radio Architecture- Digital Signal Processor and SDR Baseband Architecture-Reconfigurable OFDM and CDMA- Digital Radio Processing- Wireless Networks - Multiple Access Communications and ALOHA- Splitting Algorithms- Carrier Sensing- Routing - Flow Control.

#### UNIT 2 **COOPERATIVE COGNITIVE RADIO COMMUNICATIONS**

Information Theory for Cooperative Communications- Cooperative Communications, Cooperative Wireless Networks- Cognitive Radios and Dynamic Spectrum Access- Fundamental Limits of Cognitive Radios- Mathematical Models Toward Networking Cognitive Radios.

#### UNIT 3 **COGNITIVE RADIO NETWORK**

Network Coding for Cognitive Radio Relay Networks- System Model- Network Capacity Analysis on Fundamental CRRN Topologies- Link Allocation- Numerical Results- Cognitive Radio Networks Architecture- Network Architecture.

#### UNIT 4 MAC AND NETWORK LAYER DESIGN

Spectrum Sensing for Cognitive OFDMA Systems- Spectrum Sensing for Cognitive Multi-RadiNetworks- Medium Access Control: MAC for Cognitive Radios, Routing in Cognitive Radio Networks- Control of CRN- Self-organization in Mobile Communication Networks.

#### UNIT 5 TRUSTED COGNITIVE RADIO NETWORKS

Framework of Trust in CRN- Trusted association and routing- Trust with learning- Security inCRN. **TOTAL: 45 PERIODS** 

#### **TEXT BOOK:**

- Mubashir Husain Rehmani ,RiadhDhaou, "Cognitive Radio, Mobile Communications and 1. Wireless Networks", EAI/Springer Innovations in Communication and Computing, 2019.
- Kwang-Cheng Chen, Ramjee Prasad, "Cognitive Radio Networks", Wiley, 2009 2.
- Bruce A. Fette, "Cognitive Radio Technology", Elsevier, 2009. 3.

#### **REFERENCES:**

- Jung-Min Park, Kaigui Bain, "Cognitive Radio Networks: Medium Access Control for 1. Coexistence if Wireless Systems", Springer, 2014.
- E. Biglieri, A.J. Goldsmith., L.J. Greenstein, N.B. Mandayam, H.V. Poor, "Principles of 2. Cognitive Radio", Cambridge University Press, 2013.
- 3. Mussaab Ibrahim, Mohammed Ibrahim and Lufungula Kalemba Mosa Dadhy, "Spectrum Management in Cognitive Radio Networks", LAMbert Academic, 2012.

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#### e-RESOURCES:

- 1. NptelVideo: https://nptel.ac.in/courses/108/107/108107107/, "Basics of software defined radios and practical applications", DrMeenakashi, Rawat, IIT Roorkee.
- 2. Web Sources: https://www.youtube.com/watch?v=SljXFf0vgvw, "Cognitive radio and wireless communication", Prof.K.AdityaJagannathan, IIT kANPUR

#### **Course Outcomes OUTCOMES: Upon completion of the course, students will be able to:**

- 1. Explain the basics of Software Defined Radio and how it evolves from Software Defined Radio to Cognitive Radio.
- 2. Illustrate the performance of cognitive networks using Cooperative Cognitive Radio and Cooperative wireless networks.
- 3. Develop the frequency band with seamless communication during transition of data in Cognitive radio network.
- 4. Describe the functions of MAC layer and Network layer and its various protocols to performing multiplexing and scheduling tasks in QoS.
- 5. Interpret the basics of security management attacks & its counter measures to secure Routing Model in Cognitive Radio Network

#### Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
005/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	1	2	2		-	-	-	-	1	-	1	3	-
CO 2	3	1	2	2	-	-	-	-	-	1	-	-	3	-
CO 3	3	1	2	2	2	2	-	1	-	-	1	1	3	-
CO 4	3	1	2	2	2	2	-	-	-	-	-	-	3	-
CO 5	3	1	2	2	2	2	1	-	-	-	1	1	3	-

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High)

#### 22ECE21

#### **Preamble:**

This course deals with the field of medical equipment's and their advancement in their technologies. Various biomedical equipment are being used by doctors, hospitals as well as industries. Even now a days, people are having some health related issues BP, Sugar etc measuring devices at homes. With the huge demand of such devices, more trained and certifies manpower is required by the biomedical industry

#### UNIT 1 ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING

**MEDICAL ELECTRONICS** 

Sources of bio medical signals: Bio-potentials, Biopotential electrodes, biological amplifiers- ECG- EEG- EMG- PCG: typical waveforms and signal characteristics.

#### UNIT 2 BIO -CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT

pH- PO2- PCO2- Colorimeter- Blood flow meter- Cardiac output-Respiratory measurement- Blood pressure measurement- Temperature and Pulse measurement- Blood Cell Counters.

#### UNIT 3 ASSIST DEVICES

Cardiac pacemakers- DC Defibrillator - Dialyser- Ventilators- Magnetic Resonance Imaging Systems-Ultrasonic Imaging Systems.

#### UNIT 4 PHYSICAL MEDICINE AND BIOTELEMETRY

Diathermies: Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy-Biotelemetry.

#### UNIT 5 RECENT TRENDS IN MEDICAL INSTRUMENTATION

Telemedicine- Insulin Pumps- Radio pill- End micros copy- Brain machine interface- Lab on a chip.

#### **TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

- 1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.
- 2. Khandpur R S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003.

#### **REFERENCES:**

- 1. John G.Webster, "Medical Instrumentation Application and Design", 3rd Edition, Wiley India Edition, 2007
- 2. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, 2004

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#### e-RESOURCES:

- 1. NPTEL Vide: https://nptel.ac.in/courses/108108180. "Mathematical Aspects of Biomedical Electronic System Design", IISc Bangalore Prof. Chandramani Singh.
- 2. NPTEL Video: https://www.digimat.in/nptel/courses/video/108105091/L01.html. "Medical Image analysis" IIT Kharapur Prof. Debdoot Sheet.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Demonstrate the human body electro- physiological parameters and recording of bio-potentials
- 2. Comprehend the non-electrical physiological parameters and their measurement body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.
- 3. Interpret the various assist devices pacemakers, defibrillators, dialyzers and ventilators used in the hospitals
- 4. Comprehend ultrasonic, shortwave, microwave surgical diathermies, and bio-telemetry principles and methods
- 5. Operate and demonstrate recent trends in medical instrumentation

	PO	PSO	PSO											
COS/POS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	1	2	1	1	2	1	-	1	1	-	1	-	3
CO 2	2	1	3	1	1	2	1	-	1	1	-	1	-	3
CO 3	3	1	2	1	1	2	1	-	1	-	1	1	-	3
CO 4	3	1	2	1	1	2	1	-	1	1	1	1	-	3
CO 5	3	1	2	1	1	2	1	-	1	-	1	1	-	3

#### Mapping of COs with POs and PSOs:

1: Slight (Low) 2: M

2: Moderate (Medium)

3: Substantial (High)

# IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4,

802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN - Network Layer: IP versions, Constrained Nodes and Constrained Networks - Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks - Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

#### UNIT 3 **DESIGN AND DEVELOPMENT**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

SQL Databases - Hadoop Ecosystem - Apache Kafka, Apache Spark - Edge Streaming Analytics and Network Analytics - Xively Cloud for IoT- AWS for IoT.

#### **APPLICATIONS OF IOT IN HEALTHCARE** UNIT 5

Healthcare Monitoring system through Cyber-physical system, An IoT Model for Neuro sensors, Secured architecture for IoT enabled Personalized Healthcare Systems, Healthcare Application Development in Mobile and Cloud Environments.

### **TEXT BOOK:**

- 1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.
- 2. Venkata Krishna, Sasikumar Gurumoorthy, Mohammad S. Obaidat, "Internet of Things and Personalized Healthcare Systems", Springer Briefs in Applied Sciences, and Technology, Forensic and Medical Bioinformatics, 2019.

### **REFERENCES:**

- Arshdeep Bahga, Vijay Madisetti, "Internet of Things A hands-on approach", Universities 1. Press. 2015
- Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things Key applications 2. and Protocols", Wiley, 2012.

## **Preamble:**

This course provides the concepts of IoT Architectures and IOT-related protocols to build simple IoT Systems using Arduino and Raspberry Pi. This course helps to understand data analytics and cloud in the context of IoT and to develop IoT infrastructure for popular applications.

**INTERNET OF THINGS FOR HEALTHCARE** 

#### UNIT 1 **FUNDAMENTALS OF IoT**

Evolution of Internet of Things - Enabling Technologies - IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models - Simplified IoT Architecture and Core IoT -Functional Stack -- Fog, Edge and Cloud in IoT - Functional blocks of an IoT ecosystem - Sensors, Actuators, Smart Objects and Connecting Smart Objects.

#### UNIT 2 **IoT PROTOCOLS**

DATA ANALYTICS AND SUPPORTING SERVICES UNIT 4

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest - Role of Machine Learning - No

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#### **TOTAL: 45 PERIODS**

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3. Jan Ho<sup>--</sup> ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

#### e-RESOURCES:

- 1. Nptel Video, https://www.digimat.in/nptel/courses/video/106105166/L01.html, "Introduction to Internet of Things", Prof.Sudip Misra, IITKGP.
- 2. Nptel Video, https://www.digimat.in/nptel/courses/video/106106212/L01.html, "Phython for Data Science", Prof. Ragunathan Rengasamy, IIT Madras.

#### **Course Outcomes : Upon completion of the course, students will be able to:**

- 1. Describe the concept of IoT architecture.
- 2. Analyze various protocols for IoT.
- 3. Design an IoT system using Rasperry Pi/Arduino.
- 4. Apply data analytics and use cloud offerings related to IoT.
- 5. Analyze applications of IoT in real time scenario.

#### Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	3	1	2	1	1	1	1	2	2	1	2	3	1
CO 2	2	3	1	2	1	-	-	-	-	2	-	2	3	-
CO 3	2	3	1	2	1	1	1	1	2	2	1	2	3	1
CO 4	2	3	1	2	1	1	1	1	2	2	1	2	3	1
CO 5	2	3	1	2	1	1	1	1	-	2	-	2	3	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

#### Sensors / Receptors in the Human Body - basic organization of Nervous System- Neural mechanism -Hot And Cold receptors - Barro receptors - Sensors for smell, sound and vision

#### TRANSDUCERS **PRINCIPLES** AND **MEDICAL** UNIT 2 9 **APPLICATIONS:**

Classification of transducers - characteristic of transducers - Resistance temperature detector (RTD) -Thermistor, Thermocouple - Chemical Thermometry -Potentiometer, Inductive & Capacitive transducer -Magneticsensors - Hall effect sensors - Variable Capacitance Pressure Transducers - LVDT transducers - Strain Gauge transducers - Semiconductor transducers - P-I-N transducers - Catheter Tip transducers - Piezoelectric transducer - LDR - Photo-Emissive tubes - Photodiodes - LED - Avalanche Photo Diode (APD).

#### UNIT 3 OPTICAL SENSOR AND RADIATION DETECTORS

Principles of optical sensors - Optical Fiber sensors - Indicator - Mediated transducers - Optical Fiber Temperature sensors - LASER detector - Proportional counter - Gas- Ionisation chamber - Geiger counters. Scintillation detectors.

### UNIT 4 BIOCHEMICAL TRANSDUCERS

Electrode theory - Electrode-Tissue interface - Metal-Electrolyte interface - Electrode-Skin interface -Electrode Impedance – Bio-potential electrodes – Microelectrodes - Body Surface electrodes - Needle electrodes - Electrodes for ECG, EEG, and EMG - Reference electrodes: Hydrogen electrodes - Silver-Silver Chloride electrodes - Calomel electrodes, Ion electrodes - Specific Ion electrodes - pH electrode,  $O_2$  electrode -  $CO_2$  electrode.

#### UNIT 5 SPECIAL MEDICAL APPLICATIONS OF SENSORS

Gas sensor - Microbial sensor - Electro Analytical sensor - Enzyme based sensor - Glucose sensor -Electronic nose -Halitosis - Advances in sensor technology: Lab-on-a-chip - Smart sensor - MOSFET biosensors - Bio-MEMS and Nano sensor.

### **TEXT BOOKS:**

- 1. R. S. Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw Hill
- 2. S.C. Cobbold, "Transducers for Biomedical Instruments", Prentice Hall.

### **REFERENCES:**

- Brown & Gann, "Engineering Principles in Physiology Vol. I", Academic Press. 1.
- 2. Jon Cooper, "Biosensors A Practical Approach" Bellwether Books, 2004..
- 3. Carr & Brown, Introduction to Biomedical Equipment Technology Pearson Edn, Asia

## **Preamble:**

22ECE23

The purpose of learning this course is to understand about the various sensors and receptors in the body and differentiate between transducers and biosensors. It analyses the working of various electrodes used for measuring physical quantities and to understand the concepts of nano sensors.

MEDICAL SENSOR AND APPLICATIONS

UNIT 1 INTRODUCTION TO BIOLOGICAL SENSORS

#### Page 162

### **TOTAL: 45 PERIODS**

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LTPC 3003

#### e-RESOURCES:

- 1. NPTEL Video: <u>https://onlinecourses.nptel.ac.in/noc21\_ee32/preview</u>. Prof. Hardik Jeetendra Pandya, IISc Bangalore.
- 2. Web link : <u>https://sps.honeywell.com/us/en/support/blog/siot/complete-guide-to-medical-sensors-</u> benefits-and-applications.

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Select suitable sensors and transducers based on functions for medical applications.
- 2. Measure physical parameters from biosensors and transducers.
- 3. Demonstrate the working and application of Optical Sensor/Radiation Detectors
- 4. Measure physiological parameters and interpret the data
- 5. Design and develop systems for tailor made applications.

#### Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	2	2	1	1	1	2	2	1	2	3	1
CO2	3	2	1	2	2	-	-	-	-	2	-	2	3	-
CO3	3	2	1	2	2	1	1	1	2	2	1	2	3	1
CO4	3	2	1	2	2	1	1	1	2	2	1	2	3	1
CO5	3	2	1	2	2	1	1	1	-	2	-	2	3	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

## VCET, B.E-ECE, R2022 Curriculum and Syllabus

### **Preamble:** Telemedici

22ECE24

Telemedicine is the remote delivery of healthcare services, such as health assessments or consultations, over the telecommunications infrastructure. It allows healthcare providers to evaluate, diagnose and treat patients using common technology, such as video conferencing and Smartphone, without the need for an in-person visit. The student will learn the key principles for telemedicine and health, Tele medical standards, mobile telemedicine. This course will equip the learners to understand the Tele medical technology and hospital information system, application of telemedicine by providing deep insight to the various aspects of body area network.

TELE HEALTH TECHNOLOGY

#### UNIT 1 TELEMEDICINE ANDHEALTH

History of telemedicine: definition of telemedicine, tele-health, tele-care, scope- Telemedicine Systems: benefits & limitations of telemedicine.

### UNIT 2 TELEMEDICAL TECHNOLOGY

Audio, video, still images, text and data, fax-type of communications and network: PSTN, POTS, ANT, ISDN, internet, air/ wireless communications, GSM satellite, micro wave, Mobile health and ubiquitous healthcare.

#### UNIT 3 ETHICAL AND LEGAL ASPECTS OF TELEMEDICINE

Confidentiality, patient rights and consent: confidentiality and the law, the patient-doctor relationship, access to medical records, consent treatment - data protection & security, jurisdictional issues, intellectual property rights.

### UNIT 4 PICTURE ARCHIVING AND COMMUNICATION SYSTEM

Introduction to radiology information system and ACS, DICOM, PACS strategic plan and needs assessment, technical Issues, PACS architecture.

### UNIT 5 APPLICATIONS OF TELEMEDICINE

Teleradiology-telepathology-telecardiology-teleoncology-teledermatology-telesurgery- e-Health- Cyber Medicine.

### **TEXT BOOKS:**

- 1. Norris A C, "Essentials of Telemedicine and Telecare", John Wiley, New York, 2002.
- H K Huang, "PACS and Imaging Informatics: Basic Principles and Applications" Wiley, New Jersey, 2010

**TOTAL : 45 PERIODS** 

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#### **REFERENCES:**

- 1. Olga Ferrer Roca, Marcelo Sosa Iudicissa, "Handbook of Telemedicine", IOS Press, Netherland, 2002.
- 2. Khandpur R S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003.
- 3. Keith J Dreyer, Amit Mehta, James H Thrall, "Pacs: A Guide to the Digital Revolution", Springer, New York, 2002.
- 4. William A. Reinke "Health Planning For Effective Management" Oxford University Press. 1988
- 5. Khandpur R S, "TELEMEDICINE Technology and Applications", PHI Learning Pvt Ltd., New Delhi, 2017.

#### e-RESOURCES:

- 1. E-PPT: https://www.slideshare.net/rajendrapgupta/telehealth-report-india
- 2. NPTEL Video: https://nptel.ac.in/courses/103/106/103106071/#Lecture-5-Electrical-Safety-Hazard.html

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Apply multimedia technologies in telemedicine.
- 2. ExplainProtocolsbehindencryptiontechniquesforsecuretransmissionofdata.
- 3. Demonstrate the basic concepts involved intelemetry based transmission and reception
- 4. Demonstrate the working principles of communication devices and Network telemedicine
- 5. Describetelehealthsystemsforsecuretransmissionofmedicaldataandretrievaloftelemedicinebasedinfo rmation.

	PO	<b>PO1</b>	<b>PO1</b>	PO	PSO	DSO								
COS/POS	1	2	3	4	5	6	7	8	9	0	1	12	1	P502
CO 1	3	1	2	1	-	3	3	3	-	2	1	1	-	3
CO 2	2	2	2	1	-	3	3	3	1	3	-	1	-	3
CO 3	3	1	2	1	2	3	3	2	1	3	-	1	-	3
CO 4	3	1	2	1	2	3	3	3	-	2	1	1	-	3
CO 5	3	1	2	1	2	3	3	3	1	3	1	1	-	3

#### Mapping of COs with POs and PSOs:

1: Slight (Low) 2: 1

2: Moderate (Medium) 3

3: Substantial (High)

## VCET, B.E-ECE, R2022 Curriculum and Syllabus

#### 22ECE25 **BIOMEDICAL INSTRUMENTATION**

#### **Preamble:**

The course deals with the origin of bio potentials and its propagations. This course gives the knowledge about different types of electrodes and its placement for various recordings and also provides detailed knowledge about ophthalmology instruments and life assisting devices.

#### UNIT 1 BIOPOTENTIAL ELECTRODES

Origin of bio potential and its propagation: Electrode-electrolyte interface, electrode-skin interface- halfcell potential- Contact impedance- polarization effects of electrode- non polarizable electrodes- Types of electrodes: surface, needle and micro electrodes and their equivalent circuits-Recording problems: motion artifacts, measurement with two electrodes.

#### UNIT 2 **BIOPOTENTIAL MEASUREMENTS**

Bio signals characteristics: frequency and amplitude ranges- ECG: Einthoven's triangle, standard 12 lead system, Principles of vector cardiography- EEG: 10-20 electrode system, unipolar, bipolar and average mode- EMG: unipolar and bipolar mode- Recording of ERG, EOG and EGG.

### UNIT 3 SIGNAL CONDITIONING CIRCUITS

Need for bio-amplifier: single ended bio-amplifier, differential bio-amplifier- Impedance matching circuit, isolation amplifiers: transformer and optical isolation, isolated DC amplifier and AC carrier amplifier, Power line interference, Right leg driven ECG amplifier, Band pass filtering.

### UNIT 4 OPTHAMOLOGY INSTRUMENTS

Vision test-Ophthalmoscope- Humphrey visual field analyser- Glaucoma meter-Fundus Camera- Auto refractometer-Keratometer.

### UNIT 5 ASSIST DEVICES

Audiology equipment: audiometers, tympanometers, otoacoustic emissions, real ear measurement, ABR, and VNG-Hearing aid and its advancement –Powered wheel chair-Smart blind stick-Hand talk assistance.

### **TEXT BOOKS:**

Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 1. 2nd edition, 2015

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**TOTAL : 45 PERIODS** 

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2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill New Delhi, 3rd edition, 2014.

#### **REFERENCES:**

- 1. John G. Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India PvtLtd,New Delhi, 2015.
- 2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.
- 3. Myer Kutz, "Standard Handbook of Biomedical Engineering and Design", McGraw Hill Publisher, 2003.

#### e-RESOURCES:

- 1. Journal: IJNRD Research Journal (ISSN: 08998205) https://www.scimagojr.com/journalsearch.php?q=28587&tip=sid
- 2. Journal: Journal of Bioengineering & Biomedical Science(ISSN: 2155-9538) http://www.omicsonline.org/scholarly/biomedical-instrumentation-journals-articles-ppts-list.php

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Differentiate different bio-potentials and its propagations
- 2. Illustrate different electrode placement for physiological recordings
- 3. Design bio-amplifier for physiological recordings
- 4. Explain various technique for non-electrical physiogical measurements
- 5. Demonstrate different biochemical measurement techniques.

#### Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
COS/FOS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	3	3	1	2	1	-	-	1	-	3	-	3
CO 2	3	3	3	3	1	2	1	-	-	1	-	3	-	3
CO 3	3	3	3	3	1	2	1	-	-	-	-	3	-	3
CO 4	3	3	3	3	1	2	1	-	-	1	-	3	-	3
CO 5	3	3	3	3	1	2	1	-	-	-	-	3	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

#### 22ECE26

#### **Preamble:**

This course deals with the principles, practices and areas of applications in hospitals that helps for the bio medical waste disposal. The importance of supportive services along with the quality aspects specified by the international standards were maintained for hospital safety

HOSPITAL MANAGEMENT

#### UNIT 1 OVERVIEW OF HOSPITAL ADMINISTRATION

Distinction between Hospital and Industry- Challenges in Hospital Administration– Hospital Planning-Equipment Planning – Functional Planning - Current Issues in Hospital Management – Telemedicine -Bio-Medical Waste Management.

#### UNIT 2 HUMAN RESOURCE MANAGEMENT

HRM: Principles of HRM, Functions of HRM, Profile of HRD Manager, Tools of HRD, Human Resource Inventory, Manpower Planning- Different Departments of Hospital: Recruitment, Selection, Training Guidelines, Methods of Training, Evaluation of Training, Leadership grooming and Training, Promotion – Transfer- Communication: nature, scope, barriers, styles and modes of communication.

#### UNIT 3 MARKETING RESEARCH PROCESS

Marketing information systems: assessing information needs, developing & disseminating information-Market Research process- Other market research considerations: Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - The buyer decision process - Model of business buyer behavior: Major types of buying situations - WTO and its implications

#### UNIT 4 HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems - Medical Transcription, Medical Records Department: Central Sterilization and Supply Department - Pharmacy-Food Services - Laundry Services.

#### UNIT 5 QUALITY AND SAFETY ASPECTS IN HOSPITAL

Quality system: Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000, 9004, Features of ISO 9001, ISO 14000, Environment Management Systems- NABA, JCI, NABL- Security: Loss Prevention, Fire Safety, Alarm System, Safety Rules- Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

#### **TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

1. R.C.Goyal, "Hospital Administration and Human Resource Management", PHI – Fourth Edition, 2006.

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2. G.D.Kunders, "Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.

#### **REFERENCES:**

- 1. Cesar A.Caceres and Albert Zara, "The Practice of Clinical Engineering, Academic Press, New York, 1977.
- 2. Norman Metzger, "Handbook of Health Care Human Resources Management", 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.
- 3. Peter Berman "Health Sector Reform in Developing Countries" Harvard University Press, 1995.
- 4. William A. Reinke "Health Planning For Effective Management" Oxford University Press. 1988
- 5. Blane, David, Brunner, "Health and SOCIAL Organization: Towards a Health Policy for the 21st Century", Eric Calrendon Press 2002.
- 6. Arnold D. Kalcizony& Stephen M. Shortell, "Health Care Management", 6th Edition Cengage Learning, 2011.

#### e-RESOURCES:

- 1. YouTube Video: https://www.youtube.com/watch?v=ZZS8-ySBNFM, "Organisation and Management of Hospital", Prof. S.B.Aroara, Professor, School of Health Sciences, Indira Gandhi National Open University (IGNOU), MaidanGarhi, New Delhi
- NPTEL Video: http://www.nptelvideos.in/2012/11/human-resource-management-i.html, "Lecture Series on Human Resource Management-I", Prof. KalyanChakravarti, Vinod Gupta School of Management, IIT Kharagpur.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Apply the principles of Hospital administration
- 2. Identify the importance of Human resource management
- 3. Apply various marketing research techniques
- 4. Identify Information management systems and its uses
- 5. Instruct safety procedures to be followed in the hospitals

COs/POs	PO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	1	1	2	2	2	2	-	2	1	-	1	-	3
CO 2	2	1	1	2	2	2	2	-	1	1	-	1	-	3
CO 3	3	1	1	2	2	2	2	-	2	-	1	1	-	3
CO 4	3	1	1	2	2	2	2	-	2	1	1	1	-	3
CO 5	3	1	1	2	2	2	2	-	2	1	1	1	-	3

#### Mapping of COs with POs and PSOs:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

#### **22ECE27**

#### MEDICAL WEARABLE SYSTEMS

#### **Preamble:**

Medical wearable system (MWS) is an end-to-end integrated and connected system. It is focusing on multi-parameter physiological sensor systems and activity and mobility measurement system designs that reliably measure mobility or vital signs and integrate real- time decision support processing for disease prevention, symptom detection, and diagnosis. The student will learn the different sensors used in measurement for physiological system. This course will equip the learners to know about various energy harvesting techniques for wearable devices and applications of wearable systems for human physiological systems.

#### **SENSORS** UNIT 1

Need for wearable systems, Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor, GSR, Radiant thermal sensor, Wearable motion sensors, CMOS -Based Biosensors, E-Textiles, Bio compatibility.

#### UNIT 2 SIGNAL PROCESSING

Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, Constraint on sampling frequency for reduced energy consumption, light weight signal processing, Rejection of irrelevant information, Datamining.

#### ENERGY HARVESTING FOR WEARABLE DEVICES UNIT 3

Solar cell, Vibration based Thermal based Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

#### UNIT 4 WIRELESS HEALTH SYSTEMS

Need for wireless monitoring, Definition of Body area network and Healthcare, Technical Challenges-System security and reliability, BAN Architecture – Introduction, Wireless communication techniques.

#### UNIT 5 **APPLICATIONS OF WEARABLE SYSTEMS**

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Multi parameter monitoring, Neural recording, Gait analysis, Sports Medicine, Smart Fabrics.

#### **TEXT BOOKS:**

- 1. Annalisa Bonfiglio, Danilo De Rossi, "Wearable Monitoring Systems", Springer, 2011.
- 2. Sandeep K.S. Gupta, Tridib Mukherjee, Krishna Kumar Venkata Subramanian, "Body Area Networks Safety, Security, and Sustainability," Cambridge University Press, 2013.

#### **REFERENCES:**

- Hang, Yuan-Ting, "wearable medical sensors and systems", Springer-2013 1.
- Mehmet R.Yuce, JamilY. Khan, "Wireless Body Area Networks Technology, Implementation and 2. Applications ", Pan Stanford Publishing Pvt. Ltd, Singapore, 2012
- 3. Guang-Zhong Yang(Ed.), "Body Sensor Networks, "Springer, 2006

TOTAL: 45 PERIODS

#### LTPC 3003

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4. Andreas Lymberis, Danilo de Rossi ,'Wearable e-Health systems for Personalized Health Management - State of the art and future challenges ' IOS press, The Netherlands,2004

#### e-RESOURCES:

- 1. E-PPT: https://www.slideshare.net/rajendrapgupta/telehealth-report-india
- 2. NPTEL Video: https://www.digimat.in/nptel/courses/video/108105091/L01.html. "Medical Image analysis" IIT Kharapur Prof. Debdoot Sheet
- 3. Journal: Journal of Bioengineering & Biomedical Science(ISSN: 2155-9538)

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Describe different sensors used in Physiological system measurements.
- 2. Understand the bio signal acquisition methods and signal processing methods for human systems.
- 3. Analyze the usage of optimized energy techniques for wearable Devices.
- 4. Evaluate the wireless Tele health technology for applications.
- 5. Executing the specified wearable systems for respective physiological systems.

#### Mapping of COs with POs and PSOs:

COs/POs	PO	РО	РО	PO	PSO	PSO								
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	-	1	2	2	1	-	1	1	2	1	-	3
CO 2	3	2	-	1	2	2	1	-	1	1	2	1	-	3
CO 3	3	2	-	1	2	2	1	-	1	1	2	1	-	3
<b>CO 4</b>	3	2	-	1	2	2	1	-	1	1	2	1	-	3
<b>CO 5</b>	3	2	-	1	2	2	1	-	1	1	2	1	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

22ECE31

#### TRANSMISSION LINES AND WAVEGUIDES

#### **Preamble:**

Signal propagation in transmission media are described by characteristics impedance along with transmission line primary and secondary constants. The choice of transmission line based on the analysis of characteristic impedance, dissipation, reflection and standing wave ratio, attenuation and phase constants over a range of frequencies. This course aims to provide basic knowledge to engineering students in transmission line parameters, passive filters, impedance matching networks and waveguides.

#### UNIT 1 TRANSMISSION LINE THEORY

General theory of Transmission lines - the transmission line - general solution - The infinite line -Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading and different methods of loading - Line not terminated in Z<sub>0</sub> - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

#### HIGH FREQUENCY TRANSMISSION LINES UNIT 2

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipationless line - Open and short circuited lines - Power and impedance measurement on lines -Reflection losses - Measurement of VSWR and wavelength.

#### UNIT 3 IMPEDANCE MATCHING IN HIGH FREQUENCY LINES

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

#### UNIT 4 WAVE GUIDES AND CAVITY RESONATORS

General Wave behaviours along uniform Guiding structures, Transverse Electromagnetic waves, Transverse Magnetic waves, Transverse Electric waves, TM and TE waves between parallel plates, TM and TE waves in Rectangular wave guides, Bessel's differential equation and Bessel function, TM and TE waves in Circular wave guides, Rectangular and circular cavity Resonators.

#### **RF SYSTEM DESIGN CONCEPTS** UNIT 5

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors, Fundamentals of MMIC, Basic concepts of RF design: Filters, couplers, power dividers, Amplifier power relations, Low noise amplifiers, Power amplifiers.

#### **TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

- E.C.Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems" Prentice Hall of 1. India, 2006.
- 2. Mathew M. Radmanesh, "Radio Frequency & amp; Microwave Electronics", Pearson Education Asia, Second Edition, 2002

#### **REFERENCES:**

Reinhold Ludwig and Powel Bretchko, "RF Circuit Design" - Theory and Applications", Pearson 1. Education Asia, First Edition, 2001.

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- 2. D. K. Misra, "Radio Frequency and Microwave Communication Circuits"- Analysis and Design, John Wiley & Company, 2004.
- Richard Chi Hsi Li, "RF Circuit Design" A John Wiley & Sons, Inc., Publication, 2<sup>nd</sup> Edition, 2012.

#### e-RESOURCES:

- 1. NPTEL video : <u>http://nptel.ac.in/courses/117101056/1</u>, "Transmission Lines & EM waves", Prof R.K.Shevgaonkar,IIT, Bombay.
- 2. NPTEL video: <u>http://nptel.ac.in/courses/115101005/5</u>, "Electromagnetic Theory", Prof. D.K. Ghosh,IIT, Bombay.

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Describe the propagation of signals through transmission lines and nature of reflection in open and short circuited lines.
- 2. Compute the standing wave ratio, input impedance of the dissipation less line and reflection loss for high frequency transmission lines.
- 3. Analyze the suitable impedance matching network for high frequency transmission lines using smith chart.
- 4. Compare and contrast the performance of rectangular, circular waveguides and cavity resonators needed for microwave applications.
- 5. Analyze the design of RF Filters, couplers, power dividers, Amplifier, Low noise Amplifiers.

Mapping of COs with POs and PSOs:

COs/POs	PO 1	PO 2	PO 3	<b>PO</b> 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	2	-	-	-	2	-	1	1	-	-	3	-
CO2	1	1	2	-	-	-	2	-	1	1	-	-	3	-
CO3	1	1	2	-	-	-	2	-	1	1	-	-	3	-
CO4	1	1	2	-	-	-	2	-	1	1	-	-	3	-
CO5	1	1	2	-	-	-	2	-	1	1	-	-	3	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

## 22ECE32 EMI/EMC PRE COMPLIANCE TESTING L T P C

3003

#### **Preamble:**

This course exposes the basics and fundamentals of Electromagnetic Interference and Compatibility in Communication system design and to know the concepts of EMI Coupling Principles, EMI measurements and control techniques, receivers & analyzer functionalities in EMI design.

#### UNIT 1 NATURE AND ORIGINS OF ELECTROMAGNETIC COMPATIBILITY 9

Introduction – Visualizing the EMI problem – Source of EMI – EMI coupling to victim equipment– Intersystem and Intrasystem EMI – EMC standards and specifications

#### UNIT 2 TYPES of EMI COUPLING

Conducted, radiated and transient coupling – Common ground impedance coupling – Common mode and ground loop coupling – Differential mode coupling – Near field cable to cable coupling – Field to cable coupling – Power mains and Power supply coupling – Transient EMI

#### UNIT 3 MEASUREMENT DEVICES FOR EMI

Introduction – Measurement by direct connection – Inductively coupled devices – EMC antennas – Basic antenna parameters – Antennas for radiated emission testing – Wideband antennas – Magnetic field antennas – Type of antennas used in susceptibility testing

#### UNIT 4 RECEIVERS, ANALYSERS AND MEASUREMENT EQUIPMENT

EMI receiver– Spectrum Analyzers – RF power meter Frequency meters – Standards requiring immunity tests – Automatic EMC tests – Electromagnetic transient testing – Transient types – Continuous and transient signal – ESD – electrostatic discharge

#### UNIT 5 PRE - COMPLIANCE TESTING TO AVOID EMC PROBLEMS

Need for Pre – Compliance Testing – Intersystem and Intrasystem EMC – Developing an approach to EMC design – Process flow chart – EMC strategy – Self certification – Solutions to avoid EMC – ESD Shielding – EMI Filters – Grounding – Bonding – Isolation transformer – Transient suppressors – EMI Suppression Cables.

#### **TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

- 1. David Morgan "A Handbook for EMC Testing and Measurement", IET Electrical Measurement, 2012
- 2. Tim Williams "EMC for Product Designers", 5th Edition, Newnes Elsevier, 2017
- 3. V.P.Kodali "Engineering EMC Principles, Measurements and Technologies", IEEE Press, Newyork, 1996

#### **REFERENCES:**

- 1. Paul, C.R. "Introduction to Electromagnetic Compatibility", 2nd ed., Wiley (2010)
- 2. David K. Cheng "Field and Wave Electromagnetics", 2nd ed. Pearson Education, 2009

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#### e-RESOURCES:

- 1. Nptel video: <u>https://nptel.ac.in/courses/108106138</u>, "Introduction to Electromagnetic compatibility", Prof. Daniel Mansson, Prof. Rajeev Thottappillil, IIT, Madras
- 2. Web resources: <u>https://en.wikipedia.org/wiki/Electromagnetic\_compatibility</u>.

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Perceive the various types and mechanisms of Electromagnetic Interference.
- 2. Propose a suitable EMI mitigation technique.
- 3. Evaluate EMI coupling & control principles.
- 4. Apply and follow the standards for immunity, automatic EMC, EM transient tests.
- 5. Inspect the design issues in EMI/EMC.

COs/POs	PO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	2	3	3	1	1	_	_	1	_	1	3	_
CO 2	3	3	2	1	3	2	1	_	_	1	—	2	3	_
CO 3	3	3	3	3	3	2	1	_	_	1	—	2	3	_
CO 4	3	3	2	2	2	2	1	1	_	1	—	2	3	_
CO 5	3	_	3	3	2	2	1	_	_	1	_	2	3	_

#### Mapping of COs with POs and PSOs:

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

#### **Preamble:**

This course provides an introduction to the basic concepts and fundamentals of Antenna. This course exposes the different algorithms used for angle of arrival estimation in smart antenna and introduces the concepts of fixed weight beamforming and adaptive beamforming.

**ANTENNA DESIGN** 

#### UNIT 1 FUNDAMENTALS OF ANTENNA

Definition of antenna parameters – Radiation pattern - Beam solid angle - Radiation Intensity - Gain, Directivity - Antenna aperture - Input Impedance - Matching Baluns - Polarization mismatch - Antenna noise temperature, Concept of vector potential - Radiation from Half wave dipole.

#### UNIT 2 APERTURE AND SPECIAL ANTENNAS

Reflector Antenna - Paraboloidal reflector; Feeding structures - Microstrip antennas; Radiation mechanism - Principle of frequency independent antennas - Log periodic antenna - Helical antenna - Reconfigurable antenna.

#### UNIT 3 ANTENNA ARRAY FUNDAMENTALS

Linear Array - N-element linear array, Broadside array, End fire array, Directivity - Pattern Multiplication - Phased Array - Non-uniform excitation - Binomial Array.

#### UNIT 4 SMART ANTENNA

Need for smart antennas - Smart antenna overview - Smart antenna configurations - Switched-beam antennas - Adaptive antennas - Architecture of a smart antenna system - Receiver - Transmitter - Benefits and drawbacks - Angle of arrival estimation - Beamforming.

#### UNIT 5 ANTENNA MEASUREMENT

Near and Far Fields, Measurement of Radiation pattern, Gain, Polarization and VSWR - Anechoic chamber measurement - Vector network analyzer.

#### **TEXT BOOKS:**

- 1. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas Wave Propagation", Fourth Edition, Mc Graw Hill Education Private Limited, 2015.
- 2. Frank Gross, "Smart antennas for wireless communications", McGra-Hill, 2006.

#### **REFERENCES:**

- 1. Balanis A Constantine, Panayiotis I. Ioannides, "Introduction to Smart Antennas", Morgan & Claypool Publishers, 2007.
- 2. Chandran S, "Adaptive antenna arrays, trends and applications", Springer, 2009.
- 3. Robert A.Monzingo, Randy L. Haupt and Thomas W.Miller, "Introduction to Adaptive arrays", 2nd Edition, IET, 2011.

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**TOTAL : 45 PERIODS** 

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#### e-Resources:

- 1. Nptel Video, https://nptel.ac.in/courses/117107035, "Advanced Antenna Theory" Dr. Amalendu Patnaik, IIT Roorkee.
- 2. Nptel Video, https://nptel.ac.in/courses/117107035, "Introduction and Types of antennas", Dr. Amalendu Patnaik, IIT Roorkee.

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

- CO1 Analyze the half wave dipole antenna using Maxwell's equation to determine the electric and magnetic field components.
- CO2 Design and analyze the performance of aperture antenna.
- CO3 Determine the radiation pattern, half power beam width and directivity of broadside array and end fire array.
- CO4 Analyze the performance characteristics of Smart antennas.
- CO5 Measure the antenna parameters of gain, radiation pattern, polarization and VSWR using anechoic chamber.

Cos/POs	PO 1	<b>PO</b> 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	2	1	1	1	1	-	1	1	-	-	3	-
CO 2	3	2	2	2	2	-	-	-	-	-	1	-	3	1
CO 3	3	2	2	2	2	-	-	-	-	-	-	1	3	-
CO 4	3	2	1	1	2	-	-	2	-	-	-	1	3	-
CO 5	3	2	1	1	2	-	-	-	-	-	-	1	3	-

#### Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

#### 22ECE34 Preamble:

This course provides the basic concept of electromagnetic radiation principles, Laws of Planetary motion and resolution types. This course gives the knowledge to interpret and analyze the data obtained from satellites through various digital image processing techniques.

**REMOTE SENSING** 

#### UNIT 1 REMOTE SENSING AND ELECTROMAGNETIC RADIATION

Definition- components of RS- History of Remote Sensing- Merits and demerits of Data Collation between conventional and remote sensing methods- Electromagnetic Spectrum- Radiation principles: Wave- theory- Planck's law- Wien's Displacement Law- Stefan's Boltzmann law-Kirchhoff's law - Radiation sources- active & passive- Radiation Quantities.

# UNIT 2 EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL

Standard atmospheric profile- main atmospheric regions and its characteristics- interaction of radiation with atmosphere- Scattering- absorption and refraction- energy interactions with earth surface materials- Specular and diffuse reflectors-Spectral reflectance & spectroradiometer- Spectral Signature concepts-Typical spectral reflectance curves for Vegetation- soil and water.

#### UNIT 3 ORBITS AND PLATFORMS

Motions of planets and satellites- Newton 's law of gravitation- Gravitational field and Escape velocity -Kepler 's law of planetary motion- Orbit elements and types- Orbital perturbations and maneuvers- Types of remote sensing platforms- Ground based platforms- Air borne platforms and Space borne platforms- Classification of satellites- Sun synchronous and Geosynchronous satellites-Legrange Orbit.

### UNIT 4 SENSING TECHNIQUES

Classification of remote sensors- Resolution concept: spatial- spectral- radiometric and temporal resolutions -Scanners -Along and across track scanners- Optical- infrared sensors- microwave sensors- Calibration of sensors- High Resolution Sensors- LIDAR, UAV.

## UNIT 5 DATA PRODUCTS AND INTERPRETATION

Data formats- ground segment organization- sources of errors in received data- data product generation- data products output medium- Visual interpretation: basic elements and interpretation keys- Digital interpretation: Concepts of Image rectification, Image enhancement and Image Classification.

### **TEXT BOOKS:**

- 1. Thomas M. Lillesand, Ralph W. Kieferand Jonathan W. Chipman, "Remote Sensing and Image interpretation", John Wiley and Sons, Inc., New York, 2015.
- 2. George Joseph and C Jeganathan, "Fundamentals of Remote Sensing", Universities Press (India) Private limited, Hyderabad, Third Edition, 2018.

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**TOTAL: 45 PERIODS** 

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#### **REFERENCES:**

- 1. Stanley A Morain, Amelia M Budge, Michael S Renslow, "Manual of Remote Sensing", American Society for Photogrammetry and Remote Sensing, Virginia, USA, 4th edition, 2019.
- 2. VerbylaDavid, "Satellite Remote Sensing of Natural Resources", CRC Press, First edition, 2022.
- 3. Charles Elachi and Jacob Van Zyl, "Introduction to Physics and Techniques of RemoteSensing", Wiley Publication, Edition3, 2021.
- 4. Basudeb Bhatta, "Remote Sensing and GIS", Oxford University Press, third edition, 2020.

#### e-RESOURCES:

- 1. Nptel Video,<u>https://nptel.ac.in/courses/105101206</u>, "Remote sensing: Principles and applications", Prof. Eswar Rajasekaran, Department of Civil Engineering, IIT, Bombay.
- 2. Nptel Video,https://nptel.ac.in/courses/105103193, "Remote sensing and GIS", Prof. S.Rishikesh Bharti, Department of Civil Engineering, IIT, Guwahati.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Apply the principles of electromagnetic radiation.
- 2. Interpret and analyze the atmospheric radiation interactions.
- 3. Select remote sensing platforms based on the laws of planetary motion.
- 4. Analyze the remote sensors based on resolution types.
- 5. Analyze the received data and apply digital interpretation techniques.

#### Mapping of COs with POs and PSOs:

COs/POs	PO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	2	3	1	3	2	-	-	-	-	1	3	3
CO 2	3	2	2	3	1	3	2	-	-	-	-	1	3	3
CO 3	1	2	1	3	2	3	2	-	-	-	-	1	3	3
CO 4	1	2	3	1	3	3	2	-	-	-	-	1	3	3
CO 5	2	2	2	-	3	3	2	-	-	-	-	1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

#### VCET, B.E-ECE, R2022 Curriculum and Syllabus

#### and non-Geo-stationary orbits - Antenna Look angle - Limits of visibility - eclipse - Sub satellite point -Sun transit outage – Launching Procedure – Launch Vehicles and propulsion.

#### UNIT 2 SPACE SEGMENT AND SATELLITE LINK DESIGN

Spacecraft Technology – Structure – Primary power – Attitude Control – Station Keeping – Thermal control - Propulsion Subsystem - Telemetry - Tracking and command (TTC) - Transponders and supporting subsystem – system noise – inter modulation and interference – Propagation Characteristics and Frequency consideration – System reliability and design lifetime.

MODERN SATELLITE COMMUNICATION

understanding of satellite communication system operation, launching techniques, satellite link design and earth station technology. Satellite communication systems support a wide range of applications which need to

#### UNIT 3 EARTH SEGMENT

satisfy a number and variety of requirements.

SATELLITE ORBITS

**21ECE35** 

UNIT 1

Introduction - Receive - Only home TV systems - Outdoor unit - Indoor unit for analog (FM) TV - Master antenna TV System - Community antenna TV System - Transmit - Receive earth stations - Equivalent isotropic radiated power - System noise - Antenna noise - Carrier to Noise ratio - Uplink - Saturation flux density - Input back off - The earth station - HPA - Downlink - Output back off - Satellite TWTA output -Effects of rain – Inter modulation noise.

#### UNIT 4 SATELLITE ACCESS

Modulation and Multiplexing: Voice, Data and Video – Analog-digital transmission system – Multiple Access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum Communication.

#### UNIT 5 SATELLITE APPLICATIONS

INTELSAT Series - INSAT - VSAT - Mobile satellite services: GPS - INMARSAT - Satellite Navigational System - Direct to home Broadcast (DTH) - Worldspace services - Business TV (BTV) -GRAMSAT – Case Studies: Chandrayaan - I – Chandrayaan - II – Mangalyaan (MOM).

#### **TOTAL : 45 PERIODS**

- 1. Dennis Roddy, "Satellite Communication", McGraw Hill International, 4th Edition, 2016.
- Wilbur L.Pritchard, HenriG.Suyderhoud, Robert A.Nelson, "Satellite Communication 2. Systems Engineering", Prentice Hall, 2nd edition, 1993.

#### **REFERENCES:**

**TEXT BOOKS:** 

- 1. Bruce R.Elbert, "The Satellite Communication Application", Hand Book, Artech House, Bostan London, 2nd edition, 2004.
- 2. Tri T.Ha, "Digital Satellite Communication", McGraw Hill Education, 2nd Edition, 2008.
- 3. Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.

#### 3003 **Preamble:** This course deals with the field of satellite communication orbits and provide an in-depth

9 Kepler's Laws – Newton's Law – orbital parameters – orbital perturbation – station keeping – geo stationary

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#### e-RESOURCES:

- 1. Nptel Video :https://nptel.ac.in/courses/117105131, "Satellite Communication Systems" Prof. KalyankumarBandyopadhyay, Department of Electronics and Electrical Communication Engineering,IIT Kharagpur.
- 2. Web resource : Chandrayaan I: <u>https://en.wikipedia.org/wiki/Chandrayaan-1</u>, Mangalyaan (MOM):<u>https://en.wikipedia.org/wiki/Mars\_Orbiter\_Mission</u>.

Course Outcomes: Upon completion of the course, students will be able to:

- 1 Identify and explain the orbital parameters, types of orbit and geo-stationary satellite launching method.
- 2 Determine the system noise and propagation characteristics in satellite link design.
- 3 Summarize the equivalent isotropic radiated power, antenna noise, saturation flux density and Inter modulation noise for satellite earth segment.
- 4 Compare and contrast the performance characteristics of FDMA, TDMA and CDMA techniques in satellite communication.
- 5 Explain the launching procedures, payloads and functions of Chandrayan-1 and Mangalyaan satellites.

#### PO PSO **PSO COs/POs CO1 CO 2 CO3 CO 4 CO 5**

#### Mapping of COs with POs and PSOs:

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

**22ECE36** 

## **Preamble:**

This course enables the student to understand the basic principles of radar operation and the different types of radars and their conventional applications with new techniques currently being researched and implemented.

**RADAR TECHNOLOGIES** 

#### **UNIT 1 INTRODUCTION TO RADAR EQUATION**

The Origins of Radar - Radar principles - Basic Block Diagram - Radar classifications based on Frequencies - Wave form and application - Radar Fundamentals: Detection, Range, velocity -Simple form of the Radar Equation - Pulsed Radar equation - Detection of Signals in Noise -Receiver Noise, Signal-to-Noise Ratio – Probabilities of Detection and False Alarm – Integration of Radar Pulses - Radar Cross Section of Targets - Transmitter Power - Pulse Repetition Frequency -Antenna Parameters – System losses.

#### UNIT 2 CW– MTI AND PULSE DOPPLER RADAR

CW and Frequency Modulated Radar- Doppler and MTI Radar- Delay Line Cancellers- Staggered Pulse Repetition Frequencies- Doppler Filter Banks - Digital MTI Processing- Moving Target 157 Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) - Pulse Doppler Radar.

#### UNIT 3 TRACKING RADAR

Tracking with Radar - Monopulse Tracking - Conical Scan- Sequential Lobing - Limitations to Tracking Accuracy – Low – Angle Tracking – Comparison of Trackers– Track while Scan (TWS) Radar - Target prediction - state estimation - Measurement models - alpha - beta tracker - Kalman Filtering – Extended Kalman filtering.

#### UNIT 4 RADAR SIGNAL PROCESSING

Radar Signal Processing Fundamentals - Detection strategies - Optimal detection - Threshold detection - Constant False alarm rate detectors - Adaptive CFAR - pulse compression waveforms compression gain - LFM waveforms matched filtering - radar ambiguity functions - radar resolution - Detection of radar signals in Noise and clutter - detection of non-fluctuating target in noise – Doppler spectrum of fluctuating targets – Range Doppler spectrum of stationary and moving radar.

#### **RADAR TRANSMITTERS AND RECEIVERS** UNIT 5

Radar Transmitter - Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron -Crossed Field Amplifiers - Other RF Power Sources - The Radar Receiver - Receiver noise power - Super heterodyne Receiver - Duplexers and Receiver Protectors - Radar Displays - Radar Antenna – Reflector Antennas – Electronically Steered Phased Array Antennas – Phase Shifters

## **TEXT BOOKS:**

- 1. Habibur Rahman – "Fundamental Principles of Radar", CRC press, Taylor and Francis, 2019.
- M. R. Richards, J. A. Scheer, W. A. Holm, Editors "Principles of Modern Radar Basic 2. Principles", SciTech Publishing, 2012

**TOTAL: 45 PERIODS** 

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3. Nathansan – "Radar design principles– Signal processing and environment", PHI, 2nd Edition, 2007.

#### **REFERENCES:**

- 1. M.I.Skolnik "Introduction to Radar Systems", Tata McGraw Hill, 2006
- 2. Mark A. Richards "Fundamentals of Radar Signal Processing", McGraw–Hill, 2005.

#### e- RESOURCES:

- 1. Nptel Video: <u>https://nptel.ac.in/courses/108105154</u>, "Dr. Amitabha Bhattacharya", IIT Kharagpur
- 2. Web resources: <u>https://en.wikipedia.org/wiki/Radar</u>.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Identify the Radar parameters.
- 2. Differentiate various radar types.
- 3. Evaluate different tracking and filtering schemes.
- 4. Apply signal processing in target detection.
- 5. Design Radar transmitter and receiver blocks.

#### Mapping of COs with POs and PSOs:

COs/POs	PO	PSO	PSO											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	3	3	2	2	_	—	—	—	2	2	3	_
CO 2	3	3	3	3	2	2	_	—	—	—	2	2	3	_
CO 3	3	3	3	3	2	2	_	_	—	_	2	2	3	_
CO 4	3	3	3	2	3	2	_	—	—	—	1	2	3	_
CO 5	3	2	2	2	3	2	_	—	—	—	1	2	3	_

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

#### 22ECE37

#### **Preamble:**

This course provides the basic knowledge on the needs of avionics for both civil and military aircraft. This course gives the knowledge to understand the various cockpit displays, flight control systems and navigation techniques that can be adopted in aircrafts.

**AVIONICS SYSTEMS** 

## UNIT 1 INTRODUCTION TO AVIONICS

Basics of Avionics-Basics of Cockpits- Need for Avionics in civil and military aircraft and space systems- Integrated Avionics Architecture- Military and Civil system- Typical avionics System and Sub systems Design and Technologies.

#### UNIT 2 DIGITAL AVIONICS BUS ARCHITECTURE

Evolution of Avionics architecture- Avionics Data buses- MIL-STD-1553, ARINC-429, ARINC-629, and ARINC-818- Aircraft system Interface.

## UNIT 3 COCKPIT DISPLAYS AND MAN-MACHINE INTERACTION

Trends in display technology- CRT, LED, LCD and plasma panel- Touch screen- cockpit displays: HUD, HDD, HMD- control and data entry.

#### UNIT 4 FLIGHT CONTROL SYSTEMS

Introduction to Flight control systems and FMS- Longitudinal control- Lateral Control- Autopilot-Flight planning- Certification of aircrafts.

#### UNIT 5 NAVIGATION SYSTEMS

Overview of navigation systems- Inertial navigation- Terrain Reference Navigation- Global Positioning System (GPS)- Landing Aids- ILS & MLS.

#### **TOTAL: 45 PERIODS**

#### **TEXT BOOKS:**

1. R.P.G. Collinson, "Introduction to Avionics", Springer Publications, Third Edition, 2011.

## **REFERENCES:**

- 1. Cary R. Spitzer, "The Avionics Handbook", CRC Press, 2000.
- 2. Middleton, D.H., "Avionics Systems", Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
- 3. Cary R. Spitzer, "Digital Avionics Systems", Prentice Hall, Englewood Cliffs, N.J., U.S.A., 1987.
- 4. Myron Kayton, Walter R. Fried, "Avionics Navigation Systems", Wiley Publication,2nd Edition, 2008.
- 5. Jim Curren, "Trend in Advanced Avionics", IOWA State University, 1992.

#### e-RESOURCES:

1. Nptel Video : <u>https://nptel.ac.in/courses/101101083</u>, "Introduction to aircraft design", Prof. Rajkumar Pant, Department of Aerospace Engineering, IIT, Bombay.

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2. Nptel Video : https://nptel.ac.in/courses/101104069, "Aircraft design", Dr.A.K.Ghosh, Department of Aerospace Engineering, IIT, Kanpur.

Course outcomes : Upon completion of the course, students will be able to:

- 1. Analyze the Avionics Systems and its need for civil and military aircrafts.
- 2. Analyze avionics architectures and data bus based on the requirements.
- 3. Distinguish the different display technologies used in cockpit.
- 4. Demonstrate the concepts of flight control and management systems.
- 5. Identify the navigation techniques used in aircrafts.

Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO 2	3	3	3	2	2	2	-	-	-	-	-	3	3	2
CO 3	3	3	3	3	1	2	-	-	-	-	-	3	2	3
CO 4	3	3	3	2	2	1	-	-	-	-	-	2	2	1
CO 5	3	3	2	2	2	1	-	-	-	-	-	2	2	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

## 22ECE41 COMPUTER ARCHITECTURE

#### **Preamble:**

This course provides a basic structure and operations of a computer, Arithmetic and Logic unit& Basics of Pipelined execution. The course gives the knowledge to understand parallelism and multi-core processors, memory techniques and different way of I/O communication devices.

## UNIT 1 BASIC STRUCTURE OF A COMPUTER SYSTEM

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing

## **UNIT 2** ARITHMETIC FOR COMPUTERS

 $\label{eq:construction} Addition \ and \ Subtraction-Multiplication-Division-Floating Point \ Representation-Floating Point \ Operations-Subword \ Parallelism$ 

## UNIT 3 PROCESSOR AND CONTROL UNIT

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards Exceptions.

## UNIT 4 PARALLELISIM

Parallel processing challenges – Flynn's classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

## UNIT 5 MEMORY & I/O SYSTEMS

Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB's – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits - USB.

#### **TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

- 1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann / Elsevier, 5th Edition, 2014.
- 2. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, Computer Organization and Embedded Systems, Tata McGraw Hill, 6<sup>th</sup> Edition, 2012.

#### **REFERENCES:**

- 1. William Stallings, "Computer Organization and Architecture Designing for Performance", Pearson Education, 8<sup>th</sup> Edition, 2010.
- 2. John P. Hayes, "Computer Architecture and Organization", Tata McGraw Hill, 3rd Edition, 2012.



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3. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

#### e-RESOURCES:

- 1. Nptel Video :https://onlinecourses.nptel.ac.in/noc21\_cs61, "Computer Organization and Architecture", Prof. IndranilSengupta, Prof. KamalikaDatta ,Department of CSE,IIT Kharagpur
- 2. Nptel Video :https://nptel.ac.in/courses/106102062, "Computer Architecture",Prof. Anshul Kumar, Department of CSE, IIT Delhi.

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Demonstrate the basics structure of computers, operations and instructions.
- 2. Demonstrate the functions of arithmetic and logic unit.
- 3. Interpret the data in pipelined execution and design control unit
- 4. Classify parallel processing architectures.
- 5. Describe the various memory systems and I/O communication.

#### Mapping of COs with POs and PSOs:

Course	PO	PSO	PSO											
outcomes	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	2	3						1	1	1	1	3	
CO 2	2	2	3						1	1	1	1	3	
CO 3	2	2	3	2					1	1	1	1	3	
CO 4	2	2	3	2	2	1	1		1	1	1	1	3	
CO 5	2	2	3	2	2	1	1		1	1	1	1	3	

1: Slight (Low)

- 2: Moderate (Medium)
- 3: Substantial (High)

#### 22ECE42

#### **Preamble:**

This course provides a basic concept of micropython programming for microcontroller. The course gives the knowledge to develop python development boards for robotics, automation and sensor network application

**MICROPYTHON** 

#### UNIT 1 INTRODUCTION TO MICROPYTHON HARDWARE

Introduction to Micropython –MicroPython Features - Pyboard–Raspberry PICOboards - Micro Python on the ESP32/ESP8266 -Setting Up MicroPython on Boards –Libraries.

## UNIT 2 PROGRAMMING IN MICROPYTHON

Basic concepts - variables and data types - arithmetic - conditional statements – Loops - modules – Functions - classes and objects - Object oriented programming terminology.

## UNIT 3 MICROPYTHON FOR CONTROLLERS

Interacting with GPIO – Digital inputs and Outputs - Analog Inputs – Built-in and standard libraries - Interrupts - Pulse width modulation – Timers.

#### UNIT 4 INTERFACING WITH SENSOR MODULES

UART serial protocol – I2C serial protocol – SPI protocol – Light and Temperature sensor interfacing – accelerometers and pulse sensor interfacing – Capacitative touch interface.

## UNIT 5 INTERFACING WITH ACTUATORS

Interfacing LCD and – OLED interface - Control DC motors – Networking: WLAN and LAN - Transferring sensor readings via Email (IFTTT) to cloud – Trundle bot and Racer bot design.

#### **TOTAL : 45 PERIODS**

## **TEXT BOOKS:**

- 1. Nicholas H. Tollervey, "Programming with MicroPython: Embedded Programming with Microcontrollers & Python", O'Reilly Media, Inc, First Edition, 2018.
- 2. Donald Norris, "Python for Microcontrollers: Getting Started with MicroPython", McGraw Hill Education Private Limited, First Edition, 2016.

## **REFERENCES:**

- 1. Charles Bell, "MicroPython for the Internet of Things: A Beginner's Guide to Programming with Python on Microcontrollers", Apress, 3rd Edition, 2017.
- 2. Rui Santos, Sara Santos, "MicroPython Programming with ESP32 and ESP8266", PE press, 2019.
- 3. Charles Bell, "Beginning Sensor Networks with XBee, Raspberry Pi, and Arduino: Sensing the World with Python and MicroPython", Apress, 2020.

## e-RESOURCES:

- 1. Website:https://micropython.org/
- 2. Website:https://learn.adafruit.com/micropython/

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**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Demonstrate the micropython programming features, hardware and application domains.
- 2. Write the micropython programming to control the python development boards
- 3. Develop a micropython program for the given application using ESP32 development board.
- 4. Interface sensor modules with ESP32 development board using UART, I2C and SPI protocol.
- 5. Develop micropython program to interface LCD, OLED, DC motors and robots with ESP32 development board.

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
COS/POS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	1	2	3	-	2	-	-	-	-	-	1	1	-	3
CO 2	1	2	3	-	2	-	-	-	-	-	1	1	-	3
CO 3	1	2	3	2	2	-	-	-	-	-	1	1	2	3
CO 4	1	2	3	2	2	1	2	-	2	1	1	1	2	3
CO 5	1	2	3	2	2	1	2	-	2	1	1	1	2	3
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#### Mapping of COs with POs and PSOs:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

#### IOT BASED SYSTEM DESIGN

# Internet of Things (IoT) has gained prominence with the ever increasing connected devices, sensor systems and capability of computing resources. An IoT system typically comprises of smart sensor nodes to collect data either real-time or offline, data communication over a network and the back-end data management & processing to extract intelligent information. The typical use cases of IoT are wearable's, smart homes, smart vehicles, traffic prediction & control, weather monitoring & forecasting, indoor location-based services, health monitoring of machines & structures, augmented/virtual reality etc..

#### UNIT 1 INTRODUCTION

**22ECE43** 

**Preamble:** 

Rise of the machines - Evolution of IoT - Web 3.0 view of IoT - Characteristics of IoT - IoT Enabling Technologies - IoT Architecture - Fog, Edge and Cloud in IoT - Functional blocks of an IoT ecosystem - Sensors, Actuators, Smart Objects and Connecting Smart Objects - IoT levels and deployment templates - A panoramic view of IoT applications.

#### UNIT 2 MIDDLEWARE AND PROTOCOLS OF IOT

Middleware technologies for IoT system - IoT Ecosystem Overview - Horizontal Architecture Approach for IoT Systems - SOA based IoT Middleware, Middleware architecture of RFID, WSN, SCADA, M2M - Interoperability challenges of IoT - Protocols for RFID, WSN, SCADA, M2M-Zigbee, KNX, BACNet, MODBUS - Challenges Introduced by 5G in IoT Middleware - Technological Requirements of 5G Systems - Perspectives and a Middleware Approach Toward 5G - Resource management in IoT.

#### UNIT 3 COMMUNICATION AND NETWORKING

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN - Network Layer: IP versions, Constrained Nodes and Constrained Networks - Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks - Application Transport Methods: Supervisory Control and Data Acquisition - Application Layer Protocols: CoAP and MQTT - Data aggregation & dissemination.

#### UNIT 4 IOT IMPLEMENTATION TOOLS

Introduction to different IoT tools - Developing applications through IoT tools - Developing sensor based application through embedded system platform - Implementing IoT concepts with python - Implementation of IoT with Raspberry Pi.

#### UNIT 5 APPLICATIONS

Home automations - Smart cities - Environment - Energy - Retail - Logistics - Agriculture - Industry - Health and life style.

#### TOTAL: 45 PERIODS

#### **TEXT BOOK:**

- 1. Honbo Zhou, "Internet of Things in the cloud: A middleware perspective", CRC press, 2012.
- 2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", VPT, 1st Edition, 2014.

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#### **REFERENCES:**

- 1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
- 2. Constandinos X. Mavromoustakis, George Mastorakis, Jordi MongayBatalla, "Internet of Things (IoT) in 5G Mobile Technologies" Springer International Publishing Switzerland 2016.
- 3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things" Springer-Verlag Berlin Heidelberg, 2011.

#### e-RESOURCES:

- 1. Nptel Video : https://nptel.ac.in/courses/106105166, "Introduction to internet of things", Prof. SudipMisra, Department of Computer Science and Engineering, IIT, Kharagpur.
- 2. Nptel Video: <u>https://nptel.ac.in/courses/108108098</u>, "Design for internet of things", Prof. T V Prabhakar, Department of Electronic Systems Engineering, IISc, Bangalore.

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Interface sensors, actuators and smart objects with IoT.
- 2. Implement the different middleware architecture, infrastructure models and protocols of IoT.
- 3. Analyze the networking and connect the sensors with IoT.
- 4. Analyze and design different models for IoT using python with Raspberry Pi.
- 5. Implement IoT on embedded platform for real time problems.

Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	2	3	2	1	-	-	-	-	-	-	1	3	2
CO 2	2	2	3	2	1	-	1	1	-	1	-	-	3	2
CO 3	2	2	3	2	2	1	1	-	-	1	-	-	3	2
CO 4	2	2	3	3	2	1	-	1	1	-	1	1	3	2
CO 5	2	2	3	3	2	-	-	-	1	-	1	-	3	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

# **22ECE44**

#### **Preamble:**

The Internet of Things is the concept of connecting any object/thing/device to the internet. This course aims to provide techniques to build small low cost embedded IoT system using MQTT and HTTP protocols with Raspberry Pi /Arduino open source hardware platforms.

**EMBEDDED INTERNET OF THINGS** 

#### UNIT 1 INTRODUCTION TO INTERNET OF THINGS

Characteristics of IoT - Physical Design of IoT - Things in IoT - IoT Protocols - Logical Design of IoT- IoT Communication Models - IoT Communication APIs - IoT Enabling Technologies.

## UNIT 2 IOT NETWORKING

Introduction to M2M - Difference between IoT and M2M - SDN and NFV for IoT - Software Defined Networking Network Function Virtualization - IoT System Management with NETCONF-YANG - Need for IoT Systems Management - Network Operator Requirements - NETCONF - YANG

#### UNIT 3 PHYSICAL COMPUTING USING PYTHON

Introduction to Raspberry Pi – Setup- Applications of GPIO – Blink lights- DC motor control in pythonserial port communication – I2C and SPI interface – memory chip interface –controlling appliances using Flask web framework – Web Framework based appliance control / dashboard. Python packages for IoT.

#### UNIT 4 INTERNET OF THINGS WITH RASPBERRY PI

Communication with cloud using HTTP and MQTT protocols – Building a cloud data logger - Setting up a weather station – Security surveillance system using camera, motion sensor and cloud – Controlling a robot car with python car using MQTT protocol.

## UNIT 5 INTERNET OF THINGS WITH ARDUINO

Creation of own web server and web page to control to the hardware – using HTTP protocol sending sensor data to cloud platforms–interacting with web services – Building IoT devices with MQTT – data acquisition and control using cloud server with the user interface -home automation projects – cloud controlled digital candle

#### **TEXT BOOKS:**

- 1. ArshdeepBahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Orient Blackswan Private Limited New Delhi, 1st edition, 2015.
- 2. SaiYamanoor, SrihariYamanoor, Python Programming with Raspberry Pi, First edition, PacktPublishing Limited, Mumbai, 2017.

#### **REFERENCES:**

- 1. ManeeshRao, Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects, Packt Publishing Limited, Mumbai 2018.
- 2. Marco Schwartz, Internet of Things with Arduino Cookbook, First edition, Packt Publishing. 2016.

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**TOTAL: 45 PERIODS** 

3. Tim Pulver, -Hands-On Internet of Things with MQTT, First edition, Packt Publishing, 2019.

#### e-RESOURCES:

- Nptel Video:https://swayam.gov.in/nd1 noc20 cs22, "Introduction to internet of things", Prof. 1. SudipMisra, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur.
- Nptel Video:https://swayam.gov.in/nd1 noc20 cs24, "Introduction to Industry 4.0 and 2. Industrial Internet of Things", Prof. SudipMisra, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur.

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Demonstrate IoT characteristic, protocol layers, enabling technologies, and its design levels.
- 2. Utilize of software defined networking and manage networking using SNMP and NETCONF protocols.
- Develop a python program for the given application and implement in Raspberry Pi 3. development board.
- 4. Develop HTTP and MQTT protocol based weather station, data logger, Security surveillance system and remote Viewing through Pi Camera using raspberry pi development board.
- Develop Internet enabled data acquisition and control with the user interface, home automation 5. projects and Light controller system using Arduino development board.

#### Mapping of COs with POs and PSOs:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
COS/POS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	1	2	3	1	1								3	
CO 2	1	2	3	1	1								3	
CO 3	1	2	3	2	2	1	2				2		3	2
CO 4	1	2	3	2	2	1	2		1	1	2	1	3	2
CO 5	1	2	3	2	2	1	2		1	1	2	1	3	2
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1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

#### 22ECE45 Preamble:

This course provides the basic electrical and mechanical concepts of MEMS design. This course gives the knowledge of electrostatic sensors and actuators, magnetic sensors and actuators.

**MEMS DESIGN** 

## UNIT 1 ESSENTIAL ELECTRIC AND MECHANICAL CONCEPTS

Conductivity of semiconductors - Crystal planes and orientations - stress and strain - flexural beam bending analysis under simple loading conditions - Dynamic system - resonant frequency and quality factor.

#### UNIT 2 ELECTRO STATIC SESNING AND ACTUATION

Parallel plate capacitor - Applications of parallel plate capacitors- inertial sensor - pressure sensor - flow sensor - tactile sensor - parallel plate actuators – interdigitated finger capacitors - applications of comb drive devices

## UNIT 3 THERMAL SENSING AND ACTUATION

Fundamentals of thermal transfer -Sensors and actuators based on thermal expansion - Themal couples ,Thermal resistors – Applications - Infrared sensors - flow sensors - Inertial sensors.

#### UNIT 4 PIEZOELECTRIC SENSING AND ACTUATION

Mathematical description of piezoelectric effects - Cantilever piezoelectric actuator model - properties of piezoelectric materials: Quarz , PZT, PVDF, ZnO - Applications – Acoustic sensors - Tactile sensors.

## UNIT 5 MAGNETIC SENSING AND ACTUATION

Concepts and principles- magnetization and nomenclatures - principles of micromagnetic actuators - fabrication of micro magnetic components- deposition, design and fabrication of magnetic coil - MEMS magnetic actuators

#### **TEXT BOOKS:**

- 1. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006
- 2. Eun Sok Kim," Fundamentals of Microelectromechanical Systems", McGraw Hill,1<sup>st</sup> edition,2021

#### **REFERENCES:**

- 1. Murty B.S, Shankar P, Raj B, Rath, B.B, Murday J, "Textbook of Nanoscience and Nanotechnology", Springer publishing, 2013.
- 2. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures", CRC Press, 2002.
- 3. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata Mcgraw Hill, 2002.

## e-RESOURCES:

## **TOTAL: 45 PERIODS**

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- 1. Nptel video: https://nptel.ac.in/courses/117105082/ "Introduction to MEMS & Microsystems", Prof. Santiram Kal, IIT Kharagpur.
- 2. Nptel video: https://onlinecourses.nptel.ac.in/noc19\_ee40 "Fabrication Techniques for MEMs based sensors: clinical Perspective", Prof.Hardik J. Pandya & Prof Chandramani Kishore Singh, IISC Bengaluru.

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Demonstrate the components of MEMS.
- 2. Apply the knowledge in the development of electro static sensors and actuators.
- 3. Apply the knowledge in the development of thermal sensors and actuators.
- 4. Apply the knowledge in the development of piezoelectric sensors and actuators.
- 5. Apply the knowledge in the development of magnetic sensors and actuators.

#### Mapping of COs with POs and PSOs:

COs/POs	PO	PSO	PSO											
005/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	2	2	2	2	-	-	-	-	-	1	3	2
CO 2	3	3	3	2	2	2	-	-	-	-	-	2	3	2
CO 3	3	3	3	2	2	2	-	-	-	-	-	2	3	2
<b>CO 4</b>	3	3	3	2	2	2	-	-	-	-	-	2	3	2
CO 5	3	3	3	2	2	2	-	-	-	-	-	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

## 22ECE46 INDUSTRIAL IOT AND INDUSTRY 4.0

#### **Preamble:**

The course aims to provide knowledge and skills related to Industry 4.0, including the use of IoT sensors and devices to collect data and improve industrial processes. This aligns with the goals of Industry 4.0, which seek to create smart factories that are more efficient, productive, and responsive to customer needs.

#### UNIT 1 UNDERSTANDING IOT CONCEPT AND DEVELOPMENT PLATFORM 9

IOT Definition - Importance of IoT - Applications of IOT - IoT architecture - Understanding working of Sensors – Actuators - Sensor calibration - Study of Different sensors and their characteristics.

## UNIT 2 ANALYZING & DECODING OF COMMUNICATION PROTOCOL USED IN IOT DEVELOPMENT PLATFORM

UART Communication Protocol, I2C Protocol device interfacing and decoding of signal - SPI Protocol device interfacing and decoding of signal - WiFi and Router interfacing - Ethernet Configuration - Bluetooth study and analysis of data flow.

#### UNIT 3 IOT PHYSICAL DEVICES AND ENDPOINTS AND CONTROLLING HARDWARE AND SENSORS

IoT Physical Devices and Endpoints - Controlling Hardware- Connecting LED, Buzzer, Switching HighPower devices with transistors - Controlling AC Power devices with Relays- Controlling servo motor- speed control of DC Motor- unipolar and bipolar Stepper motors - Sensors- Light sensor-temperature sensor with thermistor-voltage sensor- ADC and DAC-Temperature and Humidity Sensor DHT11- Motion Detection Sensors-Wireless Bluetooth Sensors-Level Sensors- Distance Measurement with ultrasound sensor.

## UNIT 4 CLOUD SERVICES USED IN IOT DEVELOPMENT PLATFORM

Configuration of the cloud platform- Sending data from the IoT nodes to the gateways using different communication options-Transferring data from gateway to the cloud - Exploring the web services like mail, Messaging and Twitter etc.

## UNIT 5 CHALLENGES IN IOT SYSTEM DESIGN – HARDWARE & SOFTWARE

Antenna design and placement, Chip-package system development-Power electronics-electromagnetic interference/compatibility (EMI/EMC)- Electronics reliability-Battery simulation.

#### **TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

- 1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things A Hands-on Approach", Universities Press, 2015.
- 2. Matt Richardson and Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 2014, ISBN: 9789350239759.

#### **REFERENCES:**

1. N. Ida, "Sensors, Actuators and Their Interfaces", SciTech Publishers, 2014.



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- 2. Simon Monk, "Raspberry Pi Cookbook, Software and Hardware Problems and solutions", O'Reilly (SPD), 2016, ISBN 7989352133895.
- 3. Peter Waher, "Learning Internet of Things", Packt Publishing, 2015.

#### e-RESOURCES:

- 1. Website:https://aws.amazon.com/iot/solutions/industrial-iot/
- 2. Nptel Video:https://nptel.ac.in/courses/106105195,"Introduction to Industry 4.0 and Industrial Internet of Things", Prof. Sudip Misra, IIT Kharagpur,

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Analyze the building blocks of IoT technology and explore the vast spectrum of IoT applications.
- 2. Built IoT hardware using processors & peripherals.
- 3. Assess, select and customize technologies for IoT applications.
- 4. Configure cloud platform for realtime applications and transfer the data from gateway to cloud.
- 5. Design and implement IoT applications that manage big data.

#### Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
COS/POS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	1	2	3	2	2							1	3	
CO 2	1	2	3	2	2	1						1	3	
CO 3	1	2	3	2	2	1	2		2	1	1	1	3	2
CO 4	1	2	3	2	2	1	2		2	1	1	1	3	2
CO 5	1	2	3	2	2	1	2		2	1	1	1	3	2

- 1: Slight (Low) 2
- 2: Moderate (Medium)
- 3: Substantial (High)

#### VCET, B.E-ECE, R2022 Curriculum and Syllabus

#### 22ECE47 SOFTWARE-DEFINED NETWORKS Preamble:

This course provides a comprehensive understanding of Software Defined Networks, including the architectural framework, the different technologies and protocols involved, and the practical applications of SDN in modern network design. Students will learn how to design, deploy and manage SDN networks, and will gain hands-on experience with the tools and platforms used in the field.

## UNIT 1 SDN: INTRODUCTION

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane , Control plane and Application Plane.

#### UNIT 2 SDN DATA PLANE AND CONTROL PLANE

Data plane functions and protocols-Open flow protocol-Flow table-Control Plane functions-Southbound interface, Northbound interface-SDN Controllers-Ryu, Open Day light, ONOS-Distributed Controllers.

## UNIT 3 SDN APPLICATIONS

SDN Application plane Architecture-Network services Abstraction layer-Traffic Engineering-Measurement and Monitoring-Security-Data Center Networking.

#### UNIT 4 NETWORK FUNCTION VIRTUALIZATION

Network Virtualization-Virtual LANs-Open Flow VLAN Support-NFV Concepts-Benefits and Requirements-Reference Architecture.

## UNIT 5 NFV FUNCTIONALITY

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV.

## TOTAL: 45 PERIODS

#### **TEXT BOOKS:**

- 1. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud", Pearson Education, 1st Edition, 2015.
- 2. Software Defined Networks: A Comprehensive Approach Paperback Illustrated, 30 June 2014

#### **REFERENCES:**

- 1. Ken Gray, Thomas D. Nadeau, "Network Function Virtualization", Morgan Kauffman, 2016.
- 2. Thomas D Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.
- 3. Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", 1st Edition, CRC Press, 2014.
- 4. Paul Goransson, Chuck Black Timothy Culver, "Software Defined Networks: AComprehensive Approach", 2nd Edition, Morgan Kaufmann Press, 2016.
- 5. Oswald Coker, SiamakAzodolmolky, "Software-Defined Networking with OpenFlow", 2nd Edition, O'Reilly Media, 2017.

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#### e-RESOURCES:

- 1. Nptel Video: https://nptel.ac.in/courses/106105183,"Computer Networks and Internet Protocol", Prof. SoumyaKanti Ghosh, Prof. Sandip Chakraborty,IIT Kharagpur.
- 2. Nptel Video :https://onlinecourses.nptel.ac.in/noc23\_cs35, "Advanced Computer Networks", Prof. NeminathHubballi, Prof. Sameer G Kulkarni, IIT Indore & IIT Gandhi nagar.

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Identify the fundamentals concepts of software-defined networking, including its architecture, components and protocols.
- 2. Demonstrate the benefits of software-defined networking improved network flexibility, scalability, and automation.
- 3. Design and implement software-defined network architectures using controllers, switches, and protocols.
- 4. Construct the network using NFV by analyzing components and protocols.
- 5. Solve the issues while implementing of SDN and NFV.

#### Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	1	2	3	1	3	-	-	-	2	3	1	3	3	1
CO 2	2	1	2	2	3	-	-	-	2	2	2	2	3	
CO 3	2	2	2	3	3	-	-	-	3	1	1	2	3	1
CO 4	2	2	2	3	1	-	-	-	1	3	1	2	3	1
CO 5	3	3	1	1	3	-	-	1	1	2	2	2	3	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

#### DIGITAL IMAGE PROCESSING

#### 22ECE51 Preamble:

Digital image processing has become inevitable in many fields such as signature recognition, iris recognition and face recognition, in forensics, in automobile detection and in military applications. Each of these applications has its basic requirements, which may be unique from the others. Everyone is concerned and demands a system as faster, more accurate, cheaper and more extensive computation. In order to understand the analysis of entire image in the frequency domain, it is essential to learn the various image transforms. Also, It is necessary to learn the concepts of image enhancement, segmentation and compression.

#### UNIT 1 DIGITAL IMAGE FUNDAMENTALS

 $Elements \ of \ visual \ perception \ - \ Image \ sensing \ and \ acquisition \ - \ Image \ sampling \ and \ quantization \ - \ Color \ images \ - \ RGB \ model \ - \ Basic \ relationship \ between \ pixels \ - \ Histogram \ - \ Histogram \ equalization.$ 

#### UNIT 2 IMAGE TRANSFORMS

Basics of 1D and 2D image transforms - Separable Image Transforms - One dimensional Fourier Transform - DFT - Two dimensional Fourier Transform - Discrete Cosine Transform - Walsh -Hadamard Transform - Wavelet transform - Haar transform - Properties.

#### UNIT 3 IMAGE ENHANCEMENT AND RESTORATION

Image Enhancement: Gray level transformations - Spatial Domain Methods - Image subtraction - Image averaging - Spatial filtering - Smoothing, Sharpening filters - First and Second Derivatives - Frequency Domain Methods - Filtering - Smoothing and Sharpening filters - Butterworth and Gaussian. Image Restoration: Model of Image Degradation/ Restoration process - Linear, position invariant degradation - Inverse filtering - Weiner filtering.

#### UNIT 4 IMAGE SEGMENTATION AND REPRESENTATION

Detection of discontinuities - Point, Line and Edge detection - Gradient operators - Edge linking -Graph theoretic technique - Thresholding - global and adaptive - Region based segmentation -Boundary representation - chain codes - Polygonal approximation - Signatures - skeletons -Boundary segments.

#### UNIT 5 IMAGE COMPRESSION

Introduction to Image compression : Lossy and Lossless compression - Sequential and Progressive Compression - Rate/Distortion optimization - Parameters of compression - Huffman coding - Run Length Coding - Predictive coding - DPCM - Transform coding - Vector quantization - Image compression standards: JPEG, JPEG2000.

## TOTAL: 45 PERIODS

## **TEXT BOOK:**

1. R. C. Gonzalez, R. E. Woods- "Digital Image Processing", Prentice-Hall, 4<sup>th</sup> Edition, 2018.

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2. Anil K- Jain- "Fundamentals of Digital Image Processing", Pearson/Prentice Hall of India-2002

#### **REFERENCES:**

- 1. David Salomon, —Data Compression, Springer Verlag New York Inc., 4th Edition. 2006.
- 2. Dr. S. Jayaraman, —Digital Image Processing, Tata McGraw Hill, 2009.
- 3. William K Pratt, —Digital Image Processing, John Wiley and Sons, 4th Edition, 2007.

#### e-RESOURCES:

- 1. NPTEL video: <u>http://nptel.ac.in/courses/117105135</u>, "Digital Image Processing", <u>Prof. P.K.</u> <u>Biswas</u>, IIT, Kharagpur.
- 2. NPTEL video: <u>https://nptel.ac.in/courses/117104069</u>, "Digital Image Processing", Prof. Sumana Gupta, IIT, Kanpur.

#### **Course Outcomes: Upon completion of the course, students will be able to:**

- 1. Infer the digital images using sampling and quantization techniques and obtain the histogram of the given image by equalization and specification.
- 2. Compute the frequency spectrum of one dimensional signals using Fourier transform and DFT and two dimensional images using DCT, Walsh, Hadamard, Wavelet and Haar transforms.
- 3. Analyze the enhanced image by spatial domain and frequency domain methods and restore the images using inverse and Weiner filtering.
- 4. Contrast the given image discontinuities by point, line and edge detection and segment the given image by thresholding and represent the boundary of images using chain codes, polygonal approximation, signatures and skeletons.
- 5. Illustrate the compression techniques for the images using Huffman coding, Run length coding, Predictive coding and Transform Coding.

#### Mapping of COs with POs and PSOs:

COs/POs	PO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	3	2	3	2		2			1			3	1
CO 2	2	3	1	3	2				1				3	
CO 3	2	3	2	3	2						2	2	3	
CO 4	2	3	2	3	2	1	2		1		2	2	3	
CO 5	1	3	2	3	1	1	2			1	2	2	3	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

## 22ECE52 DSP ARCHITECTURE AND PROGRAMMING L T P C

#### **Preamble:**

This course provides knowledge on architecture of programmable DSP processors. The course helps to implement various standard DSP algorithms in DSP Processors to build real-time DSP systems.

# UNIT 1 ARCHITECTURES FOR PROGRAMMABLE DSP PROCESSORS

Basic Architectural features - DSP Computational building blocks - Bus architecture and memory - Data addressing capabilities - Address generation Unit - Programmability and program execution - Speed issues - Features for external interfacing.

#### UNIT 2 TMS320C5X PROGRAMMABLE DSP PROCESSOR

Architecture of TMS320C54xx DSP processors - Addressing modes – Assembly language Instructions -Memory space, interrupts, and pipeline operation of TMS320C54xx DSP Processor - On-Chip peripherals - Block Diagram of TMS320C54xx DSP starter kit.

#### UNIT 3 TMS320C6X PROGRAMMABLE DSP PROCESSOR

Commercial TI DSP processors - Architecture of TMS320C6x DSP Processor - Linear and Circular addressing modes - TMS320C6x Instruction Set, Assembler directives - Linear Assembly – Interrupts - Multichannel buffered serial ports - Block diagram of TMS320C67xx DSP Starter Kit and Support Tools.

#### UNIT 4 IMPLEMENTATION OF DSP ALGORITHMS

DSP Development system - On-chip and On-board peripherals of C54xx and C67xx DSP development boards - Code Composer Studio (CCS) and support files - Implementation of Conventional FIR - IIR and Adaptive filters in TMS320C54xx/TMS320C67xx DSP processors for real-time DSP applications - Implementation of FFT algorithm for frequency analysis in real-time.

#### UNIT 5 APPLICATIONS OF DSP PROCESSORS

Voice scrambling using filtering and modulation - Voice detection and reverse playback - Audio effects - Graphic Equalizer - Adaptive noise cancellation - DTMF signal detection - Speech thesis using LPC - Automatic speaker recognition

#### **TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

- 1. Avtar Singh and S. Srinivasan "Digital Signal Processing Implementations using DSP Microprocessors with Examples from TMS320C54xx"- Cengage Learning India Private Limited- Delhi-2012.
- 2. Rulph Chassaing and Donald Reay-"Digital Signal Processing and Applications with the C6713 and C6416 DSK"- John Wiley & Sons, Inc., Publication- 2012 (Reprint).

#### **REFERENCES:**

- 1. B.Venkataramani and M.Bhaskar, "Digital Signal Processors Architecture, Programming and Applications", Tata McGraw Hill Publishing Company Limited- New Delhi- 2003.
- 2. If each or E. C and Jervis B. W -"Digital Signal Processing: A practical approach"- Pearson Education, PHI- 2<sup>nd</sup> Edition- 2002.

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3. Peter Pirsch- "Architectures for Digital Signal Processing'- John Weily- 1<sup>st</sup> Edition- 2007.

#### e-RESOURCES:

- 1. Nptel Course, https://nptel.ac.in/courses/108106149, "Mapping Signal Processing Algorithms to Architectures", Prof. Nitin Chandrachoodan, Department of Electrical Engineering, IIT, Madras.
- 2. Nptel Course, https://archive.nptel.ac.in/courses/108/108/108108185/, "Real-Time Digital Signal Processing (Video)", Prof. Rathna G N, Department of Electrical Engineering, IISc Bangalore.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Enumerate the architecture and features of DSP Processors.
- 2. Comprehend the organization and addressing modes of TMS320C54xx DSP processors.
- 3. Build solutions using TMS320C6x DSP Processor for signal processing applications.
- 4. Implement DSP Algorithms for filters and digital systems.
- 5. Develop the real time applications using DSP Processors.

#### Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
COS/POS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	3	3	1	1				1		1	3	3
CO2	2	2	3	3	1	1				1		1	3	3
CO3	2	2	3	3	1	1				1		1	3	3
CO4	2	2	3	3	1	1				1		1	3	3
CO5	2	2	3	3	1	1				1		1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

#### 22ECE53 ADVANCED DIGITAL SIGNAL PROCESSING

#### **Preamble:**

Advanced Digital Signal Processing provides an introduction to the basic concept of discrete time random signal processing and multirate signal processing and its applications. The course gives the knowledge the spectrum estimation techniques and learns the concept of prediction theory and filtering.

#### UNIT 1 MULTIRATE SIGNAL PROCESSING

Review of Convolution - DFT and ZT - Multirate Signal Processing - Decimation - Interpolation -Sampling Rate Conversion by a rational factor – digital filter banks - sub band coding - Quadrature Mirror Filter.

#### UNIT 2 DISCRETE TIME RANDOM PROCESSES

Stationary random processes – Autocorrelation - Rational Power Spectra - Filters for generating random Processes from white noise and inverse filter - AR - MA and ARMA processes - relationship between autocorrelation and the filter parameters.

#### UNIT 3 LINEAR PREDICTION AND FILTERING

Linear Prediction - Forward and Backward - Wiener filters for filtering and prediction - FIR Wiener Filter – IIR Wiener Filter – Kalman Filter.

#### **ADAPTIVE FILTERING UNIT 4**

FIR adaptive filters – adaptive filters based on steepest descent method – LMS algorithm – Variants of LMS algorithm – adaptive echo cancellation – adaptive channel equalization – RLS Algorithm.

#### UNIT 5 SPECTRUM ESTIMATION

Estimation of power spectra from finite duration observations of signals – Non parametric methods of spectrum estimation - the Bartlett and the Welch method - Parametric spectrum estimation - AR, MA and ARMA.

#### **TOTAL: 45 PERIODS**

#### **TEXT BOOKS:**

- 1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Pearson Education / Prentice Hall, Fifth Edition, 2021.
- 2. P. Vaidyanathan, "Multirate systems and filter banks", Prentice Hall Inc. 2021.

#### **REFERENCES:**

- Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons 1. Inc. New York, Indian reprint 2008.
- Haykin, Adaptive Filter Theory, 4th Edition, Pearson Education, New Delhi, 2006. 2.
- 3. Sophoncles J. Orfanidis, "Optimum Signal Processing", McGraw Hill, 2000.

#### e-RESOURCES:

Nptel Video, https://nptel.ac.in/courses/117101001, "Adv. Digital Signal Processing - Multirate 1. and wavelets", Prof. V.M. Gadre, IIT Bombay.

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2. Course Content: https://itieacademy.com/training/advanced-digital-signal-processing-withmatlab/

#### **Course Outcomes: Upon completion of the course, students will be able to:**

- 1. Compute multirate signal processing by using sampling rate conversion by a rational factor and demonstrate its applications.
- 2. Calculate the power spectral density for discrete random signals and systems
- 3. Apply linear prediction and filtering techniques to discrete random signals for signal detection and estimation.
- 4. Analyze adaptive filtering problems and demonstrate their application by using various adaptive algorithms.
- 5. Estimate the power spectrum from finite duration observations of signals using parametric and non-parametric techniques.

## Mapping of COs with POs and PSOs:

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	3	2	2	2	1	1	1	2	1	1	1	3	1
CO 2	2	3	2	2	2					1		1	3	
CO 3	2	3	2	2	2	1	1	1	2	1	1	1	3	1
CO 4	2	3	2	2	2	1	1	1	2	1	1	1	3	1
CO 5	2	3	2	2	2	1	1	1		1		1	3	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

#### 22ECE54 **DIGITAL SPEECH PROCESSING**

## **Preamble:**

The course provides the foundation knowledge on speech production and perception along with processing of speech signal in digital domain.

#### UNIT 1 **FUNDAMENTALS OF SPEECH**

The Human speech production mechanism - Discrete-Time model of speech production - Speech perception - human auditory system, Phonetics - articulatory phonetics - acoustic phonetics, and auditory phonetics - Categorization of speech sounds - Spectrographic analysis of speech sounds -Pitch frequency - Pitch period measurement using spectral and cepstral domain - Formants, Evaluation of Formants for voiced and unvoiced speech.

#### UNIT 2 SPEECH FEATURES AND DISTORTION MEASURES

Significance of speech features in speech - based applications - Speech Features - Cepstral Coefficients - Mel Frequency Cepstral Coefficients (MFCCs) - Perceptual Linear Prediction (PLP) -Log Frequency Power Coefficients (LFPCs) - Speech distortion measures-Simplified distance measure - LPC-based distance measure - Spectral distortion measure - Perceptual distortion measure.

#### UNIT 3 **SPEECH CODING**

Need for speech coding - Waveform coding of speech - PCM, Adaptive PCM - DPCM - ADPCM -Delta Modulation - Adaptive Delta Modulation - G.726 Standard for ADPCM - Parametric Speech Coding - Channel Vocoders - Linear Prediction Based Vocoders - Code Excited Linear Prediction (CELP) based Vocoders - Sinusoidal speech coding techniques - Hybrid coder - Transform domain coding of speech.

#### UNIT 4 **SPEECH ENHANCEMENT**

Classes of Speech Enhancement Algorithms - Spectral-Subtractive Algorithms - Multiband Spectral Subtraction - MMSE Spectral Subtraction Algorithm - Spectral Subtraction Based on Perceptual Properties - Wiener Filtering - Wiener Filters in the Time Domain - Wiener Filters in the Frequency Domain - Wiener Filters for Noise Reduction - Maximum-Likelihood Estimators - Bayesian Estimators - MMSE and Log-MMSE Estimator - Subspace Algorithms.

#### UNIT 5 SPEECH SYNTHESIS AND APPLICATION

A Text-to-Speech systems (TTS) - Synthesizers technologies - Concatenative synthesis - Use of Formants for concatenative synthesis - Use of LPC for concatenative synthesis - HMM-based synthesis - Sinewave synthesis - Speech transformations - Watermarking for authentication of a speech - Emotion recognition from speech.

#### **TEXT BOOK:**

- Shaila D. Apte- "Speech and Audio Processing", Wiley India (P) Ltd, New Delhi, 2012. 1.
- 2. Philipos C. Loizou - "Speech Enhancement Theory and Practice", Second Edition, CRC Press, Inc., United States, 2013

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**TOTAL: 45 PERIODS** 

#### **REFERENCES:**

- 1. Rabiner L. R. and Juang B. H- "Fundamentals of speech recognition", Pearson Education, 2003
- 2. Thomas F. Quatieri- "Discrete-time speech signal processing" Principles and practice, Pearson, 2012.
- 3. Rabiner- "Digital Processing of Speech Signals", Pearson, 2003.

#### e-RESOURCES:

- 1. NPTEL video, https://onlinecourses.nptel.ac.in/noc22\_ee117, "Digital Speech Processing", Prof. Shyamal Kumar Das Mandal, IIT, Kharagpur.
- 2. NPTEL video, https://nptel.ac.in/courses/117105081, "Digital Voice & Picture Communication", Prof. Somnath Sengupta, IIT, Kharagpur.

#### **Course Outcomes: Upon completion of the course, students will be able to:**

- 1. Explore the basics of speech signal
- 2. Extract speech features for speech related applications
- 3. Analyze and choose an appropriate speech coder for a given application.
- 4. Build a speech enhancement system.
- 5. Build a text-to-speech synthesis system for various applications

Mapping of COs with POs and PSOs:

COs/POs	PO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	1	2	1	1	2	1	-	-	-	-	-	2	3	2
CO 2	1	2	1	1	2	1	-	-	-	-	-	2	3	2
CO 3	1	2	1	1	2	1	-	-	-	-	-	1	3	2
<b>CO 4</b>	3	-	3	3	-	3	-	-	-	-	-	2	3	2
CO 5	3	-	3	3	-	3	-	-	-	-	-	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: 1

3: Substantial (High)

# 22ECE55

#### **Preamble:**

This course provides a basic concept of software defined Radio. The course gives the knowledge to develop smart antennas for spectrum exploitation, signal processing and cognitive Networking.

SOFTWARE DEFINED RADIO

#### UNIT 1 INTRODUCTION TO SOFTWARE RADIO

The Need for Software Radios - Characteristics and benefits of a software radio - Design principles of a Software Radio.

#### UNIT 2 RF IMPLEMENTATION

Purpose of RF front-end - Dynamic range - RF receiver front-end topologies- Enhanced flexibility of the RF chain with software radios- Importance of the components to overall performance-Transmitter architectures and their issues-Noise and distortion in the RF chain- Hybrid DDS – PLL systems- Applications of Direct Digital Synthesis.

#### UNIT 3 DIGITAL GENERATION OF SIGNALS

Comparison of direct digital synthesis with analog signal synthesis - Approaches to direct digital synthesis - Analysis of spurious signals - Performance of direct digital synthesis systems - Applications of direct digital synthesis.

#### UNIT 4 SMART ANTENNAS

Benefits of smart antennas - Structures for beam forming systems - Smart antenna algorithms - Hardware implementation of smart antennas - Digital Hardware Choices-Key hardware elements.

#### UNIT 5 HARDWARE AND SOFTWARE FOR SDR & CASE STUDIES

DSP Processors – FPGA – ASICs - Trade-offs - Object oriented programming - Object Brokers - GNU Radio-USRP - Case Studies: SPEAK easy – JRTS - SDR-3000

#### **TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

- 1. Jeffrey Hugh Reed- "Software Radio: A Modern Approach to Radio Engineering," Prentice Hall Professional 2002.
- 2. Tony J Rouphael- "RF and DSP for SDR," Elsevier Newnes Press 2008.

#### **REFERENCES:**

- 1. P. Kenington "RF and Baseband Techniques for Software Defined Radio," Artech House 2005.
- 2. Paul Burns "Software Defined Radio for 3G"- Artech House 2002.
- 3. Behrouz. F. Bourjney "Signal Processing for Software defined Radios"- Lulu 2008.

#### e-RESOURCES:

1. Nptel course, <u>https://nptel.ac.in/courses/108107107</u>, "Basics of software-defined radios and practical applications", Dr. Meenakshi Rawat, Department of Electronics and Communication Engineering, IIT Roorkee.

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2. Nptel video, https://www.youtube.com/watch?v=CaukSKg sI0, "Software Defined Networking - I (Basics)", Prof. Sandip Chakraborty , Department of Computer Science and Engineering, IIT Kharagpur.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Demonstrate the knowledge in the evolving paradigm of Software defined radio and technologies for its implementation.
- 2. Analyze complex problems in Radio frequency implementation issues
- Compare and analyze various digital synthesis systems. 3.
- Implement Smart antenna techniques for software defined radio. 4.
- Develop various hardware and software applications for software defined radios. 5.

COs/P Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
<b>CO1</b>	3	3								1		1	2	3
CO2	3	3	2	2	2	2				1		1	2	3
CO3	3	3	2	2	2	2				1		1	2	3
<b>CO4</b>	3	3	2	2	2	2				1		1	2	3
CO5	3	3	2	3	2	2				1		1	2	3

#### Mapping of COs with POs and PSOs:

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High)

## 22ECE56

#### **Preamble:**

This course provides basic concepts of image formation and image processing. The course gives the knowledge to develop skills on 3D reconstruction and image-based rendering and recognition.

**COMPUTER VISION** 

#### UNIT 1 INTRODUCTION TO IMAGE FORMATION ANDPROCESSING

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms-Pyramids and wavelets - Geometric transformations - Global optimization.

#### UNIT 2 FEATURE DETECTION, MATCHING AND SEGMENTATION

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

#### UNIT 3 FEATURE-BASED ALIGNMENT & MOTION ESTIMATION

2D and 3D feature-based alignment -Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

#### UNIT 4 3D RECONSTRUCTION

Shape from X - Active rangefinding - Surface representations - Point-based representations-Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

## UNIT 5 IMAGE-BASED RENDERING AND RECOGNITION

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

#### **TOTAL : 45 PERIODS**

## **TEXT BOOKS:**

- 1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
- 2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

#### **REFERENCES:**

- 1. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.
- 2. ChristopherM. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
- 3. E.R.Davies," Computer and Machine Vision", Fourth Edition, Academic Press, 2012.

#### e-RESOURCES:

1 Nptel Video, https://nptel.ac.in/courses/108103174, "Computer Vision and Image Processing", Fundamentals and Applications, IIT Guwahati, Prof. M. K. Bhuyan.

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2 Nptel Video, https://onlinecourses.nptel.ac.in/noc19\_cs58/preview, "Computer Vision" By Prof. Jayanta Mukhopadhyay, IIT Kharagpur.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Describe the fundamental concepts related to Image formation and processing.
- 2. Evaluate feature detection, matching and detection.
- 3. Summarize feature based alignment and motion estimation.
- 4. Apply 3Dreconstruction techniques on images
- 5. Apply interpolation, rendering and recognition on images.

#### Mapping of COs with POs and PSOs:

COs/POs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	1	1	1		2				1	2	1	2	1
CO2	3	3	3	2			1			1	1	1	3	1
CO3	3	3	2	2						1	1	1	3	2
CO4	2	3	3	2						1	1	2	2	2
CO5	2	3	3	2		2		2		1	1	2	3	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

#### VLSI SIGNAL PROCESSING

#### **22ECE57 Preamble:**

This course provides the concepts of iteration bound, algorithmic strength reduction techniques, pipelining and parallel processing techniques to enhance the system performance parameters.

#### UNIT 1 **ITERATION BOUND**

Iteration Bound - Data flow graph representations - loop bound and iteration bound- Longest path Matrix algorithm - Pipelining of FIR Digital Filters - parallel processing - pipelining and parallel processing for low power.

#### **RETIMING- UNFOLDING AND FOLDING** UNIT 2

Retiming - definitions and properties- Retiming techniques - Unfolding - an algorithm for Unfolding-Properties of unfolding- applications of unfolding. Folding - Folding transformation- Register Minimization techniques- Register minimization in folded architecture.

#### UNIT 3 FAST CONVOLUTION

Fast convolution -Cook-Toom algorithm- Modified Cook-Toom algorithm- Winograd algorithm-Modified Winograd algorithm - Iterated convolution - Cyclic convolution.

#### PIPELINING AND PARALLEL PROCESSING RECURSIVE **UNIT 4 FILTERS**

Parallel FIR filters - Pipelining interleaving in digital filters - Pipelining in first order IIR Digital filters - Pipelining in higher order IIR Digital filters - Parallel processing for IIR filters - Combined pipelining and parallel processing for IIR filters.

#### **BIT LEVEL ARITHMETIC ARCHITECTURES** UNIT 5 ANDPROGRAMMABLE DSP

Parallel Multipliers - Bit Serial Multipliers - Bit Serial filter design and implementation - Canonic Signed digit arithmetic - distributed arithmetic - Programmable DSPs - Evaluation of programmable DSPs- Important features of DSP processors- DSP processor for wireless communication- Processor for multimedia signal processing.

## **TEXT BOOK:**

Keshab K.Parhi, "VLSI Digital Signal Processing Systems- Design and Implementation", John 1. Wiley, Indian Reprint, 2013.

## **REFERENCES:**

- 1. U. Meyer, Baese, "Digital Signal Processing with Field Programmable Arrays", Springer, Second Edition, Indian Reprint, 2007.
- S.Y.Kuang, H.J. White house, T. Kailath, "VLSI and Modern Signal Processing", PrenticeHall, 2. 1995.

**TOTAL: 45PERIODS** 

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#### e-RESOURCES:

- Nptel Video, http://www.nptel.ac.in/courses/108105157, "VLSI Signal processing techniques", Prof.Mirtyunjoy Chakraborty, Department of Electrical and Electronics Engineering, IIT, Khargpur.
- 2. Nptel Video, <u>http://www.nptel.ac.in/courses/108103108</u>, "Optimization techniques for VLSI design", Prof. Chandan Karfa, Department of Electrical Engineering, IIT, Guwahati

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Identify iteration bound using longest path algorithm and apply pipelining and parallel processing algorithm to VLSI digital circuits.
- 2. Calculate critical path and adopt unfolding technique to reduce critical path.
- 3. Estimate the system output using fast convolution algorithm.
- 4. Apply the concepts of pipelining and parallel processing techniques to improve the speed of the VLSI circuits.
- 5. Analyze VLSI architectures for digital signal processing.

#### Mapping of COs with POs and PSOs:

COs/POs	PO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	1	3	2	1	-	2	-	-	-	1	2	-	-	3
CO 2	1	3	1	1	-	2	-	-	-	-	2	1	-	3
CO 3	1	3	2	1	-	-	2	-	-	-	2	-	-	3
CO 4	1	3	2	-	2	2	-	-	-	-	2	1	-	3
CO 5	1	3	2	-	2	-	2	-	-	1	-	-	-	3

- 1: Slight (Low)
- 2: Moderate (Medium)
- 3: Substantial (High)

# 22ECE61ASIC AND FPGA DESIGNL T P CPreamble:3 0 0 3

This course aims to provide the design flow and different technologies in ASIC design and to impart the knowledge of the architecture of different types of FPGAs.

#### UNIT 1 INTRODUCTION TO ASICs,CMOS LOGIC AND ASIC LIBRARY DESIGN

Types of ASICs - Design flow - CMOS transistors CMOS Design rules - Combinational Logic Cell - Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort - Library cell design - Library architecture.

#### UNIT 2 PROGRAMMABLE ASICs , PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS

Anti fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA - Altera FLEX - Altera MAX DC &AC inputs and outputs - Clock &Power inputs - Xilinx I/O blocks.

#### UNIT 3 PROGRAMMABLE ASIC INTERCONNECT, DESIGN SOFTWARE AND 9 LOW, LEVEL DESIGN ENTRY 9

Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 - Altera FLEX - Design systems - Logic Synthesis - Half gate ASIC - Schematic entry - Low level design language - PLA tools - EDIF - CFI design representation.

## UNIT 4 LOGIC SYNTHESIS, SIMULATION AND TESTING

Verilog and logic synthesis - VHDL and logic synthesis - types of simulation - boundary scan test - fault simulation - automatic test pattern generation.

#### UNIT 5 ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND 9 ROUTING

System partition - FPGA partitioning - partitioning methods - floor planning - placement - physical design flow - global routing - detailed routing - special routing - circuit extraction - DRC.

## TOTAL: 45 PERIODS

## **TEXT BOOK:**

- 1. M.J.S. Smith, "Application Specific Integrated Circuits", Addison -Wesley Longman Inc., 2010.
- 2. Wayne Wolf, "FPGA, Based System Design", Prentice Hall PTR, 2004.

## **REFERENCES:**

- 1. Farzad Nekoogar and Faranak Nekoogar- "From ASICs to SOCs: A Practical Approach", Prentice Hall PTR, 2003.
- 2. R. Rajsuman, "System-on-a-Chip Design and Test", Santa Clara- CA: Artech House Publishers, 2000.
- 3. F. Nekoogar, "Timing Verification of Application-Specific Integrated Circuits (ASICs)", Prentice Hall PTR, 1999.

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#### e-RESOURCES:

- 1. NPTEL Video: <u>https://nptel.ac.in/courses/117108040."Digital</u> system design with PLDs and FPGAs",Prof. Kuruvilla Varghese, Department of Electronic systems Engineering,IISc Bangalore.
- 2. NPTEL Video: <u>https://nptel.ac.in/courses/106105161"VLSI</u> Physical Design", Prof IndranilSengupta,Department of Computer Science Engineering, IIT Kharagpur.

Course Outcomes Upon completion of the course, students will be able to:

- 1. Infer the different types of ASICs design, CMOS characteristics and programming technologies & programmable ASICs.
- 2. Elucidate the different programmable ASIC logic cells and I/O cells.
- 3. Infer the different programmable interconnects and synthesis.
- 4. Analyze FPGA architecture and Implement VLSI Circuits in the suitable FPGA.
- 5. Apply algorithms for partitioning, floor planning and placement and Perform routing design in an ASIC.

#### Mapping of COs with POs and PSOs:

COs/POs	PO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	2	2	1	2			1		1	1		3
CO 2	3	3	2	2	1	2				1				3
CO 3	3	3	2	2	2	2	1				1	1		3
CO 4	3	3	2	2	2	2					1			3
CO 5	3	3	2	2	2	1						1		3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

# 22ECE62 HARDWARE SOFTWARE CO-DESIGN

## Preamble:

This course provides the concepts of co-design approaches for single processor and multiprocessor architectures. This course explores the various techniques of prototyping and emulation and the languages for system level specification and design.

#### UNIT 1 SYSTEM SPECIFICATION AND MODELLING

Embedded Systems-Hardware/Software Co-Design-Co-Design for System Specification and Modeling- Co-Design for Heterogeneous Implementation - Single-Processor Architectures with one ASIC and many ASICs- Multi-Processor Architectures- Comparison of Co- Design Approaches-Models of Computation- Requirements for Embedded System Specification.

#### UNIT 2 HARDWARE / SOFTWARE PARTITIONING

The Hardware/Software Partitioning Problem- Hardware-Software Cost Estimation- Generation of the Partitioning Graph-Formulation of the HW/SW Partitioning Problem-Optimization-HW/SW Partitioning based on Heuristic Scheduling-HW/SW Partitioning based on Genetic Algorithms.

## UNIT 3 HARDWARE / SOFTWARE CO-SYNTHESIS

The Co-Synthesis Problem-State-Transition Graph-Refinement and Controller Generation-Co-Synthesis Algorithm for Distributed System.

#### UNIT 4 PROTOTYPING AND EMULATION

Introduction, Prototyping and Emulation Techniques- Prototyping and Emulation Environments-Future Developments in Emulation and Prototyping -Target Architecture- Architecture Specialization Techniques - System Communication Infrastructure-Target Architectures and Application System Classes-Architectures for Control-Dominated Systems-Architectures for Data-Dominated Systems-Mixed Systems and Less Specialized Systems

## UNIT 5 DESIGN SPECIFICATION AND VERIFICATION

Concurrency-Coordinating Concurrent Computations-Interfacing Components-Verification-Languages for System-Level Specification and Design System-Level Specification-Design Representation for System Level Synthesis-System Level Specification Languages-Heterogeneous Specification and Multi-Language Co-simulation.

#### **TEXT BOOK:**

- 1. Ralf Niemann , "Hardware/Software Co-Design for Data Flow Dominated Embedded Systems", Kluwer Academic Publications, 2008.
- 2. Jorgen Staunstrup, Wayne Wolf ,"Hardware/Software Co-Design: Principles and Practice", Kluwer Academic Publications,1997.

#### **REFERENCES:**

- 1. Giovanni De Micheli , Rolf Ernst Morgon, "Reading in Hardware/Software Co-Design", Kaufmann Publishers, 2001.
- 2. Patrick R. Schaumont, "A Practical Introduction to Hardware/Software Codesign", Springer, 2010.

#### **TOTAL: 45 PERIODS**

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3. Soonhoi Ha and Jrgen Teich, "Handbook of Hardware/Software Co-design", Springer 2017.

#### e-RESOURCES:

- 1. Nptel Video, http:// https://nptel.ac.in/courses/ 106103229, "NOC:C-Based VLSI Design", Prof: Chandan Karf, IIT Guwahati.
- 2. Nptel Video, http://nptel.ac.in/courses/108/102/108102169, "NOC: Introduction to Embedded System Design", IIT, Jammu.

Course Outcomes Upon completion of the course, students will be able to:

- 1. Illustrate system specification and co-design approaches for single and multiprocessor embedded systems.
- 2. Solve the Hardware/Software Partitioning Problem using scheduling and algorithmic approaches.
- 3. Elucidate Hardware/Software co-synthesis algorithm for distributed systems.
- 4. Compare the prototyping and emulation techniques for embedded systems.
- 5. Formulate the design specifications and validate its functionality by simulation.

#### Mapping of COs with POs and PSOs:

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	2	2	2	2			1		1	1		3
CO 2	3	2	2	2										3
CO 3	3	2	2	2										3
CO 4	3	2	2	2	2	2			1			1		3
CO 5	3	2	2	2	2	2	1		1	1	1	1		3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

### LOW POWER IC DESIGN

#### 22ECE63 **Preamble:**

This course aims to provide an in depth understanding of the sources of power dissipation in digital CMOS circuitsto anlayse the various power optimization methods and techniques to reduce power consumption.

#### UNIT 1 FUNDAMENTALS OF LOW POWER CIRCUITS

Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects - Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

#### UNIT 2 **LOW-POWER DESIGN APPROACHES**

Low-Power Design through Voltage Scaling: VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures.

#### UNIT 3 LOW-VOLTAGE LOW-POWER ADDERS

Introduction, Standard Adder Cells, CMOS Adder's Architectures - Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, LowVoltage Low Power Design Techniques -Trends of Technology and Power Supply Voltage, LowVoltage Low-Power Logic Styles.

#### UNIT 4 LOW-VOLTAGE LOW-POWER MULTIPLIERS

Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh- Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

#### UNIT 5 LOW-VOLTAGE LOW-POWER MEMORIES

Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low Power SRAM Technologies, Basics of DRAM, Self-Refres Circuit, Future Trend and Development of DRAM.

#### **TOTAL: 45 PERIODS**

### **TEXT BOOKS:**

- 1. Sung-MoKang, YusufLeblebici, "CMOSDigitalIntegratedCircuits-AnalysisandDesign", TMH, 2011.
- Kiat-SengYeo, KaushikRoy,"Low Voltage, Low- Power VLSI Sub systems", TMH 2. Professional Engineering, 2004.

#### **REFERENCES:**

- Ming-BOL in, "Introduction to VLSI Systems: ALogic, Circuit and System Perspective" 1. ,CRCPress, 2012.
- 2. Anantha Chandrakasan, "Low Power CMOS Design", IEEE Press /WileyInternational, 1998
- 3. KaushikRoy, SharatC. Prasad, "Low Power CMOS VLSI Circuit Design", John Wiley &Sons, 2000.

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#### e-RESOURCES:

- 1. Nptel Video: <u>https://nptel.ac.in/courses/106105034</u>"Low Power VLSI Circuits & Systems,",Prof. Ajit Pal, Department of Compute Science Engineering, IIT Kharagpur.
- Nptel Video: https://nptel.ac.in/courses/117/106/117106149/"Design and Analysis of VLSI Subsystems,"Prof. Madhav Rao, Department of Electronics and Communication Engineering, IIT Chennai.

Course Outcomes Upon completion of the course, students will be able to:

- 1. Identify the source of power dissipation and Calculate the power dissipation for CMOS circuits.
- 2. Design the CMOS circuits using low power architectural structure.
- 3. Analyze Low-VoltageLow-Power adders and utilize in the applications.
- 4. Analyze and design Low-Voltage Low-Power Multipliers.
- 5. Design and develop Low Power, Low Voltage Memories.

	PO	PSO	PSO											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	2	3	2	1					1	2		3
CO 2	3	2	1	2	3	1					1	1		3
CO 3	3	3	3	2	2		1	1			1	1		3
CO 4	2	3	3	3	3		1	1			1	1		3
CO 5	3	3	3	2	2		1				1	2		3

#### Mapping of COs with POs and PSOs:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

# 22ECE64VLSI TESTING AND DESIGN FOR TESTABILITYL T P CPreamble:3 0 0 3

This course provides the basic concept of VLSI test principles, DFT architectures and fault diagnosis techniques. This course gives the knowledge to test and verify the functionality of the design in order to manufacture the fault free devices.

#### UNIT 1 TESTING AND FAULT MODELING

Importance of Testing - Challenges in VLSI Testing - Fault models - Logic simulation - Compiled code simulation - Event driven simulation - Fault simulation.

### UNIT 2 DESIGN FOR TESTABILITY

Design For Testability basics - Testability analysis: SCOAP testability analysis - Scan cell designs: Muxed D scan cell, clocked D scan cell and LSSD scan cell - Scan architectures - Scan design rules.

#### UNIT 3 TEST GENERATION

Random test generation- exhaustive testing - ATPG for Combinational Circuits - Designing a sequential ATPG - Designing Simulation based ATPG.

#### UNIT 4 BUILT IN SELF TEST

BIST design rules - Test pattern generation: exhaustive testing, pseudo-random testing, pseudo-exhaustive testing- Output response analysis for BIST- Logic BIST architectures.

### UNIT 5 FAULT DIAGNOSIS

Introduction and basic definitions - Fault model for diagnosis - Combinational logic diagnosis - Scan chain diagnosis - logic BIST diagnosis.

#### **TEXT BOOKS:**

- 1. Laung Terngwang, Cheng wenwu, Xiaoqing wen, "VLSI Testing Principles and Architectures: Design for Testability", Elsevier, 2017.
- 2. Abramovici, M., Breuer, M.A and Friedman, A.D., "Digital Systems and Testable Design", Jaico Publishing House, 2014.

#### **REFERENCES:**

- 1. Bushnell, M.L and Agrawal, V.D., "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwar Academic Publishers, 2017.
- 2. Niraj K. Jha and Sandeep Gupta, "Testing of Digital Systems", Cambridge University Press, 2017.
- 3. A.L.Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall International, 2002.

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#### e-RESOURCES:

- Nptel Video, https://nptel.ac.in/courses/106103116, "Design verification and test of digital VLSI circuits", Dr. Santosh Biswas, Department of Electrical Engineering and Computer Science, IIT, Guwahati.
- 2. Nptel Video, https://nptel.ac.in/courses/117105137, "Digital VLSI Testing", Dr.Santanu Chattopadhyay, Electronics and Electrical Communication Engineering, IIT, Kharagpur.

Course Outcomes Upon completion of the course, students will be able to:

- CO1 Analyze the design by using different fault models and simulation techniques.
- CO2 Elucidate the design for testability techniques for combinational and sequential circuits.
- CO3 Apply various test generation methods for combinational and sequential circuits.
- CO4 Generate test patterns using Built In Self Test design rules.
- CO5 Analyze fault diagnosis methods and apply it in digital circuits.

#### Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	2	2						1	1	1		3
CO 2	3	3	2	2						1				3
CO 3	3	3	2	2	2	2			1		1	1		3
CO 4	3	3	2	2	2	2			1					3
CO 5	3	3	2	2	2	2	1		1		1	1		3

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High)

#### VCET, B.E-ECE, R2022 Curriculum and Syllabus

### **TEXT BOOKS:**

- Gordon W.Roberts, Friedrich Taenzler, Mark Burns, "An Introduction to Mixed-signal IC Test 1. and Measurement" Oxford University Press, Inc.2012 (Unit I - V).
- M.L.Bushnell and V.D.Agrawal, "Essentials of Electronic Testing for Digital, Memory and 2. Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002. (Unit - III)

#### **REFERENCES:**

Bapiraju Vinnakota, "Analog and mixed-signal test", Prentice Hall, 1998.(Unit - II) 1.

# **Preamble**

**22ECE65** 

This course gives a comprehensive exposure to know about mixed-signal devices and the need for testing these devices and study the various techniques for testing. This helps to learn about ADC and DAC based testing. It explains the clock and serial data communications Channels and also studies the general purpose measuring devices.

MIXED SIGNAL IC DESIGN TESTING

## **UNIT 1 MIXED – SIGNAL TESTING**

Common Types of Analog and Mixed- Signal Circuits - Applications of Mixed-Signal Circuits - Post-Silicon Production Flow - Test and Packing - Characterization versus Production Testing - Test and Diagnostic Equipment - Automated Test Equipments - Wafer Probers - Handlers - E-Beam Probers -Focused Ion Beam Equipments – Forced – Temperature.

### UNIT 2 YIELD, MEASUREMENT ACCURACY, AND TEST TIME

Yield - Measurement Terminology - Repeatability, Bias, and Accuracy - Calibrations and Checkers -Tester Specifications - Reducing Measurement Error with Greater Measurement Time - Guardbands -Effects of Measurement Variability on Test Yield - Effects of Reproducibility and Process Variation on Yield – Statistical Process Control.

#### **UNIT 3 DAC TESTING**

Basics of Data Converters - Principles of DAC and ADC Conversion, Data Formats, Comparison of DACs and ADCs, DAC Failure Mechanisms - Basic DC Tests - Transfer Curve Tests - Dynamic DAC Tests – Tests for Common DAC Applications.

### **UNIT 4 ADC TESTING**

ADC Testing Versus DAC Testing - ADC Code Edge Measurements - Edge Code Testing Versus Center Code Testing, Step Search and Binary Search Methods, Servo Method, Linear Ramp Histogram Method, Histograms to Code Edge Transfer Curves, Rising Ramps Versus Falling Ramps, Sinusoidal Histogram Method - DC Tests and Transfer Curve Tests - Dynamic ADC Tests - Tests for Common ADC Applications.

#### **UNIT 5 CLOCK AND SERIAL DATA COMMUNICATIONS CHANNEL MEASUREMET** 9

Synchronous and Asynchronous Communications - Time-Domain Attributes of a Clock Signal -Frequency-Domain Attributes of a Clock Signal - Communicating Serially Over a Channel - Bit Error Rate Measurement - Methods to Speed Up BER Tests in Production - Deterministic Jitter Decomposition – Jitter Transmission Tests.

### **TOTAL: 45 PERIODS**

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- 2. Digital and Analogue Instrumentation: Testing and Measurement by Nihal Kularatna
- 3. Jose L Huertas "Test and design-for-testability In mixed-signal integrated Circuits" IMSE CNM, Spain. Springer science + Business Media Yew York, 2004. (eBook)

#### e-Resources:

- 1. NPTEL Video : https://onlinecourses.nptel.ac.in/noc20\_ee05/preview,"Digital IC Design", By Prof. Janakiraman, IIT Madras.
- 2. NPTEL Video : <u>https://archive.nptel.ac.in/courses/106/105/106105082/, "Data Communication</u>", Dr.Ajit Pal, III Kharagpur.

#### Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Demonstrate the methodologies used for testing and packaging of mixed signal circuits.
- CO2 Demonstrate the various measurement terminologies.
- CO3 Convert the data of the required format and test the DAC.
- CO4 Carry out testing for Analog to Digital and Digital to Analog converters.
- CO5 Design a clock signal for synchronous and asynchronous circuits considering time and frequency domain attributes.

COs/POs	PO 1	<b>PO</b> 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	2	2	2						1	1	2	3
CO 2	3	3	2	2	2			1			1	1	1	3
CO 3	2	3	2	2	2	1	1		1	1		1	1	3
CO 4	2	3	2	2	2	1	1		1	1		1	2	3
CO 5	2	3	2	2	2	1					1	1	2	3

#### Mapping of COs with POs and PSOs:

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

# various levels in VLSI design flow and various algorithms used for floor planning and routing

CAD FOR VLSI CIRCUITS

#### UNIT 1 VLSI DESIGN METHODOLOGIES

Introduction to VLSI Design methodologies - Review of Data structures and algorithms - Review of VLSI Design automation tools - Algorithmic Graph Theory and Computational Complexity -Tractable and Intractable problems - general purpose methods for combinatorial optimization.

#### UNIT 2 **DESIGN RULES**

**22ECE66** 

**Preamble:** 

techniques.

Layout Compaction - Design rules - problem formulation - algorithms for constraint graph compaction - placement and partitioning - Circuit representation - Placement algorithms partitioning.

#### UNIT 3 **FLOOR PLANNING**

Floor planning concepts - shape functions and floor plan sizing - Types of local routing problems -Area routing - channel routing - global routing - algorithms for global routing.

#### UNIT 4 **SIMULATION**

Simulation - Gate-level modeling and simulation - Switch-level modeling and simulation -Combinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis.

#### UNIT 5 **MODELLING AND SYNTHESIS**

High level Synthesis - Hardware models - Internal representation - Allocation assignment and scheduling - Simple scheduling algorithm - Assignment problem - High level transformations.

## **TEXT BOOK:**

- S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2008. 1.
- 2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers.2002.

## **REFERENCES:**

- Sadiq M. Sait, Habib Youssef, "VLSI Physical Design automation: Theory and Practice", 1. World scientific 1999.
- 2. Sung Kyu Lim, "Practice Problems in VLSI physical design Automation", Springer, 2008.
- 3. Steven M.Rubin, "Computer Aids for VLSI Design", Addison Wesley Publishing 1987.

## e-RESOURCES:

Nptel Video http://www.nitttrc.edu.in/nptel/courses/video/106105161/L03.html, "NOC-VLSI 1. Physical Design", Prof.Indranil Sengupta, IIT, Kharagpur.

# This course provides the concepts of physical design methods in VLSI, simulation techniques at

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2. Online Video https://ict.iitk.ac.in/courses/vlsi-physical-design/ IIT Kharagpur.

**Course Outcomes:** Upon completion of this course, students will be able to:

- 1. Analyze the computational and optimization algorithms and tools applicable for solving CAD related problems.
- 2. Apply VLSI design methodologies and design rules for digital circuits.
- 3. Apply floor planning and routing concepts for digital circuits.
- 4. Apply Gate level and Switch level modelling for logic circuits.
- 5. Elucidate high level logic synthesis and scheduling.

Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	2	2	1					1				3
CO 2	2	3	2	2				1		1	2			3
CO 3		3	3	3	2									3
CO 4	2	3	3	3	2						2			3
CO 5		3	3	3										3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

#### VLSI SIGNAL PROCESSING

#### 22ECE67 **Preamble:**

This course provides the concepts of iteration bound, algorithmic strength reduction techniques, pipelining and parallel processing techniques to enhance the system performance parameters.

#### UNIT 1 **ITERATION BOUND**

Iteration Bound - Data flow graph representations - loop bound and iteration bound- Longest path Matrix algorithm - Pipelining of FIR Digital Filters - parallel processing - pipelining and parallel processing for low power.

#### **RETIMING- UNFOLDING AND FOLDING** UNIT 2

Retiming - definitions and properties- Retiming techniques - Unfolding - an algorithm for Unfolding-Properties of unfolding- applications of unfolding. Folding - Folding transformation- Register Minimization techniques- Register minimization in folded architecture.

#### FAST CONVOLUTION UNIT 3

Fast convolution -Cook-Toom algorithm- Modified Cook-Toom algorithm- Winograd algorithm-Modified Winograd algorithm - Iterated convolution - Cyclic convolution.

#### UNIT 4 PIPELINING AND PARALLEL PROCESSING RECURSIVE **FILTERS**

Parallel FIR filters - Pipelining interleaving in digital filters - Pipelining in first order IIR Digital filters - Pipelining in higher order IIR Digital filters - Parallel processing for IIR filters - Combined pipelining and parallel processing for IIR filters.

#### UNIT 5 **BIT LEVEL ARITHMETIC ARCHITECTURES AND PROGRAMMABLE DSP**

Parallel Multipliers - Bit Serial Multipliers - Bit Serial filter design and implementation - Canonic Signed digit arithmetic - distributed arithmetic - Programmable DSPs - Evaluation of programmable DSPs- Important features of DSP processors- DSP processor for wireless communication- Processor for multimedia signal processing.

### **TEXT BOOK:**

Keshab K.Parhi, "VLSI Digital Signal Processing Systems- Design and Implementation", John 1. Wiley, Indian Reprint, 2013.

## **REFERENCES:**

- 1. U. Meyer, Baese, "Digital Signal Processing with Field Programmable Arrays", Springer, Second Edition, Indian Reprint, 2007.
- 2. S.Y.Kuang, H.J. White house, T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1995.

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#### e-RESOURCES:

- 1. Nptel Video, http://www.nptel.ac.in/courses/108105157, "VLSI Signal processing techniques", Prof. Mirtyunjoy Chakraborty, Department of Electrical and Electronics Engineering, IIT, Khargpur.
- 2. Nptel Video, <u>http://www.nptel.ac.in/courses/108103108</u>, "Optimization techniques for VLSI design", Prof. Chandan Karfa, Department of Electrical Engineering, IIT, Guwahati.

#### Course Outcomes:: Upon completion of the course, students will be able to:

- 1. Identify iteration bound using longest path algorithm and apply pipelining and parallel processing algorithm to VLSI digital circuits.
- 2. Calculate critical path and adopt unfolding technique to reduce critical path.
- 3. Estimate the system output using fast convolution algorithm.
- 4. Apply the concepts of pipelining and parallel processing techniques to improve the speed of the VLSI circuits.
- 5. Analyze VLSI architectures for digital signal processing.

#### Mapping of COs with POs and PSOs:

	PO	PSO	PSO											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	1	3	2	1		2				1	2			3
CO 2	1	3	1	1		2					2	1		3
CO 3	1	3	2	1			2				2			3
CO 4	1	3	2		2	2					2	1		3
CO 5	1	3	2		2		2			1				3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

# 22EC001CONSUMER ELECTRONICSLT30

#### Preamble:

This course provides the fundamental principles of operation of electronic devices used in household appliances and personal gadgets, including mobile and computing devices. It helps the students to develop skills to diagnose the fault and rectify the electronic appliances.

#### UNIT 1 MICROPHONES AND LOUDSPEAKERS

Microphone, types–Carbon, Dynamic, Wireless-Loudspeaker, types-Dynamic, Electrostatic, Permanent Magnet– Woofers-Tweeters-Hi-Fi system- Theatre sound system

#### UNIT 2 TELEVISION STANDARDS AND SYSTEMS

Components of a TV system – interlacing –composite video signal. Colour TV – Luminance and Chrominance signal- LCD –LED OLED TVs, PLASMA, Projectors

#### UNIT 3 OPTICAL RECORDING AND REPRODUCTION

Audio Disc – Processing of the Audio signal – Readout from the disc– Reconstruction of the audio signal – Video Disc – Recording systems – Playback Systems

#### UNIT 4 TELECOMMUNICATION SYSTEMS

Telephone services – telephone networks – LAN, MAN and WAN– Integrated Services Digital Network– Wireless Local Loop– VHF/UHF radio systems– Architecture of Cellular Phones-Media converter, Modem

### UNIT 5 HOME APPLIANCES

Microwave oven-Washing machine- Air conditioning- Refrigerators- Set-top boxes

### **TEXT BOOKS:**

- 1. S.P.Bali, Consumer Electronics, Pearson Education, 2nd Edition, 2008.
- 2. Dr.B.R.Gupta and V.Singhal, Consumer Electronics, S.K. Kataria & Sons, 2014.
- 3. The Digital Consumer Technology Handbook, A Comprehensive Guide to Devices, Standards, Future Directions, and Programmable Logic Solutions by Amit Dhir, Xilinx Inc., Elsevier 2004

### **REFERENCES:**

- 1. Gupta R.G., Audio video systems, Tata Mcgraw Hill, New Delhi, India, 2010.
- 2. Whitaker Jerry and Benson Blair, Mastering Digital Television, McGraw- Hill Professional, 2010
- 3. Bali. R and Bali. S.P., Audio video systems: principle practices & troubleshooting, Khanna Book Publishing Co. (P) Ltd., Delhi, 2010.

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#### e-RESOURCES:

- 1. NPTEL Videos https://nptel.ac.in/courses/117/105/117105133/ "Audio System Engineering", Prof.S.Dasmandal, IIT Kharagpur.
- 2. NPTEL Videos https://nptel.ac.in/courses/117/105/117105076/ "Communication Networks and Switching", Web page, IIT Kharagpur.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Describe the construction and working principle of loudspeaker and microphone and obtain sensitivity, frequency response, output impedance, distortion and directivity of microphones.
- 2. Recognize the need for preventive maintenance in television circuits and identify the advanced television systems.
- 3. Illustrate the working principle and block diagram of recorders and to identify the necessary maintenance for the recording and playback systems.
- 4. Clarify the working of networking systems and to troubleshoot the communication systems.
- 5. Illustrate the operations of domestic electronic appliances and systems.

Course	РО	PSO	PSO											
outcomes	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	1	2		1							1		
CO 2	2	1	3		1		1					1		
CO 3	3	1	2	1	1							1		
CO 4	3	1	2	1	1	1			1	1	1	1		
CO 5	2	1	3	1	1	1	1					1		

#### Mapping of COs with POs and PSOs:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

#### 22ECO02 **ADVANCED MOBILE COMMUNICATION** LT

#### **Preamble:**

This course provides the importance of wireless channel. The course gives the knowledge about cellular system. The course provides the concept of various digital signaling techniques and multipath mitigation techniques and concepts of multiple antenna techniques.

#### MULTIPLE ACCESS TECHNIQUES AND CELLULAR 9 UNIT 1 **RADIO CONCEPT**

Multiple Access Techniques: FDMA- TDMA- spread spectrum multiple access- CDMA- SDMA-CSMA protocols. Cellular Concept: Frequency reuse- channel assignment- hand off strategies-Interference and system capacity- trunking and grade of service- Improving Coverage and capacity in Cellular systems

#### UNIT 2 WIRELESS CHANNELS

Electromagnetic Wave Propagation Mechanisms - Reflection, Diffraction, Scattering Models -Large scale path loss – Path loss models: Free Space and Two-Ray models –Link Budget design – Small scale fading- Parameters of mobile multipath channels

#### **DIGITAL SIGNALING FOR FADING CHANNELS** UNIT 3

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, QAM Principle, Error performance in fading channels, OFDM principle - Cyclic prefix, Windowing, PAPR.

#### UNIT 4 **MULTIPATH MITIGATION TECHNIQUES**

Equalization – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms, Diversity - Micro and Macrodiversity, Diversity combining techniques, , Rake receiver.

#### UNIT 5 **MULTIPLE ANTENNA TECHNIQUES**

MIMO systems – spatial multiplexing –System model –Pre-coding – transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

### **TEXT BOOKS:**

- Rappaport, T.S., "Wireless communications", Pearson Education, 3rd Edition, 2010. 1.
- Andreas.F. Molisch, "Wireless Communications", John Wiley India, 2ndEdition 2012. 2. **REFERENCES:**
- David Tse and PramodViswanath, "Fundamentals of Wireless Communication", Cambridge 1. University Press, 2005.
- UpenaDalal, "Wireless Communication", Oxford University Press, 2009. 2.
- 3. Van Nee, R. and Ramji Prasad, "OFDM for wireless multimedia communications", Artech House, 2000.
- 4. Simon Haykins& Michael Moher, "Modern Wireless Communications", Pearson Education, 2007

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5. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2007.

#### e-RESOURCES:

- 1. NPTEL Video: https://onlinecourses.nptel.ac.in/noc21\_ee66/preview, "Introduction to Wireless and Cellular Communications", Prof. R. David Koilpillai,IIT Madras.
- 2. NPTEL Video: https://nptel.ac.in/courses/117104115, "Principles of modern CDMA/MIMO/OFDM Wireless communication", Prof. Aditya K. Jagannatham IIT Kanpur.

**Course Outcomes:** Upon completion of the course, students will be able to:

- 1. Comprehend and appreciate the significance and role of this course in the present contemporary world.
- 2. Characterize a wireless channel and evolve the system design specifications.
- 3. Design a cellular system based on resource availability and traffic demands.
- 4. Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration
- 5. Exploit multiple antenna techniques for capacity/ performance gains.

	PO	PS	PS											
05/105	1	2	3	4	5	6	7	8	9	10	11	12	01	02
CO1	3	3	2	2	1	2		1	1		1	1	3	1
CO2	3	3	2	2	1	2				1			3	
CO3	3	3	2	2	2	2	1				1	1	3	1
CO4	3	3	2	2	2	2		1			1		3	1
CO5	3	3	2	2	2	1						1	3	

#### Mapping of COs with POs and PSOs:

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

#### 22ECO03

#### **Preamble:**

Optoelectronics seamlessly integrates the principles of optics and electronics, unlocking a myriad of possibilities that extend beyond the conventional boundaries of each discipline. Opto-electronics serves as the bedrock for numerous cutting-edge applications, spanning telecommunications, medical imaging, sensors, displays, and beyond.

**OPTOELECTRONICS** 

#### UNIT 1 WAVE NATURE OF LIGHT AND SOLID-STATE PHYSICS

Light Waves in a Homogeneous Medium - Refractive Index and Dispersion - Sellmeier equation and Cauchy equation - Snell's Law and Total Internal Reflection (TIR) - Superposition and Interference of Waves - Diffraction Principles - Fraunhofer Diffraction - Diffraction Grating - Energy bands in solids - Conduction process in semiconductors - Optical process in semiconductors - Junction Theory.

#### UNIT 2 DISPLAY DEVICES AND LIGHT SOURCES

Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence - Plasma Display, Liquid Crystal Displays, Numeric Displays - LED Principles – Homojunction LED, Heterostructure LED – Choice of LED Materials and Structures – LED Efficiencies and Luminous Flux – Solving Problems - Laser: Operating principle - Semiconductor Lasers, Heterostructure Laser Diode.

#### **UNIT 3 OPTICAL DETECTION DEVICES**

Principle of Photo Detection — Photoconductors – Photo diodes – The PIN Photodiode – Avalanche Photodiode – Principles and Structures – Heterojunction Photodiodes - Noise in photodetectors - Detector performance parameters - Charge Coupled Device (CCD).

#### UNIT 4 OPTOELECTRONIC MODULATORS AND SWITCHING DEVICES

Introduction – Analog and Digital Modulation – Electro optic modulators - Magneto optic devices – Acousto optic modulators – optical switching and logic devices – Faraday Rotation – Optical Isolators – Nonlinear Optics and Second Harmonic Generation.

# UNIT 5 OPTOELECTRONIC INTEGRATED CIRCUITS (OEIC) AND APPLICATIONS

Introduction – Need for Integration - Hybrid and Monolithic Integration – Slab and Strip waveguides – Basic IO structural elements – Guided wave devices and active couplers – Integrated Transmitters and Receivers–Application of Optoelectronic integrated circuits.

#### **TEXT BOOKS:**

- 1. S. O. Kasap, "Optoelectronics & Photonics: Principles & Practices", Pearson Education, 2nd edition, 2013.
- 2. J. Wilson and J F B Hawkes "Optoelectronics- An Introduction", Pearson Education Taiwan Ltd, 3rd edition, 2010.

**TOTAL : 45 PERIODS** 

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#### **REFERENCES:**

- 1. Pallab Bhattacharya "Semiconductor Optoelectronic Devices", Prentice Hall of India Pvt. Ltd, 2nd Edition, New Delhi, 2009.
- 2. R. P. Khare, "Fiber Optics and Optoelectronics", Oxford University Press 2004.

#### e-Resources:

1. NPTEL web course: https://onlinecourses.nptel.ac.in/noc20\_ph24, "Semiconductor Optoelectronics", Prof. M.R. Shenoy, IIT Delhi.

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

- CO1 Define the basic concepts of optics and semiconductor optics.
- CO2 Demonstrate the working principle of various photonic sources and display devices.
- CO3 Analyze the principle and operation of various detectors and noise associated with it.
- CO4 Interpret the various optoelectronic modulators, switches, and interconnects.
- CO5 Apply the concepts of integrated optoelectronic components and its application in various fields.

Cos/POs	РО 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 1	2													
CO 2	3	3		2										
CO 3	3	3	2	3										
CO 4	3	2	3											
CO 5	3		3	3										

#### Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

# 22ECO04IOT SYSTEM DESIGN AND APPLICATIONSL TPreamble:3 (

The Internet of Things is transforming the physical world into a complex and dynamic system of connected devices on an unprecedented scale. The IoT has become prevalent due to the rise of connected devices, sensors, and computing power. It involves smart sensor nodes collecting data, network communication, and backend data processing for intelligent insights. Typical applications include wearable, smart homes, traffic control, weather monitoring, indoor positioning, machine health monitoring, and augmented/virtual reality.

#### UNIT 1 Introduction to Internet of Things

Overview of IoT- Evolution of IoT - IoT Revolution in Industries - Characteristics of IoT - IoT Reference Architecture - IoT Enabling Technologies - Wireless Sensor Networks - Cloud Computing – Big data analytics – Communication Protocols- Embedded Systems – IoT Levels and Templates.

#### UNIT 2 Python for IoT and Raspberry Pi

M2M - Differences between M2M and IoT - IoT in Autonomous Vehicles - Hardware for IoT - Connectivity Blocks and Communication Protocols - IoT gateways –Python programming: GPIO pin out and access – LED & Switch – Timers – Digital sensor interfacing – External circuit interfacing – UART – GPS interfacing.

#### UNIT 3 Implementation of IoT

Application Layer Protocols: HTTP and MQTT - Display sensor readings on webpage – Sending sensor data to Thingspeak – Sending Email – Responding to tweets using dweet and IFTTT - Control peripheral device : Smart switches.

#### UNIT 4 Node-RED

Prerequisite for Node-RED, Installing and upgrading Node-RED, Running Node-RED app locally – network -- auto-start on boot installation of various libraries for Node-RED - adding node - add debug node - deploy the flow - Case studies: IoT Environmental Monitoring with Node-RED.

#### UNIT 5 AWS IoT: Developing and Deploying in Internet of Things:

Introduction to AWS IoT-core-connecting to AWS IoT core – AWS IoT Tutorials – Managing devices with AWS IoT-Tagging AWS IoT resources – Rules – Device shadow service – storing & retrieving sensor data using storage service – Creation of web based application for device communication.

#### TOTAL: 45 PERIODS

## TEXT BOOK:

- 1. Guillermo Guillen, "Sensor Projects with Raspberry Pi: Internet of Things and Digital Image Processing", A Press Media, 1st Edition 2019.
- 2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", VPT, 1st Edition, 2015.

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#### **REFERENCES:**

- 1. Simon Monk, "Raspberry Pi Cookbook: Software and Hardware Problems and Solutions", 3rd Edition, O'Reilly Media Inc, California, USA, 2020.
- 2. Constandinos X. Mavromoustakis, George Mastorakis, Jordi Mongay Batalla, "Internet of Things (IoT) in 5G Mobile Technologies" Springer International Publishing Switzerland 2016.
- 3. Sudip Misra, Anandarup Mukherjee, Arijit Roy. "Introduction to IoT". Cambridge University Press, 1st edition, United Kingdom, 2021

#### e-RESOURCES:

- 1. Nptel Video: https://nptel.ac.in/courses/106105166, "Introduction to internet of things", Prof. Sudip Misra, Department of Computer Science and Engineering, IIT, Kharagpur.
- 2. <u>Webpage: https://aws.amazon.com/iot-core/\_for\_Unit\_V.</u>

#### **OUTCOMES:** Upon completion of the course, students will be able to:

- 1. Identify IoT enabling technologies including wireless sensor networks, cloud computing, big data analytics, and communication protocols.
- 2. Implement Python programming for GPIO pinout, LED, switch, timers, sensor interfacing, external circuit interfacing, UART, and GPS interfacing on Raspberry Pi.
- 3. Demonstrate the ability to display sensor readings on a webpage and send sensor data to platforms like Thingspeak.
- 4. Utilize Node-RED for developing IoT applications, including case studies such as environmental monitoring.
- 5. Create web-based applications for device communication on AWS IoT.

Course	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
outcomes	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	2	2	3	2	1							1		
CO 2	2	2	3	2	1			1	1			1		
CO 3	2	2	3	2	1		1		1		1	1		
CO 4	2	2	3	3	1	1	1	1	1	1	1	1		
CO 5	2	2	3	3	1	1	1		1	1	1	1		
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1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

## 22ECO05

**Preamble** This course is to let the students under

This course is to let the students understand that air Interface is one of the most important elements that differentiate between 2G, 3G, 4G and 5G. This course reveals the contents of air interface for 5G.

**5G TECHNOLOGIES** 

## UNIT 1 5G USE CASES AND SYSTEM CONCEPT

Use cases and requirements, 5G system concept: Concept overview -Extreme mobile broadband - Massive machine-type communication -Ultra-reliable machine-type communication-Spectrum toolbox.

## UNIT 2 THE 5G ARCHITECTURE

Introduction, NFV and SDN, Functional architecture and 5G flexibility, Functional split criteria, Functional split alternatives, Functional optimization for specific applications, Integration of LTE and new air interface to fulfill 5G Requirements, Physical architecture and 5G deployment.

## UNIT 3 MACHINE-TYPE COMMUNICATIONS

Introduction, MTC requirements- Fundamental techniques for MTC, Data and control for short packets, Non- orthogonal access protocols- Massive MTC, Design principles, Technology components, Ultra-reliable low-latency MTC, Design principles, Technology components, Summary of mMTC and uMTC features.

### UNIT 4 DEVICE-TO-DEVICE (D2D) COMMUNICATIONS

D2D: from 4G to 5G, D2D standardization: 4G LTE D2D, Radio resource management for mobile broadband D2D, RRM techniques for mobile broadband D2D, RRM and system design for D2D-Multi-hop D2D communications for proximity and emergency, services.

## UNIT 5 THE 5G RADIO-ACCESS TECHNOLOGIES

Access design principles for multi-user communications, Orthogonal multiple-access systems, Spread spectrum multiple access systems, Capacity limits of multiple-access methods, Sparse code multiple access (SCMA), Interleave division multiple access (IDMA), Radio access for V2X communication.

## **TEXT BOOKS:**

- 1. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, Second Edition, 2011.
- 2. Erik Dahlman, Stefan Parkvall, Johan Skold "5G NR: The Next Generation Wireless Access Technology", Elsevier, 1<sup>st</sup> Edition, 2016.

## **REFERENCES:**

- 1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 1<sup>st</sup> Edition, 2010.
- 2. Amitabha Ghosh and Rapeepat Ratasuk ,"Essentials of LTE and LTE-A" , Cambridge University Press,2011

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3. Martin Sauter, "From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband", Wiley-Blackwell,2011

#### e-Resources:

- 1. NPTEL video : http://onliecourses.nptel.ac.in/courses/108/105/108105134/ Evolution of air interface towards 5G , Prof.Suvra Sekhar Das, IIT Kharagpur.
- 2. NPTEL video: https://onlinecourses.nptel.ac.in/courses/106/106/106106167/Introduction to wireless and cellular communications, Prof.David Koilpillai, IIT Madras.

**Course Outcomes:** Upon completion of this course, students will be able to:

- CO1 Illustrate various channel models used for 5G technology and the use cases for 5G.
- CO2 Draw and explain 5G architecture, its components and functional criteria
- CO3 Analyze the machine type communication design principles.
- CO4 Demonstrate the device to device (D2D) communication and standardization.
- CO5 Analyze functioning of 5G radio access technologies.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	<b>PO</b> 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 0 1	PS O 2
CO 1	3	1	2	-	-	2	-	-	-	1	-	-	-	-
CO 2	3	1	2	-	-	2	1	-	-	-	-	1	-	-
CO 3	3	1	2	1	1	2	-	-	-	1	-	-	-	-
CO 4	3	1	2	1	1	2	1	-	-	1	-	1	-	-
CO 5	3	1	2	1	1	2	1	-	-	-	-	1	-	-

#### Mapping of COs with POs and PSOs

# New Public Administration - New Public Management - Public and Private Administration Relationships with Political Science, History and Sociology - Classical Approach - Scientific Management Approach

PRINCIPLES OF PUBLIC ADMINISTRATION

## UNIT 4

22ECM31

**UNIT 1** 

UNIT 2

UNIT 3

of Public Administration

Bureaucratic Approach: Max Weber - Human Relations Approach : Elton Mayo - Ecological Approach : Riggs

# UNIT 5

Leadership: Leadership - Styles - Approaches - Communication: Communication Types - Process -Barriers - Decision Making: Decision Making - Types, Techniques and Processes.

## **REFERENCES:**

- 1. Avasthi and Maheswari: Public Administration in India, Agra:Lakshmi Narain Agarwal, 2013
- 2. Ramesh K Arora: Indian Public Administration, New Delhi: Wishwa Prakashan, 2012.
- 3. R.B. Jain: Public Administration in India,21st Century Challenges for Good Governance, New Delhi: Deep and Deep, 2002.
- 4. Rumki Basu: Public Administration: Concept and Theories, New Delhi: Sterling, 2013.
- 5. R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 1983.

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**TOTAL: 45 PERIODS** 

# Meaning, Nature and Scope of Public Administration - Importance of Public Administration - Evolution

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22EC	M32	CONSTITUTION OF INDIA	L 3	Т 0	Р 0	C 3
UNIT	1					9
Const	itutional Developme	ent Since 1909 to 1947 - Making of the Constitution - Co	onstituent A	Assei	nbly	
<b>UNIT</b> Funda	2 mental Rights - Fun	damental Duties - Directive Principles of State Policy				9
UNIT	3					9
Presid	ent – Parliament - S	Supreme Court				
UNIT	4					9
Gover	mor - State Legisla	ture - High Court				
UNIT	5					9
Secula	arism - Social Justi	ce - Minority Safeguards				
DEEI	DENCEC.	Т	<b>`OTAL:</b> 4	5 PF	ERIC	DDS
1.	Basu. D.D.: Introdu	action to Indian Constitution: Prentice Hall: New Delhi.				
2.	Kapur. A.C: Indian	Government and Political System; S.Chand and Compa	ny Ltd., N	ew D	elhi.	
3.	Kapur. A.C: Indian	Government and Political System; S.Chand and Compa	ny Ltd., N	ew D	elhi.	
4.	Agarwal R.C: India	an Political System; S.Chand & Co., New Delhi				

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# 22ECM33PUBLIC PERSONNEL ADMINISTRATIONLT30

#### **UNIT 1** Meaning - Scope and Importance of Personnel Administration - Types of Personnel Systems: Bureaucratic - Democratic and Representative systems.

### UNIT 2

Generalist Vs. Specialist - Civil Servants' Relationship with Political Executive - Integrity in Administration.

#### UNIT 3

Recruitment: Direct Recruitment and Recruitment from Within - Training: Kinds of Training - Promotion

#### UNIT 4

All India Services - Service Conditions - State Public Service Commission

#### UNIT 5

Employer Employee Relations - Wage and Salary Administration - Allowances and Benefits

#### **REFERENCES:**

- 1. Stahl Glean O: Public Personnel Administration
- 2. Parnandikar Pai V.A: Personnel System for Development Administration.
- 3. Bhambhiru . P: Bureaucracy and Policy in India.
- 4. Dwivedi O.P and Jain R.B: India's Administrative state.
- 5. Muttalis M.A: Union Public Service Commission.
- 6. Bhakara Rao .V: Employer Employee Relations in India.
- 7. Davar R.S. Personnel Management & Industrial Relations

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# **UNIT 1**

**ADMINISTRATIVE THEORIES** 

Meaning, Scope and significance of Public Administration, Evolution of Public Administration as a discipline and Identity of Public Administration

# UNIT 2

22ECM34

Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory

## UNIT 3

Organization goals and Behavior, Groups in organization and group dynamics, Organizational Design.

# UNIT 4

Motivation Theories, content, process and contemporary; Theories of Leadership: Traditional and Modern: Process and techniques of decision-making

# UNIT 5

Administrative thinkers: Kautilya, Woodrow Willson, C.I. Barnard . Peter Drucker

## **REFERENCES:**

- 1. Crozior M : The Bureaucratic phenomenon (Chand)
- 2. Blau. P.M and Scott. W : Formal Organizations (RKP)
- 3. Presthus. R : The Organizational Society (MAC)
- 4. Alvi, Shum Sun Nisa : Eminent Administrative Thinkers.
- 5. Keith Davis : Organization Theory (MAC)

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T.N. Chaturvedi : State administration in India
Basu, D.D : Introduction to the Constitution of India

# General of India, Attorney General of India 9 Superintendent of Police, Role of Block Development Officer in development programmes, Local Government UNIT 3 9 Main Features of 73rd Constitutional Amendment Act 1992, Salient Features of 74th Constitutional Amendment Act 1992

UNIT 2 Role & Functions of the District Collector, Relationship between the District Collector and

Coalition politics in India, Integrity and Vigilance in Indian Administration

Corruption – Ombudsman, Lok Pal & Lok Ayuktha

S.R. Maheswari : Indian Administration

Ramesh K. Arora : Indian Public Administration

Khera. S.S : Administration in India

UNIT 1 Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor

**INDIAN ADMINISTRATIVE SYSTEM** 

22ECM35

**UNIT 4** 

UNIT 5

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# 22ECM36PUBLIC POLICY ADMINISTRATIONLT30

#### UNIT 1

Meaning and Definition of Public Policy - Nature, Scope and Importance of public policy – Public policy relationship with social sciences especially with political science and Public Administration

#### UNIT 2

Approaches in Policy Analysis - Institutional Approach – Incremental Approach and System's Approach – Dror's Optimal Model

#### UNIT 3

Major stages involved in Policy making Process – Policy Formulation – Policy Implementation – Policy Evaluation.

#### UNIT 4

Institutional Framework of Policy making – Role of Bureaucracy – Role of Interest Groups and Role of Political Parties

#### UNIT 5

Introduction to the following Public Policies – New Economic Policy – Population Policy – Agriculture policy - Information Technology Policy.

#### **REFERENCES:**

- 1. Rajesh Chakrabarti & Kaushik Sanyal : Public Policy in India, Oxford University Press, 2016.
- 2. Kuldeep Mathur : Public Policy and Politics in India, Oxford University Press, 2016.
- 3. Bidyutv Chakrabarty: Public Policy: Concept, Theory and Practice, 2015.
- 4. Pradeep Saxena : Public Policy Administration and Development
- 5. Sapru R.K.: Public Policy: Formulation, Implementation and Evaluation, Sterling Publishers, 2016.

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